However, upon returning to Warsaw, I found that securing an academic position as a woman was still a challenge.

All is not lost.

Back in Paris, a heartbroken Pierre awaits, and the two soon marry and form a strong scientific team.

Another physicist's work aroused Madame Curie's interest.

In 1896, Henri Becquerel discovered that uranium spontaneously emitted mysterious X-ray-like radiation that could interact with photographic film.

Curie soon discovered that the element thorium emitted similar radiation.

Most importantly, the intensity of radiation depends only on the amount of elements and is not affected by physical or chemical changes.

This led her to the conclusion that radiation originates from something fundamental within the atoms of each element.

The idea was revolutionary and helped disprove the long-held model that atoms are indivisible bodies.

Next, the Curies realized that uranium alone could not produce all the radiation, by focusing on a super-radioactive ore called pitchblende.

So were there other radioactive elements that could have been responsible?

In 1898, they reported two new elements, polonium, named after Marie's native Poland, and radium, Latin for ray.

They also coined the term radioactivity along the way.

By 1902, the Curies had extracted a tenth of a gram of pure radium chloride salt from several tons of pitchblende. This was an incredible feat for its time.

Later that year, Pierre Curie and Henri Becquerel were nominated for the Nobel Prize in Physics, but Marie was overlooked.

Mr. Pierre has taken a position to support his wife's achievements.

The Curies and Becquerels thus shared the 1903 Nobel Prize, making Marie Curie the first female Nobel laureate.

Well-funded and well-respected, the Curies were in great shape.

Tragedy struck in 1906 when Pierre was hit by a carriage while crossing a busy intersection.

Devastated, Marie devoted herself to her research and succeeded Pierre as the first female professor at the Sorbonne.

Her solo career was fruitful.

In 1911 she won yet another Nobel Prize. This time, he won in the field of chemistry for his early discoveries of radium and polonium, and for the extraction and analysis of pure radium and its compounds.

This made her the first, and still the only, person to win Nobel Prizes in two different scientific fields.

Professor Curie used his findings to change the landscape of medical research and treatment.

She opened a mobile radiology department during World War I to investigate the effects of radiation on tumors.

However, these benefits for humanity may have come at a high price, personally.

Madame Curie died of bone marrow disease in 1934, which many today attribute to her radiation exposure.

Marie Curie's groundbreaking work laid the foundations for our understanding of physics and chemistry and paved the way in oncology, technology, medicine and nuclear physics, to name a few.

For better or worse, her radiation discoveries ushered in a new era and revealed some of science's greatest secrets.

When Reverend Jim Jones founded the Peoples Temple in 1955, few could have imagined its horrific consequences.

This progressive religious movement grew in popularity and gained support from some of San Francisco's most prominent politicians.

But in 1977, amid exposure of his brainwashing and abuse, Jones emigrated with hundreds of followers to Guyana to found a commune called Jonestown.

The colony, which had been advertised as a utopian paradise, more resembled a prisoner of war camp, and when a congressional delegation arrived to investigate the situation, Jones put his final plans into action.

On November 18, 1978, 909 men, women and children died after being forced to drink poisoned flavor aids.

The grizzly bear image has since been immortalized as an acronym for the single-minded cult thought, "They drank Kool-Aid."

Today, thousands of cults exist around the world.

It's important to note two things about them.

First, not all cults are religious.

Some are political, some are therapy-based, some focus on self-improvement, and so on.

And conversely, not all new religions are called cults.

So what exactly defines our modern understanding of cults, and why do people join them?

Broadly speaking, a cult is a group or movement with a common commitment to an extreme ideology, usually embodied by a charismatic leader.

And while few are as deadly as Jonestown or Heaven's Gate, which ended in a mass suicide of 39 people in 1997, most cults share some basic traits.

A typical cult requires a high level of devotion from its members, maintains a strict hierarchy, and separates unsuspecting followers and recruits from internal activities.

Through its tenets, the organization claims to provide answers to life's biggest questions and the recipe for change needed to shape new members into true believers.

And most importantly, it tolerates little internal disagreement or external scrutiny, and uses both formal and informal influence and control systems to keep its members compliant.

You might wonder if some of these explanations apply to established religions as well.

In fact, the world "Carthus" originally depicted people who cultivated worship of certain deities by performing rituals and maintaining temples.

But over time it came to mean excessive dedication.

Many religions began as cults, but as they grew they were integrated into the fabric of larger societies.

Modern cults, by contrast, separate their members from other cults.

Rather than providing guidelines for how to lead a better life for their followers, cults seek to directly control their followers, from personal and family relationships to financial resources and living circumstances.

Cults also demand obedience to human leaders. Leaders tend to be highly persuasive people with authoritarian and narcissistic tendencies, motivated by money, sex, power, or all three.

Cult leaders use their personal charisma to attract early followers, but further expansion works like a pyramid scheme, with early members recruiting new followers.

Cults are adept at knowing who to target, often focusing on those new to the field or those who have recently suffered some kind of personal or professional loss.

Loneliness and a need for meaning make people susceptible to friendly people who provide them with community.

The hiring process is nuanced and it can take months to build a relationship.

In fact, more than two-thirds of cult members are recruited by friends, family members, or co-workers, and the invitations are difficult to turn down.

Once in a cult, members undergo various forms of indoctrination.

Some take advantage of the natural human tendency to imitate social behavior or follow orders.

Other methods can be more powerful, using coercive persuasion techniques with guilt, shame, and fear.

And in many cases members may submit willingly out of a desire to belong and a desire to earn the promised reward.

A cult-like environment discourages critical thinking and makes it difficult for everyone around you to voice your doubts when modeled on your absolute faith.

The resulting internal conflict known as cognitive dissonance keeps you trapped. Every time you compromise, it becomes even more painful to admit that you have been deceived.

And while most cults don't let their followers die, they can still be harmful.

By denying fundamental freedoms of thought, speech, and association, cults stunt the psychological and emotional development of their members, a particular problem for children who are deprived of normal developmental activities and milestones.

Nonetheless, many cultists eventually find their way out, even when their cult collapses through self-awareness, the help of family and friends, or external pressure or scandal.

Many cults can be difficult to identify, but for some, they are protected under religious liberty, no matter how bizarre their beliefs may be.

However, the law may intervene if their conduct involves harassment, threats, misconduct or abuse.

Believing in something should not come at the expense of family and friends. If someone tells you to sacrifice your relationships and morals for the greater good, that person is probably exploiting you for their own sake.

Imagine being asked to invent something new.

You can choose any shape and size you like and make anything.

This kind of creative freedom sounds very liberating, doesn't it?

Or is it?

If you're like most people, you'll probably get stuck in this task.

Without further guidance, where do I start?

After all, unlimited freedom isn't always beneficial.

In practice, any project is limited by many factors, including cost, materials at your disposal, and unbreakable laws of physics.

These factors are called creative constraints, requirements and limitations that must be addressed in order to achieve the goal.

Creative constraints apply to a wide variety of professions, including architects, artists, writers, engineers, and scientists.

In many fields, constraints play a special role as drivers of discovery and invention.

Constraints are an important part of experimental design, especially in the scientific process.

For example, a scientist studying a new virus might ask, "With the tools and technology at hand, how can I create an experiment that shows how this virus infects the body's cells?"

And what are the limitations of my knowledge that prevent me from understanding this new viral pathway?"

In engineering, constraints force us to apply scientific discoveries to invent new and useful things.

For example, the landers Viking 1 and 2 used thrusters to safely reach the surface of Mars.

question?

These thrusters left foreign chemicals on the ground and contaminated soil samples.

So a new constraint was introduced.

How can we land a rover on Mars without bringing in chemicals from Earth?

The next Pathfinder mission used an airbag system to allow the rover to bounce and roll to a halt without burning polluting fuel.

A few years later, we wanted to send an even bigger rover, Curiosity.

However, it was too large for an airbag design, so another constraint was defined.

How can we land a large rover while keeping rocket fuel away from Martian soil?

In response, the engineers came up with a wild idea.

They designed a skycrane.

Similar to a toy store crane machine, the rover is lowered from high above the surface.

With each invention, engineers demonstrated an important practice of scientific thinking: the need to recognize the limitations of current technology in order to advance solutions.

This progress can be iterative: "How can we build a better parachute to land the rover?"

It can also be innovative, such as how to reach a goal when the best possible parachute doesn't work.

In both cases, the constraints guide decision making to ensure that each goal is achieved.

Here is another Mars problem that has yet to be resolved.

Suppose you want to send an astronaut who needs water.

They keep their water very clean and rely on a filtration system that allows for 100% recovery.

These are fairly tight constraints and there may not be technology to address them at this time.

However, in the course of seeking to achieve these ends, we may discover other uses for the resulting inventions.

Building innovative water filtration systems could provide a solution for farmers working in drought-prone areas, or a way to purify municipal water in polluted cities.

In fact, many advances in science have been caused by accidental failures in one field to deal with constraints in another.

Scientist Alexander Fleming accidentally contaminated a petri dish in his laboratory, leading to the discovery of the first antibiotic, penicillin.

The same is true for synthetic dyes, plastics, and gunpowder.

All were created in error, but continued to address the constraints of other issues.

Understanding constraints guides scientific progress, and what is true in science is also true in many other fields.

Constraints are the foundation of creativity, not the boundaries of creativity.

So what we often do as researchers is to use vast resources to achieve a certain ability or to achieve a certain goal.

And this is essential for scientific progress, or the exploration of possibilities.

However, it creates an unfortunate situation in which only a small percentage of the world can actually participate in this exploration and benefit from its technology.

What really motivates me and gets me really excited about my research is when I see a simple opportunity to dramatically change that distribution and make technology accessible to a larger population.

Here are two videos that caught my attention that I think exemplify this philosophy.

For those unfamiliar with this device, it's a $40 video game controller.

And it's mostly touted for its motion-sensing capabilities, allowing you to swing a tennis racket or hit a baseball bat.

But what I'm actually more interested in is the fact that each controller has a relatively high-end infrared camera on the tip.

Here are two demos that show why this is useful.

Here, I have a projector set up on my computer and a Wii remote on top of it.

And, for example, if you go to a school that doesn't have a lot of money, maybe many, or if you're in an office environment and want an interactive whiteboard, these typically cost around $2-3,000.

So I'll show you how to make one using the Wii Remote.

Now, this requires another piece of hardware, namely this infrared pen.

If you go to Radio Shack, you can probably build your own for about $5.

It has a battery, a button, and an infrared LED that you can't see, but it lights up every time you press the button.

What this means is that when you run this software, your camera can recognize the infrared dot and register the camera's pixel position with the projector's pixel.

It's like an interactive whiteboard surface.

(Applause.) So for about $50 of hardware, you can have your own whiteboard.

This is Adobe Photoshop.

(Applause.) Thank you.

(Laughter) I actually put this software on my website for people to download for free.

In the three months since the project was published, it has been downloaded over 500,000 times.

That's why teachers and students all over the world are already using it.

(Applause.) Yes, you can do that for $50, but there are some limitations with this approach.

You can get about 80 percent of your destination for 1 percent of the cost.

Another cool thing is that the camera can recognize multiple dots, so this is actually a multi-touch interactive whiteboard system as well.

(Applause) The second demo actually has the Wii remote next to the TV.

That is, they are pointing away from the display instead of pointing at it.

Why this is interesting is that wearing safety glasses with two infrared dots, for example, gives the computer an approximate head position.

The reason this is interesting is because you are running this kind of application on your computer monitor. There is a 3D room with some targets floating in it.

It's kind of like a video game, it looks 3D, but for the most part the image is pretty flat and seems to be fixed to the surface of the screen.

But with head tracking turned on, the computer can change the image on the screen to react to your head movements.

So let's get back to it.

(Laughter) (Applause) This actually came as a bit of a surprise to the game development community.

(Laughter) Because if you already have a Nintendo Wii, this equates to about $10 extra hardware.

So I'm looking forward to seeing some games, and indeed Louis Castle, that's him there, last week one of the biggest game publishers, Electronic Arts, announced that it would be releasing a game in May with a small Easter egg feature to support this kind of headtracking.

From a prototype in my lab to a major commercial product in less than 5 months.

(Applause.) Thank you.

(Applause.) But really, what's more interesting to me than either of these two projects is how people actually found out about them.

YouTube has changed the way or the speed with which one individual can actually spread an idea around the world.

I am doing research using a video camera in my lab. One million people watched this work in the first week, and literally within days engineers, teachers and students around the world were posting YouTube videos of themselves using my system and derivatives of this work.

We therefore expect to see more of such in the future and hope that online video delivery will be accepted by the research community.

Thank you very much.

Look at the human brain, it's a visibly left-right craggy landscape.

This structure gave rise to one of the most pervasive ideas about the brain, that the left side controls logic and the right side controls creativity.

But this is a superstition without scientific evidence.

So how did this misleading idea come about and what's wrong?

It is true that the brain has a right and a left.

This is most pronounced in the outer layer or cortex.

Although internal regions such as the striatum, hypothalamus, thalamus, and brainstem appear to be made up of continuous tissue, they are actually organized on the left and right sides as well.

The left and right sides of the brain control different bodily functions such as movement and vision.

The right side of the brain controls the movement of the left arm and leg and vice versa.

The visual system is even more complicated.

Each eye has a left and right field of view.

Both left visual fields are sent to the right side of the brain and both right visual fields are sent to the left side.

So the brain uses both sides to create a complete image of the world.

Scientists aren't sure why these crossovers occur.

One theory is that it started because soon after animals developed a more complex nervous system, they gained a survival advantage with faster reflexes.

If an animal spots a predator coming from the left, it is best to flee to the right.

Thus, we can say that vision and motor control are two systems that depend on this left-right structure, but extending the idea too far into logic and creativity causes problems.

This misunderstanding began in the mid-1800s, when two neurologists, Broca and Wernicke, examined a patient who had communication problems due to an injury.

The researchers found damage to the patient's left temporal lobe, suggesting that language may be controlled by the left side of the brain.

It captured people's imagination.

Author Robert Louis Stevenson introduced the idea that the logical left hemisphere competes with the emotional right hemisphere represented by his characters Dr. Jekyll and Mr. Hyde.

However, this idea did not hold when doctors and scientists examined patients with missing hemispheres or with separated hemispheres.

These patients exhibited a full range of behaviors, both logical and creative.

Subsequent studies found that one side of the brain was more active than the other for some functions.

Language is more localized on the left and attention is focused on the right.

So one side of the brain might do more work, but this varies from system to person, not from person to person.

There is no evidence to suggest that individuals have a dominant side of the brain, or to support the idea that logic and creativity are split left and right.

Some people are extra logical or creative, but that has nothing to do with that aspect of the brain.

And even the idea that logic and creativity are at odds doesn't work.

Solving complex math problems requires inspired creativity, and many vibrant works of art have complex logical frameworks.

Nearly every feat of creativity and logic bears the imprint of the whole brain working as one.

Each year, 2.5 to 4 million concussions occur in the United States among participants in sports and recreational activities.

How dangerous are these concussions?

The answer is complex and lies in how the brain reacts when something happens.

The brain is made of soft fatty tissue and has a jelly-like consistency.

This delicate organ is usually well protected inside the protective membrane and hard shell of the skull.

However, a sudden impact can cause the brain to shift and hit the hard interior of the skull, and unlike jelly, the brain tissue is not uniform.

It consists of a vast network of 90 billion neurons that relay signals through long axons to communicate throughout the brain and control our bodies.

This elongated structure makes the neurons so fragile that they can stretch or even rupture upon impact.

This not only inhibits the ability to communicate, but also causes the death of other neurons by releasing toxins as the destroyed axons begin to degenerate.

This sequence of events causes a concussion.

That damage can manifest in many ways, including fainting, headaches, blurred vision, balance problems, mood and behavior changes, memory, thinking, sleep problems, and the development of anxiety and depression.

Every brain is different and this explains why people experience concussions so differently.

Fortunately, most concussions heal completely and symptoms go away within days or weeks.

With enough rest and a gradual return to activity, the brain recovers on its own.

As for rest, many of you may have heard that you shouldn't sleep right after a concussion because it can put you into a coma.

it's a myth.

There is no documented problem with going to bed after a concussion, although more severe brain damage, such as a cerebral hemorrhage, is also possible unless the doctor is concerned.

Concussion victims may experience what is called post-concussion syndrome (PCS).

For months or years after injury, PCS patients may experience constant headaches, learning difficulties, and behavioral symptoms that even affect relationships.

Attempting to play over a concussion, even for a few minutes, or returning to sports soon after a concussion increases the likelihood of developing PCS.

In some cases, concussions can be difficult to diagnose because symptoms develop slowly over time.

This is often the case for subconcussive impacts due to the smaller impact to the head than the impact that causes concussion.

This category of injury does not cause noticeable symptoms immediately, but repeated occurrences can lead to severe degenerative brain disease over time.

Take, for example, a soccer player who is known for repeatedly heading a soccer ball.

We are beginning to explore how it affects the brain using a technique called diffusion tensor imaging.

Using this method, scientists can find large axon bundles and see how a light blow changes their structure.

In 2013, researchers using this technique found that athletes who made the most headers, approximately 1,800 times per year, damaged the structural integrity of their axon bundles.

This damage was similar to how a rope breaks when individual fibers begin to fray.

These players also performed poorly on short-term memory tests, so even though none of the players had full-blown concussions, these subconcussive blows accumulated measurable damage over time.

In fact, researchers know that subconcussive overload is associated with a degenerative disease of the brain known as chronic traumatic encephalopathy (CTE).

People with CTE suffer from mood and behavioral changes that begin in their 30s and 40s, followed by thinking and memory problems, and in some cases, dementia.

The culprit is a protein called tau.

Tau protein normally supports small tubes within axons called microtubules.

It is believed that repeated subconcussive shocks damage microtubules, causing the tau protein to detach and aggregate.

This clump interferes with transport and communication along neurons, causing disruption of connections in the brain.

As the tau protein begins to aggregate, more aggregates form and continue to spread throughout the brain even after the impact on the head ceases.

Data show that 50-80% of concussions go unreported and untreated, at least among soccer players.

In some cases, it may be because it is difficult to determine whether a concussion has occurred in the first place.

But it is often due to pressure and a desire to keep going despite the fact that something is wrong.

This doesn't just hurt resilience.

It's also dangerous.

Our brain is not invincible.

They still need us to protect them from harm and help them undo the damage after it has been done.

the fish are in trouble.

Cod populations off the east coast of Canada plummeted in the 1990s, intense recreational and commercial fishing devastated the goliath grouper population in South Florida, most tuna populations plummeted by more than 50%, and the South Atlantic bluefin tuna is endangered.

These are just a few of many examples.

Overfishing is happening all over the world.

How did that happen?

When you think of fishing, some imagine relaxing on a boat and patiently reeling in the day's catch.

But modern industrial fishing on grocery store shelves looks more like war.

In fact, the technology they employ was developed for warfare.

Radar, sonar, helicopters, and observation equipment are all used to guide the factory's vessels toward the dwindling shoal of fish.

Long lines with hundreds of hooks and huge nets catch large amounts of fish, along with other species such as seabirds, turtles and dolphins.

The fish is then hoisted onto huge boats with onboard deep-freezing and processing facilities.

All these technologies allow us to catch fish in deeper waters than ever before.

And as fishing distances and depths have expanded, so have the species targeted.

Patagonian rockfish, for example, don't sound or look very appetizing.

And fishermen ignored it until the late 1970s.

It was then rebranded as Chilean Sea Bass and sold to U.S. chefs, even though it is actually a type of cod.

It soon appeared on markets around the world and is now a delicacy.

Unfortunately, these deep-sea fish do not breed until they are at least 10 years old, making them highly vulnerable to overfishing if juveniles are caught before they have had a chance to spawn.

Consumer tastes and prices can also have a negative impact.

For example, shark fin soup is considered a very delicacy in China and Vietnam, which makes the fin the most profitable part of the shark.

For this reason, many fishermen pack their fins onto their boats, leaving behind millions of shark carcasses.

This problem is not unique to greenlings and sharks.

Nearly 31% of the world's fish population is overfished, and a further 58% are fished at maximum sustainable levels.

Fish in the wild cannot reproduce as fast as 7 billion people eat.

Fisheries also affect wider ecosystems.

Wild shrimp are usually caught by dragging a net the size of a football field along the seafloor, destroying or destroying the seafloor habitat.

The catch is often only 5% of the shrimp.

The rest are unwanted animals that are bycatch and discarded dead.

And coastal shrimp farming isn't all that great.

Mangroves are being bulldozed to create shrimp farms, depriving coastal areas of storm protection and natural water filtration, and depriving them of critical habitat for fish.

So what does it mean to give a fish a break to recover?

Protection comes in many forms.

In national waters, governments can impose restrictions on certain boats and equipment to impose restrictions on when, where, how and how much they can fish.

Harmful practices such as bottom trawling can be banned entirely, and marine reserves can be established with all fishing prohibited to help restore ecosystems.

Consumer awareness and boycotts also play a role in reducing wasteful fishing practices like shark fin fishing and pushing fisheries towards more sustainable fishing practices.

Past interventions have been successful in restoring declining fish populations.

There are many solutions.

The optimal approach for each fishery must be based on science, the communities that depend on it, and respect for fish as wildlife.

And the rules must be enforced.

International cooperation is often needed as fish don't care about borders.

We must stop overfishing.

Ecosystems, food security, jobs, economies and coastal cultures all depend on it.

We were there on the last night of our lives, souls and bodies packed into a church in Texas.

The room was packed like this, with creaky wooden chairs upholstered in worn-out red fabric, an organ on the left, a choir behind it, and a baptismal pool built into the wall behind it.

Anyway, this is the room.

The same great anxiety, the same deep hope for salvation, the same sweaty palms, the same inattentive people behind them.

(Laughter.) This was December 31, 1999, the night of Christ's Second Coming, and the end of the world as I knew it.

That year I turned 12 and was old enough to be responsible.

And when I stopped complaining about how unfair it was for Jesus to come back so soon when I had to take responsibility for everything I did, I thought I'd better get my house in order soon.

So I went to church as often as possible.

I listened to the silence as anxiously as I listened to the noise, trying to ascertain whether the Lord had decided to give me hasty instructions to return early.

And, just in case, I had a back-up plan by reading the then-famous Left Behind book.

And I found on their page that if you don't get on the jubilation at midnight, you'll have another chance.

All I had to do was avoid the Mark of the Beast, fight demons, pestilence, and the Antichrist himself.

It would be difficult -- (Laughter), but I knew I could do it.

(Laughter) But the time for planning is over.

It was 11:50pm.

With ten minutes remaining, the pastor called us from the pew to the altar. He wanted to pray at midnight.

So every faction of the congregation took its place.

The choir remained in the choir, and the deacon and his wives—or the Baptist bourgeoisie as I call them—(laughter) headed before the altar.

As you know, in America, Second Coming of Christ also has a VIP section.

(Laughter.) (Applause.) And right behind the Baptist bourgeoisie were the older men and women in the cotton fields of East Texas, with their young backs bent in the hot sun, their skin looking as if it were East Texas clay, baked to a wrinkleless noble brown, and their hopes and dreams of what life would be like outside of East Texas, sometimes more bent and broken than their backs.

Yes, these men and women were the stars of the show to me.

They have waited for this moment all their lives, just as their medieval predecessors longed for the end of the world, and just as my grandmother waited for the Oprah Winfrey Show on Channel 8 every day at 4 p.m.

And I snuck right behind my grandmother as she made her way to the altar. Because I was sure that my grandmother would go to heaven.

And I thought that if I held her hand during this prayer, I might be able to continue with her.

So I persevered, closed my eyes, listened, and waited.

And the prayers were louder.

And the cry in response to the call to prayer grew even higher.

Then the organ rolled in, and lamentations joined.

Then the heat increased and I started sweating.

And my hands were clenched tighter so that I wouldn't be left alone on the field.

My eyes clenched so hard I couldn't see the wheat separate from the chaff.

Then I heard a voice above my head say, "Amen."

It's over.

I looked at my watch.

It was past midnight.

I saw older believers for whom the Savior had not come. They were proud and showed no hint of disappointment, and believed too long to begin to doubt now.

But I got angry on their behalf.

They cheated, cheated, cheated, and I ran into them.

I have prayed their prayers and resisted temptation as much as possible.

I have dipped my head in that snotty baptismal pool more than once.

I believed

So?

I just got home and turned on the TV to see Peter Jennings announcing the millennium around the world.

I thought it would be strange anyway that Jesus would come back multiple times based on different time zones.

(Laughter.) And this made me feel even more ridiculous, really hurt.

But that night, I never stopped believing.

I just believed in new things. It is possible not to believe it.

My answer may be wrong, or the question itself may be wrong.

And now, where there was once a mountain of certainty, to its foundation was a spring of doubt, a spring of promising rivers.

All the drama in my life can be traced back to that night in church when the Savior failed to pick me up. When what I believed most certainly turned out to be not true at all, if not a lie.

And even though most of you were preparing for Y2K in very different ways, I am sure you are here because some of you have been doing what I have been doing since the dawn of this new millennium, when your mother left, your father left home, and you refused to let the Lord come.

And I held out my hand for something to believe in.

When I arrived at Yale University at 18, I held on, believing that the journey from Oak Cliff, Texas, was a chance to leave behind all the hardships I'd known, the broken dreams and broken bodies I'd seen.

But when I came home one winter break to find myself face-buried on the floor, hands tied behind my back, and a robber's gun pressed to my head, I knew that even the best education wouldn't save me.

I kept it when I joined Lehman Brothers as an intern in 2008.

(Laughter) My expectations were so high that (Laughter) I called home and told my family that I would never be poor again.

(Laughter) But as I watched this financial temple crumble before my eyes, I realized that no amount of my best work could save me.

When I showed up in Washington, D.C. as a young official, I persevered. I heard from the state of Illinois that "it's been a long time coming, but this election has changed America."

But when Congress came to a standstill, and the country was torn apart, and hope and change felt like a cruel joke, I realized that not even the return of politics could save me.

I kneeled faithfully at the altar of the American Dream, praying to the God of times, money, and power that had been successful.

But many times midnight came and when I opened my eyes I found that all these gods were dead.

And from that cemetery I started searching again. Not because I was brave, but because I knew I would die if I didn't believe.

So I made a pilgrimage to yet another Mecca, Harvard Business School. (Laughter.) This time, I knew I couldn't simply accept the salvation it claimed to offer.

No, I thought there would be more to do.

The piece begins late at night on a miserable early winter in Cambridge, in a dark corner of a crowded party. Then three friends and I asked the long-held question of young people looking for something authentic. “What if we go on a road trip?”

(Laughter) I didn't know where I was going or how I was going to get there, but I knew I had to do it.

Because all our lives, as Jack Kerouac wrote, we longed to “sneak out into the night and disappear” and go find out what everyone was doing across the country.

So despite others saying the risk was too great and the evidence too thin, we went ahead anyway.

In the summer of 2013, we traveled 8,000 miles across the United States, through cattle meadows in Montana, through desolate Detroit, through the swamps of New Orleans. So we found men and women who were starting small businesses for profit and worked with them.

For those of us who were trained in capitalist West Point, this felt like a revolutionary idea.

(Laughter) And then this idea spread and grew into a non-profit called MBA Across America, a movement that got me on this stage today.

It spread because our generation had a great hunger for purpose and meaning.

It has spread because it has found countless entrepreneurs in every corner of America who are creating jobs, changing lives and needing a little help.

But to be honest, it also spread because I fought to spread it.

I was compelled to preach this gospel so that more people would believe that one social enterprise at a time could heal the wounds of a broken nation.

But this missionary journey led me to a much different gospel that I share with you today.

It started almost a year ago one evening at a celebration for Harvard Business School graduates at the Museum of Natural History in New York City.

Beneath a life-size replica of a whale, I sat with modern-day giants to celebrate their fellowship and their good deeds.

With over $5 billion in net worth and assets under management, there was pride in the room.

We reviewed everything we made and it was good.

(Laughter) But it just happened. Two days later I had to make my way up to Harlem. So I found myself sitting on a once empty urban farm, listening to a man named Tony listening to the children who show up there every day.

They all lived below the poverty line.

Many of them carried all their belongings in backpacks so as not to lose them at homeless shelters.

Some of them came to Tony's program called Harlem Grown to get their only meal each day.

Tony told me he started Harlem Grown with money from his pension after working as a taxi driver for 20 years.

He told me that despite its success, the program struggled with a lack of resources, so he didn't pay himself.

He told me that he would help me as much as he could.

And I was there to help.

But when I parted with Tony, I felt a stabbing pain in my eyes and tears welling up like salt.

I felt the weight of the revelation in the fact that one night hundreds of people could sit in a room with $5 trillion, and two days later another room just 50 blocks away from the road. There, a man went unpaid to give a child his only meal of the day.

And it wasn't the obvious inequality that made me want to cry, it wasn't the thought of starving homeless children, anger at the One Percent, or pity at the 99.

No, I was finally shaken to find out that I was on dialysis in a country that required a kidney transplant.

I realized that my story stood in for all the people who were expected to get back on their feet by the bootstraps, even if they didn't have boots. That my organization stood in for all the structural and organizational support that never went to Harlem or Appalachia or the Ninth Lower District. My voice was substituting for all those voices that seemed too unlearned, too unwashed, too unadapted.

And that shame, that shame, hit me like the shame of sitting in front of the TV and watching Peter Jennings announce the New Millennium over and over again.

I have been cheated, cheated, cheated.

But this time the false savior was me.

You see, I have come a long way from that altar, on that night when I thought the world was ending, where people spoke in tongues, saw suffering as a necessary act of God, and believed the scriptures to be absolute truth.

Yes, we've come this far, so we're back where we started.

Because it is simply not true that we live in an age of unbelief. No, we still believe today as we did before.

Some of us may believe the predictions of Brené Brown or Tony Robbins.

We may believe the New Yorker or the Harvard Business Review Bible.

We may believe most deeply when we worship here at TED Church, but we desperately want and must believe.

We speak in the language of charismatic leaders who promise to solve all problems.

We see suffering as a necessary act for our god, capitalism, and we take the text of technological progress as an infallible truth.

And we hardly realize the human price we pay when we don't question one brick because we fear it might shake our entire foundation.

But if you are disturbed by the unconscionable things we have accepted, it must be time to ask.

Therefore, I do not have the gospel of destruction, innovation, or triple profit.

Actually, there is no gospel of faith that I can share with you today.

I have the gospel of doubt and suggest it.

The Gospel of Doubt does not ask us to stop believing, but rather to believe in something new, that it is possible to disbelieve.

Our answer may be wrong, or the question itself may be wrong.

Yes, the gospel of doubt is that we on this stage, in this room, could be wrong.

Because it raises the question "why?"

With all the power we have at our disposal, why do people still suffer so much?

This question has led me to share that I am putting my organization, MBA Across America, out of business.

We laid off the staff and closed the door. And feel free to share our model with anyone who understands their power to do this work without waiting for our permission.

This doubt compels me to abandon the savior role some have placed on me. Because our time is too short and the odds are too long to wait for the Second Coming. Miracles don't really happen here.

And this doubt gives me strength and gives me hope. When our problems overwhelm us, when the path laid out for us seems to lead to our demise, when our healers offer no comfort to our wounds, it is not our blind faith - no, it is not our blind faith that our little doubts shed a little light into the darkness of our lives and our world, whispering, shouting, or simply saying very simply aloud. make it possible.

thank you.

(applause)

It is understood that most jobs can result in dismissal for reasons such as crime, incompetence, or simply poor performance.

But what if your job happens to be the most powerful position in the country or the world?

That's where impeachment comes in.

Impeachment is not the same as actually removing someone from office.

As with prosecution in criminal courts, only formal charges can start a trial and end in a conviction or acquittal.

The impeachment that began in Britain allowed parliament to pass the removal of government officials without the consent of the king.

This was an important check on royal power, but the king could not be impeached, as the monarch was believed to be the source of all governmental power.

But to the founders of the American Republic there was no higher authority than the people themselves.

And in the United States, impeachment was adopted as a power of Congress that applies to all civil servants, including the president.

Demands for impeachment can come from any member of the public, but only the House of Representatives has the power to actually initiate impeachment proceedings.

We begin by referring the matter to committees, usually the House Rules Committee and the House Judiciary Committee.

These commissions consider charges, examine evidence, and issue recommendations.

If sufficient grounds are found to proceed, the House will vote separately on each of the specific charges known as articles of impeachment.

If one or more pass by a simple majority, that official is impeached and ready for trial.

The actual trial after impeachment takes place in the Senate.

An elected member of Congress, known as the manager, acts as the prosecutor, while the impeached official and his attorney act as the defense counsel.

The Senate acts as both judge and jury, conducting trials and deliberating after hearing all arguments.

If the President or Vice President is impeached, the Chief Justice of the Supreme Court presides.

A conviction requires a supermajority of two-thirds, which results in an automatic ouster from power.

Depending on the original charges, he could also be disqualified from future public office and subject to regular criminal prosecution.

So, what exactly is impeachment?

It's a little more complicated.

Unlike in Britain, impeachment in the United States is contested between an elected Congress and other democratically elected government members.

Therefore, to prevent this process from being used as a political weapon, the Constitution provides that officials may only be impeached for treason, bribery, or other serious crimes and misdemeanors.

This still leaves a lot of room for interpretation, let alone politics, and many impeachment trials have been split along partisan lines.

However, it is generally understood that this process provides for serious abuses of power.

The first official to be impeached was Tenness Senator William Blount for conspiring with Britain to stop the Spanish colony of Louisiana in 1797.

Since then, the House has opened about 60 impeachment inquiries, but only 19 have led to actual impeachment proceedings.

All eight of the convicted and dismissed cases were federal judges.

And impeachment of a sitting president is even rarer.

Andrew Johnson was impeached in 1868 for trying to replace Secretary of War Edwin Stanton without consulting the Senate.

More than a century later, Bill Clinton was impeached for lying under oath in a sexual harassment trial.

Both men were eventually acquitted after failing to reach the required two-thirds majority of the Senate's guilty votes.

And contrary to popular belief, Richard Nixon was never actually impeached over Watergate.

Knowing that he would almost certainly be convicted, he resigned before that happened.

In theory, the US government is already designed to prevent abuse of power, restricting various sectors through a system of checks and balances, term limits, and free elections.

But impeachment can also be seen as an emergency brake if those safeguards fail.

In case you're wondering, I'm not wearing a dress and I haven't said what I'm wearing underneath.

(laughs) This is go.

This is my national costume.

In Bhutan, all men dress like this.

That's how our women dress.

Like women, we men also wear pretty bright colors, but unlike women, we can show off our legs.

(Laughter) Our folk costumes are unique, but that's not the only thing that makes my country unique.

Our commitment to remain carbon neutral is also unique and this is what I want to talk about today, our commitment to remain carbon neutral.

But before we go any further, we need to set the context.

let's talk about us.

Bhutan is a small country in the Himalayas.

We have been called Shangri-La, the last Shangri-La.

But first let me say that we are not Shangri-La.

My country is not a big monastery of happy monks.

(Laughter) The reality is that there are only 700,000 people sandwiched between China and India, the two most populous countries on the planet.

In reality, we are a small underdeveloped country doing our best to survive.

But we are fine. we are surviving

In fact, we are prosperous, but the reason we are prosperous is because we are blessed with extraordinary kings.

Our wise monarchs have worked tirelessly to advance our country, carefully balancing economic growth with social development, environmental sustainability and cultural preservation, all within the framework of good governance.

We call this holistic approach to development Gross National Happiness (GNH).

In the 1970s, our 4th King famously declared that Gross National Happiness was more important than Gross National Product for Bhutan.

(Applause.) Since then, all development in Bhutan has been driven by GNH, a pioneering vision aimed at improving the well-being and welfare of its people.

But that's easier said than done, especially when it's one of the world's smallest economies.

Our total GDP is less than $2 billion.

I know some of you here are worth more as individuals than my country's economy as a whole (laughs).

So our economy is small, but here's where it gets interesting.

Education is completely free.

Free school education is guaranteed to all citizens, and free university education is given to those who work hard.

Medical expenses are also completely free.

Doctor visits, treatments, medicines, they are all provided by the state.

We manage this because we use our limited resources very carefully and stay true to GNH's core mission of developing with values.

Our economy is small and we have to strengthen it.

Economic growth is important, but it must not come from degrading our unique cultures and pristine environments.

Today our culture is thriving.

We continue to celebrate art and architecture, food and festivals, monks and monasteries.

And yes, we also celebrate national dress.

That's why I can wear Go with pride.

Here's an interesting fact. You are looking at the world's largest pocket.

(Laughs) It starts here, goes around the back, and comes out from here.

This pocket holds all kinds of personal items, from cell phones and wallets to iPads, office files and books.

(Laughter) (Applause) But sometimes, sometimes even precious cargo.

So while our culture is thriving, so is our environment.

Seventy-two percent of my country is covered in forests.

Our Constitution requires that at least 60 percent of Bhutan's total land area remain forested at all times.

(Applause.) Our constitution, this constitution imposes forest cover on us.

By the way, our King used this constitution to impose democracy on us.

As you know, our people didn't want democracy.

We didn't ask for it, didn't demand it, and certainly didn't fight for it.

Instead, our King imposes democracy on us by insisting that it be included in our constitution.

But he went further.

He included a provision in the constitution giving the people the power to impeach the king, and a provision here requiring all kings to retire at the age of 65.

(Applause.) In fact, we already have a retired king. Our former king, Oshisei, retired ten years ago at the peak of his popularity.

He was 51 at the time.

So, as I said, 72 percent of our country is forested, and all of that forest is pristine.

That is why our country is one of the few remaining global biodiversity hotspots in the world and a carbon neutral country.

In a world threatened by climate change, our country is a carbon neutral country.

After all, it's a big deal.

Currently, among the more than 200 countries in the world, Japan seems to be the only country that has achieved carbon neutrality.

In practice, it's not very accurate.

Bhutan is not carbon neutral.

Bhutan is carbon negative.

The country as a whole produces 2.2 million tons of carbon dioxide, but forests sequester more than three times that amount, resulting in a net sink of more than 4 million tons of carbon dioxide each year.

But that's not all.

(Applause.) We export most of the renewable electricity we generate from fast-flowing rivers.

So today the clean energy we export offsets about 6 million tons of carbon dioxide in our neighborhoods.

By 2020, we will export enough electricity to offset 17 million tons of carbon dioxide.

And if we can tap even half the potential of hydropower, and that's exactly what we're doing, the clean, green energy we export will offset about 50 million tons of carbon dioxide annually.

That's more than the entire city of New York produces in a year.

In other words, Japan is a net carbon dioxide sink.

Outside the company, we conduct carbon offsetting.

And this is important.

As you know, the world is warming and climate change is real.

Climate change is affecting my country.

Our glaciers are melting, causing flash floods and landslides that are causing disaster and widespread destruction in our country.

I was at that lake recently.

It is wonderful.

It was the same 10 years ago, and it was the same 20 years ago.

Just 20 years ago the lake didn't exist.

It was a solid glacier.

A few years ago, a similar lake burst a dam and wreaked havoc on the valley below.

Its destruction was caused by one glacial lake.

We have to fight 2,700 of them.

The important thing is this. My country and people have done nothing to contribute to global warming, yet we are already bearing the brunt of its effects.

And for a small, poor country, landlocked and surrounded by mountains, it is very difficult.

But we are not going to sit around doing nothing.

We fight climate change.

That is why we have made a commitment to remain carbon neutral.

We made this promise for the first time at COP 15 in Copenhagen in 2009, and no one took notice.

Governments were so busy arguing and blaming each other about the causes of climate change that when a small country raised its hand and announced, "We are committed to staying carbon neutral forever," no one could hear us.

nobody cared.

At COP 21 in Paris last December, we reiterated our commitment to remain carbon neutral.

Our voices were heard this time.

We were noticed and everyone cared.

What was different in Paris was that governments were willing to come together, act collectively and work together to accept the reality of climate change.

All countries, from very small to very large, are working to reduce their greenhouse gas emissions.

The United Nations Framework Convention on Climate Change says that if these so-called purported commitments are met, we will come closer to limiting global warming to 2 degrees Celsius.

By the way, I asked the TED organizers here to raise the temperature here by 2 degrees. So if any of you are feeling hotter than usual, you know who to blame.

It is important that we all keep our promises.

As far as Bhutan is concerned, we keep our promise to remain carbon neutral.

Here are some of the ways we do it.

We provide free electricity to rural farmers.

The idea is that with free electricity, you don't need to use firewood to cook your food.

We invest in sustainable transportation and subsidize the purchase of electric vehicles.

Similarly, we are subsidizing the cost of LED lighting and are working to go paperless throughout the government.

We are purifying the entire country through our national program, Clean Bhutan, and we are planting trees across the country through another national program, Green Bhutan.

But at the core of any carbon neutral strategy are protected areas.

Our protected areas are carbon sinks.

Those are our lungs.

More than half of our country is now protected as national parks, nature reserves and wildlife sanctuaries.

But the great thing is that we connect them all together through a network of biological corridors.

Now, what this means is that our animals are free to roam the land.

Take this tiger for example.

Found 250 meters above sea level in hot subtropical jungle.

Two years later, that same tiger was spotted at nearly 4,000 meters in our cold high mountains.

Isn't that amazing?

(Applause.) We have to keep it.

We have to keep our parks in great shape.

That is why, each year, we secure resources to prevent poaching, hunting, mining and pollution within our parks, and to help park communities manage their forests, adapt to climate change, and live better lives while continuing to live in harmony with Mother Nature.

But it is expensive.

In the next few years our small economy will not have the resources to cover all the costs of protecting the environment.

In fact, if you do the math, it's going to be at least 15 years before all conservation work is fully funded.

But neither Bhutan nor the world can afford to spend 15 years going backwards.

This is why His Majesty the King started Bhutan for Life.

Bhutan For Life gives us the time we need.

It gives us breathing room.

This is essentially a funding mechanism to care for and protect our parks until our government can take over entirely on its own.

The idea is to collect transitional funds from individual donors, businesses and organizations, but the deal will only go through if certain conditions are met and all funds are committed.

So multiple parties, single closing, an idea borrowed from Wall Street.

This means that individual donors can commit without worrying about continuing to support underfunded plans.

It's like a Kickstarter project, but with a duration of 15 years and millions of tons of carbon dioxide at risk.

Once the deal is in place, we will use the Transition Fund to protect the parks, giving the government time to gradually increase its own funding until the 15-year term ends.

Our government then permanently guarantees the full amount of funds.

we are almost there.

It is scheduled to close later this year.

Naturally, I'm pretty excited.

(Applause.) The World Wide Fund for Nature has been our key partner on this journey, and I want to give them big compliments for the great work they are doing in Bhutan and around the world.

(Applause) Wow, it's getting warmer here.

Thank you for listening to our story, how we keep our promise to remain carbon neutral, how we keep our country pristine for ourselves, our children, your children and the world.

But we're not here to tell stories, are we?

We are here to dream together.

Finally, I would like to talk about another dream that I have.

What if we could combine our leadership, resources, influence and passion to spread the idea of ​​'Bhutan for Life' to other countries so that they too can preserve their protected areas forever?

After all, there are many other countries facing the same problems that we face.

They, too, have natural resources that can help win the global battle for sustainability, but they may not have the capacity to invest in them right now.

So what if we set up a global foundation, Earth for Life, to start 'Bhutan for Life' all over the world?

Help me bring this dream across borders to all those who care about the future of our planet.

After all, we are here to dream together, work together, fight climate change together, and protect the planet together.

Because in reality we are together.

Some of us may dress differently, but we are together.

Thank you very much, Kadrin Che Ra. thank you.

(Applause) Thank you, thank you, thank you.

The following are my opinions and do not reflect the opinions or policies of any particular public prosecutor's office.

(laughs) I'm a prosecutor.

I believe in law and order.

I'm the adopted son of a police officer, Marine, and hairdresser.

I believe in responsibility and that we should all be safe within our community.

I love my job and the people who work with it.

We just think it's our responsibility to make it better.

Let's raise our hands. By the age of 25, how many of you have cheated in school, gone to places that were specifically off limits, or drank before the legal age?

(Laughter) Okay.

How many people have shoplifted, tried illegal drugs, or gotten into fights? Yes, even siblings.

Now, how many of you have spent a day in prison for these decisions?

How many of you sitting here today think you are a danger to society or should be defined by the indiscretions of young people?

(Laughter) I got the points.

When we talk about criminal justice reform, we focus on a few things, and that's what I want to talk about today.

But first I'm going to -- because you shared it with me, I'm going to confess to you.

I went to law school to make money.

I had no interest in becoming a civil servant, I had no interest in criminal law, and I never thought I would become a public prosecutor.

Near the end of my first year of law school, I participated in an internship at the Roxbury Division of Boston City Court.

I knew Roxbury was a poor neighborhood in Boston plagued with gun violence and drug crime.

My life and legal career changed from day one of that internship.

As I entered the courtroom, I saw the audience approach the courtroom one by one and say only a few words, "not guilty."

They were mostly black and brown.

And judges, defense attorneys, and prosecutors make life-changing decisions about that person without their input.

They were mostly white.

As people approached the court one by one, I couldn't help but stop and think. "How did they get here?"

I wanted to know their story.

And as the prosecutor read out the facts of each case, I thought to myself, we could have predicted that.

It seems pretty preventable...

Not because I was a criminal law expert, but because it was common knowledge.

Over the course of my internship, I came to recognize the people in the auditorium. It's not because they're criminal masterminds, it's because they've come to us for help and we've sent them off with nothing.

I worked as a defense paralegal in my second year of law school and met many young people who were accused of murder in that experience.

Even in the "worst" I saw a human story.

And all of them included childhood trauma, injury, poverty, loss, school dropouts, and early involvement with the police and criminal justice system, all of which led to a seat in the courtroom.

Those convicted of murder were sentenced to death in prison, and during my meeting with them, I couldn't understand why they would spend so much money to keep this one person in prison for the next 80 years when they could have been reinvested up front and probably prevented the whole case from happening.

(Applause.) In my third year of law school, I defended people accused of petty street crimes. Most are mentally ill, most are homeless, most are drug addicts, and all need help.

They come to us, but we send them back without their help.

they needed our help.

But we weren't giving them anything.

They were prosecuted, tried, and defended by people who knew nothing about them.

That staggering inefficiency is what drove me into criminal justice work.

All of that was unfair and made me want to be a defender.

The power dynamics that I understood made me a prosecutor.

I don't want to spend a lot of time talking about the issue.

We know our criminal justice system needs reform, and we know that America is the most incarcerated country on earth, with 2.3 million people in prisons and jails.

A further 7 million people are known to be on probation or on parole, and we know that the criminal justice system disproportionately affects people of color, especially poor people of color.

And we know there are systemic failures everywhere that bring people to court.

But what we don't discuss is how ill-prepared prosecutors are to receive them.

As a society, we focus on three things when we talk about criminal justice reform.

We complain, tweet and protest police, sentencing and prisons.

We rarely, if ever, talk about prosecutors.

In the fall of 2009, a young man was arrested by Boston police.

He was 18 years old, African American, and in the 4th grade at the local public school.

He was aiming for college, but a minimum-wage part-time job didn't give him the financial opportunities he needed to get into school.

Through a series of bad decisions, he stole 30 laptops from a store and sold them on the Internet.

This led to his arrest and criminal charges of 30 felonies.

Christopher's greatest stress is the prospect of him going to jail.

But what he had little understanding of was the impact his criminal record would have on his future.

I was at the arraignment that day, when Christopher's case came to my desk.

It may sound dramatic, but in that moment I had Christopher's life in my hands.

I was 29 years old, a rookie prosecutor with little understanding of how the decisions I was making would affect Christopher's life.

Christopher's case was serious and had to be dealt with, but I didn't think stigmatizing him with a lifelong felony was the right answer.

Most of the time, prosecutors go to work with little understanding of the implications of our decisions, regardless of our intentions.

Despite our wide discretion, we learn to avoid risk at all costs, and that discretion becomes essentially useless.

History has led us to believe that the criminal justice system somehow brings accountability and improves public safety, despite evidence to the contrary.

Because we are judged internally and externally by convictions and court victories, prosecutors don't really have an incentive to be creative in disposing of cases or to take risks against those who otherwise wouldn't.

We are clinging to outdated methods that are counterproductive to achieving the very goal we all want: a safer community.

But most prosecutors standing in my seat would have arraigned Christopher.

They underestimate what we can do.

Arresting Christopher would give him a criminal record, make it harder to get a job, and set off the vicious cycle that characterizes today's dysfunctional criminal justice system.

With a criminal record and no job, Christopher cannot find a job, an education, or a stable place to live.

Without these protective elements in his life, Christopher is more likely to commit even more serious crimes.

The more Christopher's contact with the criminal justice system, the more likely he is to return to it again and again, all at great societal costs to children, families and colleagues.

And ladies and gentlemen, this is a terrible result for public safety, for the rest of us.

When I graduated from law school, I did the same thing as everyone else.

I came out as a prosecutor who was expected to do justice, but I never learned in class what justice is.

None of us are.

Still, prosecutors are the most powerful actors in the criminal justice system.

Our power is virtually limitless.

Most of the time, it's not the judges, the police, the Congress, the mayor, the governor, or the president who can tell us how to prosecute our cases.

I made the sole decision to arraign Christopher and give him a criminal record.

I would choose to indict him with 30 felonies, 1 felony, misdemeanor, or none.

I would choose to use Christopher in a plea bargain, or take him to court, and in the end I would be in a position to ask Christopher to go to jail.

These are decisions prosecutors are free to make every day, and we are ignorant and untrained in the grave consequences of those decisions.

One evening this summer, I was at a small gathering of professionals of color from all over the city.

As I stood there with a free finger sandwich shoved into my mouth as I would as a civil servant, I noticed a young man across the room waving and smiling as he approached me.

And I noticed him, but I didn't know where. And when I woke up, this young man was hugging me.

And thank me

"You care about me and you changed my life."

It was Christopher.

You see, I never arraigned Christopher.

He never faced a judge or prison and had no criminal record.

Instead, I worked with Christopher. First, hold him accountable for his actions, and second, put him in a position not to offend again.

We collected 75% of the computers he sold, returned them to Best Buy, and put together a financial plan to pay off the computers we didn't collect.

Christopher did community service.

He wrote an essay considering how the incident will affect his future and the future of his community.

He applied to college, got financial aid, and graduated from four-year school.

(Applause.) After we finished hugging, I looked at his name tag and saw that Christopher was the manager of a large bank in Boston.

Christopher made a lot more money than I did, and he did it [laughs].

I can't take credit for Christopher's path to success, but I certainly did my part to keep him on that path.

There are thousands of Christophers out there, some locked up in prisons and jails.

We need to make thousands of prosecutors aware of that and protect them.

A hired Christopher is better for public safety than a convicted Christopher.

It's a bigger win for all of us.

In retrospect, the decision not to throw the book at Christopher made perfect sense.

When I met him in Roxbury Court that first day, I didn't see the criminal standing there.

As an individual caught selling large amounts of drugs in my late teens, I knew firsthand the power of opportunity as opposed to the wrath of the criminal justice system.

Along the way, with the help and guidance of the district attorney, superiors, and judges, I learned the power of prosecution to change lives, not ruin them.

That's how it's done in Boston.

We helped find a job for a woman who was arrested for stealing food to feed her children.

Instead of putting an abused teen in adult prison for hitting another teen, we secured mental health treatment and community supervision.

A runaway girl arrested for prostitution needed a safe place to live and grow to survive on the streets. It was something we could help her with.

I once helped a young man one morning who stuffed his backpack with 9mm bullets instead of a lunchbox because he was afraid of the older gangster kids showing up after school.

We spent what would normally take months of litigation preparation to come up with practical solutions to the issues they presented for the upcoming trial.

Which one would you rather spend your time on?

How do you want prosecutors to spend their money?

Why throw $80 billion into a prison industry that we know is failing? When that money can be reallocated to education, mental health treatment, substance abuse treatment, and community investment in neighborhood development.

(Applause.) So why is this important to you?

Well, for one, we spend a lot of money.

our money.

In some states, it costs $109,000 to incarcerate a teenager for a year, and there is a 60 percent chance that the person will return to the exact same system.

That's a horrible return on investment.

Second: That's correct.

If the prosecution was involved in creating the problem, it is our duty to come up with a solution, and we can do that using data and other areas that are already doing research for us.

Third, your voice and vote can make it happen.

The next time there is a District Attorney election in your jurisdiction, ask your candidate these questions:

2: What data are you collecting and how are prosecutors trained to ensure it works?

Third: If it doesn't work for everyone, what are you doing to fix it?

If you can't answer the question, you shouldn't be doing the job.

Those of you who raised your hands at the beginning of this talk are vivid examples of opportunity, intervention, support and the power of love.

Each of you may have faced your own punishment for whatever wrongdoing you have committed, but few of you did not have to spend a day in prison to become the man you are today, the greatest mind on earth.

Every day, thousands of times a day, prosecutors across the United States wield so much power that catastrophe can come as quickly as it brings opportunity, intervention, support, and even love.

These qualities are the hallmarks of strong communities, and strong communities are safe communities.

If our community is broken, don't let the lawyer of your choice fix it in an outdated, inefficient and expensive way.

Ask for more. Vote for prosecutors who help people stay out of jail instead of putting them in jail.

Demand better.

You, your children, and, of course, those who are bound by the institution, but most of all, those whom we are sworn to protect and to do justice, demand it.

We have to do better.

thank you.

(Applause.) Thank you.

(Thank you for applause.

India has such a large family.

Many of you must have heard of it.

That means there are plenty of family-friendly events.

So when I was a kid, my parents often took me to these family events.

But what I always looked forward to was playing with my cousins.

And the uncle who was always there was always ready, jumping and playing games with us, giving the kids the best time of their lives.

This man has been very successful. I was confident and strong.

But then I saw this lively, energetic person deteriorating in health.

He was diagnosed with Parkinson's disease.

Parkinson's disease is a disease that causes degeneration of the nervous system. This means that this previously independent person suddenly finds it much more difficult to do tasks such as drinking coffee because of the tremors.

My uncle started walking with a walker, but to turn around he had to literally take one step at a time like this, which took forever.

In other words, this person who was the center of attention at every family gathering was suddenly in the shadows.

He hid from people's pitiful eyes.

And he is not the only one in the world.

Each year, 60,000 people are newly diagnosed with Parkinson's disease, and this number is only increasing.

As designers, we dream of our designs solving these multifaceted problems and being the one solution that solves them all, but it doesn't have to be that way.

You can also target a simple problem and create a small solution to it that ultimately has a big impact.

So my aim here was not to cure Parkinson's disease, but to make their day-to-day work simpler and impactful.

Well, the first thing I was aiming for was vibration.

My uncle told me that he stopped drinking coffee and tea in public because he was embarrassed. That's why we designed a cup that doesn't spill.

It works purely in its form.

The curve at the top allows the liquid to move back inward with each shake, keeping the liquid inside compared to regular cups.

But the key here is that it's not tagged as a Parkinson's product.

It looks like a cup that you, me, and the clumsy can use and feel more comfortable and blend in with.

Well, one problem is solved, but there are still many more to solve.

All the while, I was interviewing him and questioning him, only to find that I was getting only very superficial information: answers to my questions.

But I had to dig deeper to get a new perspective.

So I decided to observe him during his daily routine, eating and watching TV.

And how does this guy, who has such a hard time walking on level ground, get up the stairs when actually observing him walking towards the dining table?

This is because India does not have fancy rails for climbing stairs like in developed countries.

You actually have to climb stairs.

So he said to me, "Well, let me show you how I do it."

Let's see what I saw.

So it's taken him a very long time to get to this position, and all the while I'm thinking, 'Oh my God, is he really going to do that?

Is he really, really going to do it without a walker? ”

after that ...

(Laughter.) And the turn, he took the turn so easily.

So -- were you shocked?

Well, so did I.

A person who couldn't even walk on flat ground suddenly became a professional climber.

Upon investigation, I found that it was a continuous action.

Some men suffer from the same symptoms and use walkers. But when he gets on his bike, at that moment all symptoms disappear. Because it's a continuous movement.

So the key for me was getting this feeling of walking up stairs back to level ground.

And many ideas were tested and tried on him, but this was the one that finally worked. Let's see.

(Laughter) (Applause) He walked fast, didn't he?

(Applause.) I call it the staircase illusion, but when the staircase illusion ends abruptly, he froze, and I call this the gait freeze.

This kind of thing happens all the time, so why not make them feel more confident by running the illusion of a staircase in every room.

As you know, technology doesn't always make it possible.

We need human-centered solutions.

It could have easily been a projection or Google Glass or something.

However, I stuck to a simple print on the floor.

Bringing this print into the hospital will make them feel even more welcome.

What I want is for every Parkinson's patient to feel the way my uncle felt that day.

He told me I made him feel like he was back in his old self.

"Smart" in today's world has become synonymous with high tech, and the world is getting smarter every day.

But why isn't smart just as simple as it is effective?

All we need is a little empathy and a little curiosity to go out and observe.

But it doesn't stop there.

Let's find out these complicated problems. don't be scared of them.

Break them down and boil them down to smaller problems to find easy solutions.

Test these solutions, fail where necessary, but use new insights to make them better.

Imagine what we could do if we all came up with a simple solution.

What would the world be like if you put all the simple solutions together?

Create a simple, yet smarter world.

thank you.

(applause)

Are you as good at things as you think you are?

How good are you at managing money?

How about reading people's emotions?

How healthy are you compared to others you know?

Are you better than average in grammar?

Knowing how competent you are and how your skills stack up against those of others does more than boost your self-esteem.

It helps you understand when you can follow your decisions and intuition and when you need to seek advice.

However, psychological research shows that we are not very good at evaluating ourselves accurately.

In fact, we often overestimate our abilities.

Researchers have named this phenomenon the 'Dunning-Kruger effect'.

This effect explains why over 100 studies have shown that people exhibit an illusive advantage.

We judge ourselves better than others to the extent that we violate the laws of mathematics.

When software engineers from two companies rated performance, 32% of engineers at one company and 42% of engineers at the other were in the top 5%.

In another survey, 88% of American drivers said they had above average driving skills.

These are not isolated findings.

On average, people tend to rate themselves higher than others in areas such as health, leadership skills, and ethics.

Of particular interest is that the least competent are the most likely to overestimate their skills to the maximum.

People who are demonstrably bad at logical reasoning, grammar, financial knowledge, mathematics, emotional intelligence, performing medical tests, and chess are all more likely to rate their expertise almost as favorably as actual experts.

So who is most susceptible to this delusion?

Sadly, we all have incompetence that we are not even aware of.

but why?

When psychologists Dunning and Kruger first described this effect in 1999, they argued that those who lack knowledge and skills in certain areas suffer a double curse.

First, they make mistakes and make poor decisions.

But secondly, the same knowledge gap prevents us from noticing our mistakes.

In other words, underperformers lack the very expertise necessary to recognize how poorly they are performing.

For example, when researchers surveyed participants in a college debate tournament, teams in the bottom 25% of qualifying rounds lost almost four of their five games.

But they thought they were winning by almost 60%.

Students who did not have a solid understanding of the rules of debate were unable to recognize when and how often discussions broke down.

The Dunning Kruger effect is not a matter of the ego blinding us to our weaknesses.

People usually admit their flaws when they see them.

In one study, students who initially performed poorly on a logic quiz but then took a logic mini-course were more willing to label their original performance as poor.

This may be why people with some experience and expertise often lack confidence in their abilities.

They know full well that there are many things they don't know.

Experts, on the other hand, tend to be conscious of how much they know.

But they often make another mistake. They assume that other people are equally knowledgeable.

As a result, people, whether incompetent or highly skilled, are often caught in a bubble of inaccurate self-perception.

If your skills are low, you will not be able to see your own shortcomings.

When they are highly capable, they do not realize how extraordinary their abilities are.

So, if the Dunning-Kruger effect is invisible to those experiencing it, how do we know how good we really are in many ways?

First, listen to and consider other people's opinions, even if they are difficult to hear.

Second, and more importantly, keep learning.

The more knowledge we have, the less likely we are to see invisible holes in our abilities.

Perhaps it all comes down to the old saying, "When arguing with a fool, first make sure the other person isn't doing the same thing."

So this is a story about how we know what we know.

This is a story about a woman named Natalia Rybczynski.

She's a paleontologist. I mean, we specialize in digging up really old dead stuff.

(Audio) Natalia Rybczynski: Yeah, I had someone call me "Dr. Dead Ones."

Latif Nasser: And what she finds particularly interesting is where she mines the material, high above the Arctic in the remote tundra of Canada.

Well, on a summer's day in 2006, she was at an excavation site called Fil's Bed less than 10 degrees latitude from the North Magnetic Pole.

(Audio) NR: It doesn't sound all that exciting, really. Because it was just a day of walking around with a backpack, a GPS and a notebook to pick up what might be fossils.

LN: And at some point she realized something.

(Audio) NR: Something like a rusty, rusty color, about the size of your palm.

It just lay on the surface.

LN: And at first she thought it was just a piece of wood. Because it was part of the kind that people had found before in Fil's Foliage, prehistoric plants.

But when I returned to camp that night...

(Audio) NR: ...I took out my hand lens and looked a little more closely, and noticed that this didn't look like it had annual rings.

It may be a preserved item, but it really looks like it...

Bone.

LN: Hmm. So over the next four years, she visited the site again and again and ended up collecting 30 of the exact same bone fragments, most of them really tiny.

(Audio) NR: Not much. Fits in a small ziplock bag.

LN: And she tried to piece them together like a jigsaw puzzle.

But it was challenging.

(Audio) NR: It's broken into so many small pieces, and I'm trying to use sand and putty, and it doesn't look good.

So finally, we used a 3D surface scanner.

LN: Oh! NR: Right?

(laughs) LN: It turned out to be much easier to do it virtually.

(Audio) NR: It's kind of magical when everything fits together.

LN: How confident were you that you were doing it right, assembling it the right way?

Was it possible to put it together differently and put a parakeet or something?

(laughter) (audio) NR: (laughter) Um, no. No, I get this.

LN: It turned out that she had a tibia, a leg bone, specifically an artiodactyl mammal, something like a cow or a sheep.

But it couldn't be neither.

It was just too big.

(Audio) NR: This size was huge. It's a really big animal.

LN: So what animal is that?

Hitting a wall, she showed one of the pieces to some colleagues in Colorado, and they had an idea.

(Audio) NR: We took a saw and just scratched the end of it and it had a very interesting smell.

LN: It smelled like burnt meat.

It was the smell Natalia recognized when chopping up the skull in the gross anatomy lab: the smell of collagen.

Collagen gives structure to our bones.

And it usually breaks down after many years.

But in this case, the North Pole was preserved, acting like a natural freezer.

A year or two later, Natalia attended a conference in Bristol and saw a colleague named Mike Buckley demonstrating this new process, which he called "collagen fingerprinting."

Different species have been found to have slightly different collagen structures, so if you get the collagen profile of an unknown bone, you can compare it to the collagen profile of a known species and you'll likely find a match.

So she sent him one of the pieces, FedEx.

(Audio) NR: Yeah, you want to track it. It's kind of important.

(laughter) LN: And he processed it and compared it to 37 known modern mammals.

and he found a match.

3.5-million-year-old bones excavated by Natalia from the high Arctic...

camel.

(laughter) (audio) NR: So I'm thinking, what? That's great—if that's true.

LN: So they tested a number of fragments and each gave the same result.

However, based on the size of the bones found, it was found to be 30% larger than modern camels.

So this camel was about 9 feet tall and weighed about 1 ton.

(audience reaction) Yes.

Natalia found a giant Arctic camel.

(laughter) Now, when you hear the word “camel”, one of them is probably the Bactrian camel of East and Central Asia.

But perhaps the postcard image you have in your head is likely one of these. A quintessential desert creature, the dromedary hangs out in hot, sandy places like the Middle East and the Sahara, has a large old hump on its back to store water for long journeys in the desert, and has large, wide feet to tread on the dunes.

So how on earth does one of these guys end up in the High North Pole?

Well, scientists have long known that camels are actually native to America, even before Natalia discovered them.

(Music: The Stars and Stripes) (Laughter) They started here.

For nearly 40 of the 45 million years that camels have existed, camels can only be found in North America, with about 20 different species and sometimes more.

(Audio) LN: If you put them all side by side, would they look different?

NR: Well, the body sizes are different.

Some have very long necks, functionally similar to giraffes.

LN: Some had crocodile noses.

(Audio) NR: The really primitive early ones would have been really small, almost like rabbits.

LN: What? A camel the size of a rabbit?

(Audio) NR: The earliest.

So they probably don't recognize you.

LN: Oh my God, I want a pet rabbit and a camel.

(Audio) NR: Okay, wouldn't that be great?

(Laughter) LN: And about three to seven million years ago, one branch of camels went down to South America, where they became llamas and alpacas, and another branch crossed the Bering Land Bridge to Asia and Africa.

And towards the end of the last ice age, North American camels became extinct.

So while scientists already knew all about it, it's still not fully explained how Natalia found it in a place so far north.

This is the exact opposite of the Sahara Desert in terms of temperature.

To be fair, 3.5 million years ago it was on average 22 degrees Celsius warmer than it is today.

So it would have been a boreal forest, something like the Yukon Territory or Siberia today.

However, even so, the winter of six months with frozen ponds continues.

A blizzard will occur.

It will be pitch black 24 hours a day.

how...how?

How did one of these Sahara Desert superstars manage to survive its Arctic conditions?

(Laughter) Natalia and her colleagues think they have the answer.

And it's kind of awesome.

What if the very characteristics we imagine camels to be so well-suited to places like the Sahara actually evolved to survive the winter?

What if those wide feet were meant to tread on snow, like snowshoes, instead of on sand?

What if that hump, which to me is big news, contains no water, it contains fat (laughs), but was there to help the camel get through the half-winter when food was scarce?

And, long after crossing the overpass, did you modify your winter gear for the hot desert environment?

For example, humps may be helpful for camels in hot climates. Because once you have all the fat in one place, you don't need to insulate other parts of your body like you do with a fat backpack, for example.

This makes it easier for heat to dissipate.

It's this crazy idea that what looks like evidence of the camel's typically desert nature could actually be evidence of its high Arctic past.

Well, I'm not the first to tell this story.

Some talk of it as a way to marvel at evolutionary biology, or as a keyhole to the future of climate change.

But I love it for a completely different reason.

For me, this is a story about us, a story about how we see the world and how it changes.

So I trained as a historian.

And I learned that many scientists are actually historians as well.

they understand the past.

They tell the history of our universe, our planet, and life on this planet.

And as a historian, I start by mentally imagining how the story might unfold.

(Audio) NR: Like camels in the desert, we create stories and stick to them, right?

Great story! It fits perfectly.

Obviously, it has always lived there.

LN: But you may find a little bit of evidence at any time.

You can learn little things that force you to reframe everything you thought you knew.

For example, in this case, one scientist found a piece of what he thought was wood. So science has come up with a whole new and totally counterintuitive theory as to why this absurd Dr. Seuss-like creature looks the way it does.

And for me, it completely changed my way of thinking about camels.

It went from a ridiculously niche creature only suited to this particular environment to a world traveler who happens to be in the Sahara Desert and could end up virtually anywhere.

(Applause.) It's Azzurri.

Hi Azzurri, how are you doing?

OK, I prepared this one.

(laughs) So Azzurri is taking a break from their regular show at Radio City Music Hall.

(Laughter) It's not even a joke.

Anyway -- but really, Azri is here as a living reminder that our world's story is a dynamic one.

It requires a willingness to readjust and rethink.

(laughs) Right, Azzurri?

And the fact is that we are all a fraction of a mile away from being able to see the world anew.

thank you very much.

(applause)

In the summer of 1997, NASA's Pathfinder spacecraft landed on the surface of Mars and began transmitting incredibly iconic images to Earth.

But a few days later something went terribly wrong.

Communication has stopped.

Pathfinder was effectively procrastinating, neglecting his most important task despite being completely preoccupied.

what was going on?

It turned out to be a bug in the scheduler.

All operating systems have something called a scheduler, which tells the CPU how long each task should run before switching and what to switch to.

When a computer works properly, it moves so fluidly between its various roles that it gives the illusion that it is doing everything at once.

But we all know what happens when things go wrong.

This should at least give us some comfort.

Even computers can be overwhelming at times.

Perhaps learning about the computer science of scheduling will give you an idea of ​​our race against time.

One of the first insights is that all the time you spend prioritizing work is time you don't spend on it.

For example, when you check your inbox, you go through all your messages and select the most important ones.

Once you've dealt with that, repeat the same.

Sounds sensible, but here's the problem.

This is known as a quadratic time algorithm.

If your inbox is doubled, these passes will take twice as long and you'll need to do twice as many passes.

This means four times the work.

Programmers in the operating system Linux ran into a similar problem in 2003.

Linux ranked all tasks in order of importance and sometimes spent more time ranking tasks than doing them.

A counter-intuitive solution for programmers was to replace this perfect ranking with a limited number of priority "buckets". The system was less accurate about what to do next, but more than made up for it by spending more time making progress.

So sticking to always doing the most important things first when it comes to email can lead to meltdowns.

If you wake up in the morning and your inbox is three times larger than usual, it might take nine times longer to empty.

We recommend that you reply in chronological order or reply randomly.

Surprisingly, letting go of doing things in perfect order can be the key to getting things done.

Another insight from computer scheduling has to do with one of the most common features of modern life: interruptions.

When the computer transitions from one task to another, it has to perform something called a context switch. It bookmarks that location in some task, moves the old data out of memory, and moves the new data out of memory.

Each of these actions has a cost.

The insight here is that there is a fundamental trade-off between productivity and responsiveness.

To get serious work done, context switching should be minimal.

But being sensitive means reacting whenever something happens.

These two principles are fundamentally in tension.

Recognizing this tension can help you decide where to strike the balance.

The obvious solution is to minimize interruptions.

Less obvious is grouping them.

For example, if you don't have any notifications or emails that require an urgent response more than once an hour, you should check on that frequency. no more.

In computer science, this idea goes by the name of interrupt coalescing.

The mouse moved instead of dealing with what came to mind?

Was a key pressed?

Would you like to download more of that file? – The system groups these interruptions based on the amount of time it can tolerate waiting.

In 2013, interrupt coalescing significantly improved laptop battery life.

This is because postponing the suspend allows the system to check everything at once and quickly return to a low power state.

As computers do, so do we.

Perhaps adopting a similar approach will allow us users to regain our attention and one of the most rare things in modern life: rest.

A mosquito lands on your arm, injects its chemicals into your skin, and begins sucking blood.

Unless a visibly itchy red lump appears, you won't even know it's there.

Although annoying, the bump is an important signal that you're protected by the immune system, the body's primary defense against infection, disease, and disease.

This system is a vast network of cells, tissues, and organs that coordinate the body's defenses against all threats to health.

Without it, we would be exposed to billions of bacteria, viruses and toxins, and something as minor as a paper cut or a seasonal cold could cause fatal injuries.

The immune system relies on millions of protective white blood cells (also known as white blood cells) derived from the bone marrow.

These cells travel to the bloodstream and lymphatic system, a network of blood vessels that help remove toxins and waste from the body.

Our bodies are rich in white blood cells, with between 4,000 and 11,000 per microliter of blood.

White blood cells are on the move and act like security guards, constantly examining blood, tissues, and organs for suspicious signs.

This system mainly relies on cues called antigens.

Traces of these molecules on the surface of pathogens and other foreign substances indicate the presence of intruders.

As soon as white blood cells detect them, it takes only minutes for the body's protective immune response to kick in.

The threats to our bodies are so diverse that the immune response must be similarly adaptive.

This means you have to utilize different types of white blood cells to deal with threats in different ways.

Despite this diversity, we divide leukocytes into two major cell groups that coordinate attack from two directions.

First, phagocytes trigger an immune response by sending macrophages and dendritic cells into the blood.

As they circulate, simply ingesting them destroys any foreign cells they encounter.

This allows the phagocytic cells to identify the antigens of freshly ingested invaders and transmit this information to lymphocytes, the second major group of cells that coordinate defense.

A group of lymphocytes called T cells go looking for infected body cells and quickly kill them.

B cells and helper T cells, on the other hand, use the information gleaned from the unique antigen to initiate the production of special proteins called antibodies.

This is the most important point. Each antigen has its own corresponding antibody that can cling to it like a lock and key and destroy invading cells.

B cells produce millions of these, circulating through the body and attacking invaders until the worst threats are neutralized.

While all this is going on, familiar symptoms like high fever and swelling are actually processes designed to help the immune response.

Bacteria and viruses are temperature-sensitive, so when your body warms up, it becomes harder for them to reproduce and spread.

Also, when body cells are damaged, they release chemicals that leak fluid into surrounding tissues, causing swelling.

This also attracts phagocytic cells to consume invaders and damaged cells.

An immune response usually eradicates the threat within days.

It doesn't necessarily prevent disease, but that's not the point.

Its actual job is to stop threats from escalating to dangerous levels within the body.

And through long-term continuous monitoring, the immune system offers another advantage. It is to help develop long-term immunity.

Once B and T cells identify an antigen, that information can be used in the future to recognize invaders.

So if the threat reappears, the cells can quickly deploy the appropriate antibodies to deal with it before it can affect more cells.

In doing so, they gain immunity against certain diseases, such as chickenpox.

It doesn't always work out.

Some people have autoimmune diseases. Autoimmune diseases trick the immune system into attacking the body's own perfectly healthy cells.

No one knows the exact cause, but these diseases interfere with the immune system to varying degrees and underlie problems such as arthritis, type I diabetes, and multiple sclerosis.

But for most people, a healthy immune system will successfully fend off an estimated 300 colds and countless other potential infections over a lifetime.

Without it, these threats would escalate into something even more dangerous.

So the next time you catch a cold or get bitten by a mosquito, think about your immune system.

We owe our lives.

I am from Seattle, Washington, the most liberal, tolerant and progressive place in the United States.

And I grew up in a family of great seat-wright people.

My mother was an artist and my father was a university professor. I really appreciate my upbringing because I was always happy to design my life the way I wanted.

And as a matter of fact, I chose a completely different path than what my parents had in mind.

At 19, I dropped out of college. Dropped out, kicked out, hair torn.

(Laughs) And so I followed my lifelong dream of becoming a professional French horn player.

I have performed chamber music throughout the US and Europe, and toured for several years with the great jazz guitarist Charlie Byrd.

And by the end of my twenties, I was a member of the Barcelona Symphony Orchestra in Spain.

What a wonderful life!

And you know, my parents never complained.

They supported me all along.

It wasn't their dream.

They used to say to their neighbors and friends, "My son is having a blank decade."

(Laughter) And -- but there was one awkward conversation about my lifestyle that I want to talk about.

I am 27 years old and had just returned from Barcelona. I was visiting my parents for Christmas. I cooked dinner with my mother and it was just the two of us in the kitchen.

And she was quiet, too quiet.

something was wrong.

So I said, "Mom, what are you thinking?"

And she said, "Your father and I are very worried about you."

And I said, "What?" So, at this point, what would it be?

And she said, "Honestly, have you ever voted Republican?"

(Laughter) To tell you the truth, I wasn't very political, I was just a French horn player.

But I had a little epiphany and they detected it and it was causing confusion.

You see, I had become a capitalist zealot, and I want to tell you why.

It comes from my lifelong interest in poverty, believe it or not.

As a kid growing up in Seattle, I remember seeing real poverty for the first time.

We were a lower middle class family, but of course that's not real poverty.

It's not even close.

The first time I saw poverty and the face of poverty was in the early 1970s, when I was six or seven years old.

And it was, like many of you, a run-of-the-mill, run-of-the-mill example.

It was a National Geographic photo of a kid my age in East Africa with flies on his face and a swollen belly.

And he wasn't going to make it, and I knew it, and I was helpless.

Some of you remember that picture, but not exactly that picture, but a picture just like it.

It has brought Western countries into deep poverty around the world.

Well, that vision began to haunt me as I grew up, went to school, dropped out, dropped out and started a family.

So I wondered, what happened to that kid?

Or to people like him all over the world?

So I started studying. I wasn't in college, but I was looking for answers. What happened to the poorest people in the world?

did it get worse? Are you better? what?

I found the answer and it changed my life, so I want to share it with you.

Most Americans believe that poverty has worsened since we were children since seeing such a vision.

Ask Americans, "Has poverty gotten worse or better around the world?" 70% would say that hunger has gotten worse since the early 1970s.

But here is the truth.

This was the epiphany that made me change my mind.

From 1970 to today, the proportion of the world's population living at hunger levels and subsisting on less than $1 a day has declined by 80%, apparently adjusted for inflation.

Worst poverty in the world since I was a child has decreased by 80 percent.

Friend, this is a miracle.

That's what we should celebrate.

This is the greatest poverty eradication achievement in human history, and it has happened in our lifetime.

(Applause.) So when I found out about this, I asked, what is it? What made it possible?

Because if you don't know the reason, you can't redo it.

Because if you want to replicate that and lift the next 2 billion people out of poverty, that's what we're talking about. Since I was a child, the least two billion of these people, our brothers and sisters, have been lifted out of poverty.

I want the next 2 billion and I want to know why.

And I went looking for answers.

It wasn't a political answer. Because I didn't care.

Well, I still don't care.

I wanted the best answers from left, right and centrist mainstream economists.

And here it is.

Here's why.

Since I was a child, there are five reasons why two billion brothers and sisters have been lifted out of poverty.

The first is globalization.

Second: free trade.

Third: Property Rights.

Fourth: Rule of law.

The fifth is entrepreneurship.

It was the free enterprise system that spread all over the world after 1970 that made it possible.

Okay, I'm not naive.

I know free enterprise is not perfect, and I know that free enterprise alone is not all it takes to build a better world.

But that's great.

And it goes beyond politics.

Here's what I learned. This is the epiphany.

Capitalism is not just accumulation.

At its best, it is about aspirations, and what many are talking about at this stage are aspirations that come from the dreams embedded in the free enterprise system.

And we have to share it with more people.

Now let's talk about a second epiphany related to the first one. I believe this epiphany can bring us progress not only around the world, but here at home.

To sum up the thoughts I have just stated about lifting people out of poverty, the best words I have ever heard are: "The free market has created more wealth than any other system in history.

They have lifted billions of people out of poverty. ”

Who said it?

Like Milton Friedman or Ronald Reagan.

error.

President Barack Obama said so.

Why do I know it by heart?

Because he told me so.

crazy.

And I said, "Hallelujah."

But more than that, I thought, "What an opportunity."

do you know what i was thinking

It was at an event on the subject at Georgetown University in May 2015.

And I thought this was the solution to the biggest problem facing America today. what?

These ideas unite liberals and conservatives alike to help those who need us most.

I don't need to tell anyone in this room that we are in crisis right now, in America and in many countries around the world where political polarization is growing.

It has risen to a critical crisis level.

It's unpleasant. That's wrong.

Last year there was an article in the Proceedings of the National Academy of Sciences, one of the most prestigious scientific journals published in the West.

And that was a 2014 article on the asymmetry of political motives.

what's that? This is what psychologists call the phenomenon of assuming that one's ideology is based on love, while the other's ideology is based on hate.

It is common in world conflicts.

For example, we would expect something like this to happen between Palestinians and Israelis.

The authors of this article found that the majority of Republicans and Democrats in America today suffer from an asymmetry of political motivation.

Today, the majority of politically active people in our country believe that they are motivated by love, while the other side is motivated by hate.

please think about it. please think about it.

Most people walk around saying, "You know, my ideology is based on basic charity. I want to help people, but others are evil and want to get hold of me."

We cannot progress as a society if there is such an asymmetry.

It's impossible.

How can I solve this?

First, let's be honest, there is a difference.

Don't underestimate the differences. That would be really naive.

There is a lot of good research on this.

A TED stage veteran is my friend Jonathan Haidt.

He is a professor of psychology at New York University.

He tackles the ideologies, values, and morals of different peoples and sees how they differ.

And he showed that, for example, conservatives and liberals have very different emphasis on what they consider important.

For example, John Haidt showed that liberals care 59 percent more about poverty than about economic freedom.

Conservatives also value economic freedom 28% more than poverty.

Irreconcilable differences, right?

we will never be together error.

Diversity is our strength.

Remember what lifted the poor.

It was an obsession with poverty with the means of economic freedom spreading all over the world.

In other words, we need each other if we want to help people and lift the next two billion people out of poverty.

There is no other way.

Hmm.

How do you get it?

it's difficult.

Innovative thinking is required.

Many are at this stage.

social entrepreneurship. yes. absolutely. Amazing.

We must invest abroad in a sustainable, responsible, ethical and moral way. yes. yes.

But do you know what we really need?

We need a new day of flexible ideology.

It should be less predictable.

Isn't that right?

Have you ever felt that your own ideology is starting to become predictable?

A bit traditional?

Have you ever felt like you were always listening to people who agreed with you?

Why is it dangerous?

Because right-wing conservatives are always talking about taxes and regulations and big government when they talk about the economy in this country.

And left-wing liberals, you talk about the economy, but it's always about income inequality.

right? Well, those things are important, they're really important to me, and they're really important to you.

But they are a distraction when it comes to cheering up the hungry who need us today.

We need to unite around the best ways to alleviate poverty, using the best tools at our disposal. It will only come if it recognizes that conservatives need liberals and their obsession with poverty, and liberals need conservatives and their obsession with the free market.

It is in the diversity of this country's future strength if we choose it.

So how do we do it? How do we do it together?

I have to have some action items in place, not just for you, but for me as well.

number one. Action Item #1: Remember, it is not enough to simply tolerate those who disagree.

it's not enough.

We must remember that we also need people who disagree with us. Because there are people still waiting for these tools who need us all.

Well what do you do? How would you describe it?

Where does this start? It starts here.

You know, all of us in this room are blessed.

We are blessed with people who listen to us.

We are blessed with prosperity. We are blessed with leadership.

Maybe people would listen if they heard us with unpredictable ideologies.

Perhaps progress will begin at that point.

That's the best. number two.

Number 2: What I am asking of you is specifically asking me to be someone who blurs the lines, is vague, and is hard to categorize.

If you are a conservative, be a conservative who always advocates for poverty and the moral obligation to be warriors of the poor.

And if you are a liberal, be a liberal who always talks about the beauty of the free market, which can be used responsibly to solve problems.

Then you get two things.

The first is that we're starting to work on the next 2 billion, a solution that we've had a lot of experience with, and a lot more to consider in the future. that's what we got.

And second, that the terrible ideological crusade we are suffering in this country might be transformed into a competition of ideas based on solidarity and mutual respect.

And maybe, just maybe, we'll all realize that our big differences aren't really all that great after all.

thank you.

(applause)

Hannah is excited to go to college.

She couldn't wait to move out of her parents' house and prove to her parents that she was an adult, and to her new friends.

She heads to a campus party where she meets a man she has a crush on.

Let's call him Mike.

The next day, Hannah wakes up with a severe headache.

She can only remember that night in flash.

But what she does remember is throwing up in the hallway outside Mike's room, silently staring at the wall while Mike was in her, begging him to stop, and then lurching back home.

She doesn't feel good about what happened, but thinks, "Sex in college maybe this?"

In the United States, one in five women and one in 13 men will be sexually assaulted while in college.

Fewer than 10 percent report assaults to schools or the police.

And those who file reports take an average of 11 months to file a report.

At first, Hannah felt like she wanted to deal with what happened alone.

However, she becomes concerned when she sees Mike bringing a girl home from a party.

After graduation, Hannah finds out that Mike was one of five women who did exactly the same thing.

90% of sexual assaults are repeat offenders, so this is not an unlikely scenario.

But with reporting rates this low, even repeat offenders are much less likely to be reported, much less likely that anything will happen if they are.

In fact, only 6 percent of assaults reported to police result in the perpetrator spending a day in prison.

That means you have a 99% chance of escaping.

This means the United States has virtually no deterrent to attack.

Currently, I am an infectious disease epidemiologist by training.

I'm interested in systems and networks and where I can focus my resources to get the most out of them.

So this is a tragic but solvable problem for me.

So when campus assaults started making headlines a few years ago, it felt like the perfect opportunity to make a difference.

And we did.

We started by talking to college survivors.

And it's pretty simple to wish they had gone to college. As a first step, they wanted the safest time and place to use a website with clearly written information about their reporting options and the ability to report assaults electronically, rather than consulting someone they may or may not believe.

You have the option to create a time-stamped, secure document of what happened to you, so you can save evidence even if you don't want to report it yet.

And finally, and perhaps most importantly, the ability to report your own assault only if someone else has reported the same perpetrator.

Everything changes when you know you're not alone.

It changes how you frame your own experience and how you think about your perpetrators. It means that if you come forward, you will have someone else on your side, and they will support you.

We created a website to do this in action and [...] launched it on two college campuses in August.

And if Mike's first victim came forward and saved her record, entered it into a matching system and named her Mike, and months later Mike's second victim did the same, they incorporated a unique matching system that would match them and send both survivors' verified contact information to authorities at the same time for investigation and tracing.

If such a system had existed for Hannah and her cohorts, they would have reported it, believed it, and Mike would likely have been kicked off campus, sent to prison, or at least got the help he needed.

And if a repeat offender like Mike could be stopped with just a second post-match assault, survivors like Hannah wouldn't even get assaulted in the first place.

59% of sexual assaults could be prevented simply by stopping repeat offenders early.

And maybe for the first time, microphones all over the world will never even try to attack anyone because we are creating a real deterrent to attack.

The type of system I'm describing, the type of system survivors want, is a form of information escrow. This means an entity that holds information for its users and only releases that information to third parties when certain pre-agreed conditions are met, such as matching.

The application we built is for a university campus.

However, the same type of system could potentially be used in the military or in the workplace.

We don't need to live in a world where 99% of rapists are acquitted.

We can create a society where wrongdoers are held accountable, survivors get the help and justice they deserve, authorities have the information they need, and there is a real deterrent to violating the rights of other human beings.

thank you.

(applause)

In college, I majored in government, so I had to write a lot of papers.

Now, when an ordinary student writes a thesis, he or she may expand the work a little like this.

I mean, you know -- (laughter) it might be a little late to start, but if you can get enough work done in the first week and then a lot more busy days after that, it's all done and things stay calm.

(Laughter) And I would like to do the same.

that would be the plan.

I had it all ready, but actually the paper arrived and then I'm going to do this.

(Laughter) And it will happen in any newspaper.

But then came my 90-page graduation thesis. I have to spend a year on this thesis.

And I knew that for such papers, my normal work flow was not an option.

It was too big a project.

So I planned things out and decided I had to do something like this.

A year goes by like this.

So I started lightly, worked my way up in the middle, and at the end I was in high gear like a small staircase.

How difficult would it be to climb stairs?

No big deal, right?

But then the funniest thing happened.

the first few months?

They came and went and I couldn't do anything.

So we had a wonderful new and revised plan.

(Laughter) And then -- (Laughter) But the months in between really went by and I never really wrote a word, so here we are.

And 2 months turned into 1 month and then 2 more weeks.

Then one day, three days before the deadline, I woke up and didn't have a word written yet, so I did the only thing I could do. It took me 72 hours to write 90 pages, and I stayed up all night not once, but twice. Humans aren't supposed to pull two all-nighters, but they sprinted across campus, dived in slow motion, and submitted at the last minute.

I thought that was the end of it all.

But a week later, I got a call from the school.

And they say, "Is this Tim Urban?"

And I said, "Yes."

And they say, "I have to talk about your paper."

And I say, "Okay."

And they say, "This is the best thing we've ever seen."

(Laughter.) (Applause.) That didn't happen.

(Laughter) It was a very, very bad paper.

(Laughs) I just wanted to enjoy the moment when you think, "This person is amazing!"

(Laughter) No, no, it was very, very bad.

Anyway, today I am a writer and blogger guy.

And a few years ago I decided to write about procrastination.

My actions have always embarrassed those around me who don't procrastinate. I wanted to explain to non-procrastinators around the world what goes on in the heads of procrastinators and why we are.

Now, I hypothesized that the brains of procrastinators are actually different from other people's brains.

And to test this, I actually found an MRI lab that could scan both my brain and the brains of people who were proven not to be procrastinators, so I could compare them.

I actually brought it here to show you today.

I would like you to look carefully to see if you can tell the difference.

I know it's not very obvious unless you're a trained brain expert, but just take a look.

This is the brain of the non-procrastinator.

(laughs) Well...

Here is my brain.

(Laughter) There are differences.

Both brains have rational decision makers, but the brains of procrastinators also have instant gratification monkeys.

So what does this mean for procrastinators?

Well, all is well until this happens.

[This is the perfect time to get the job done. ] [No!] So the rational decision maker makes a rational decision to do something productive, but the monkey doesn't like the plan, so he actually gets behind the wheel and says, "Let's actually read the entire Wikipedia page on the Nancy Kerrigan and Tonya Harding scandal, because I just remembered something like that happening."

(Laughter) And -- (Laughter) Then I go to the fridge and see if there's anything new in the last 10 minutes.

It then follows a YouTube spiral that begins with a video of Richard Feynman talking about magnets and ends much later with an interview with Justin Bieber's mother.

(Laughter) "Everything takes time, so there's absolutely no room in the schedule for work today.

(sighs) Now, what's going on here?

Instant Gratification Monkey doesn't seem like the kind of guy you want behind the wheel.

He lives completely in the present moment.

He has no memory of the past, no knowledge of the future, and only cares about two things. It's easy and fun.

Well, in the animal world it works.

If you're a dog and spend your whole life doing nothing but easy and fun things, you're a big success.

(Laughter) And to monkeys, humans are just another animal species.

You have to sleep well, eat well, and continue to reproduce in the next generation, which may have worked in tribal times.

But in case you didn't realize it, we're not in tribal times now.

We are in an advanced civilization, but monkeys don't know what it is.

That's why we have another person in our brain, the rational decision maker, who gives us the ability to do things that other animals cannot.

We can visualize the future.

You can see the big picture.

We can plan for the long term.

And he wants to take them all into consideration.

And he wants us to do whatever we have to do now.

Now, there are times when it makes sense to do something simple and enjoyable, such as while you're eating dinner, going to bed, or just enjoying your well-earned leisure time.

That's why there is duplication.

sometimes they agree.

But sometimes it makes a lot more sense to do something harder and less fun for the big picture.

And then we collide.

And for the procrastinator, that conflict tends to end in a certain way each time, and he ends up spending a lot of time in this Orange Zone, a lighthearted, fun place that's completely out of the make sense circle.

I call it a "dark playground".

(Laughter) Well, the Dark Playground is a familiar place for any procrastinator.

Leisure activities take place here at times when leisure activities should not take place.

Having fun in a dark playground isn't really fun. Because it doesn't quite get it. And the air is filled with guilt, fear, anxiety, and self-loathing—all of the good feelings of procrastination.

And the question is, in this situation with a monkey at the wheel, how can a procrastinator get himself into this blue zone, a not-so-comfortable place, but where does the really important thing take place?

Well, the procrastinator has a guardian angel who always looks down on him and watches him in his darkest moments, the Panic Monster.

(Laughter) Well, Panic Monster sleeps most of the time, but when a deadline gets too close, public shaming, career disaster, or other dreadful consequences are in danger, he suddenly wakes up.

And the important thing is that he is the only one the monkey is afraid of.

Well, it was only recently that he became very relevant in my life. Because about six months ago, the people at TED contacted me and invited me to give a TED talk.

(Laughter) Of course I said yes.

It's been a dream of mine to give a TED talk in the past.

(Laughter) (Applause) But in the midst of all this excitement, rational decision makers seemed to be thinking of something else.

He said, "Are you sure what you have accepted?

Will we be able to understand what is happening now in the future?

We need to sit down and tackle this problem now. ”

Then the monkey said, "I totally agree, but open Google Earth, zoom in on the bottom of India, like 200 feet above the ground, and scroll up two and a half hours until you reach the top of the country, and you'll get a better feel for India."

(Laughter) That's what we did that day.

(Laughter) Half a year turned into four months, turned into two months, turned into a month, and the people at TED decided to release the speaker.

And when I opened the website, my face was staring back at me.

And who do you think woke up?

(Laughter) So Panic Monster starts to lose his mind and after a few seconds the whole system is in chaos.

(laughter) And the monkey--remember, he's scared of the Panic Monster--Dawn, he's in the tree!

And finally, finally, a rational decision maker can get behind the wheel and I can start working on the story.

Well, Panic Monster describes all sorts of insane procrastination behavior. For example, how someone like me can miraculously find an incredible work ethic and stay up all night writing eight pages after spending two weeks unable to start writing the opening sentence of a paper.

And the whole situation of these three characters is the procrastinator's system.

It's not pretty, but it works in the end.

This is something I wanted to blog about a few years ago.

Then I was surprised by the reaction.

I literally got thousands of emails from different people all over the world doing different activities.

They were nurses, bankers, painters, engineers, and a bunch of PhD students.

(Laughter.) And they were all writing the same thing, "I have this problem too."

But what struck me was the contrast between the light tone of the post and the weight of these emails.

These people were writing in bitter discontent about what procrastination had done to their lives and what this monkey had done to them.

And I thought about this and said, if the procrastination system works, what's going on?

Why are all these people in such a dark place?

Now, it turns out that there are two types of procrastination.

Everything I've talked about today, all the examples I've given have deadlines.

And when you have a deadline, the effects of procrastination are short-lived because the Panic Monster is involved.

But the second kind of procrastination occurs in situations where there are no deadlines.

So if you want a career in the arts or something entrepreneurial that you can start yourself with, there is no deadline for such things at first. Because nothing will happen until you go out there and work hard to build momentum and make things happen.

Aside from career, there are all sorts of important things that have no deadline, such as seeing family, exercising and taking care of health, working on relationships, and getting out of a bad relationship.

Now, if the panic monster is the only mechanism for those procrastinating on these difficult things, then that's a problem. Because panic monsters don't show up in situations other than these deadlines.

He has nothing to wake up to, so the effects of procrastination are irrepressible. They just extend outward forever.

And this long-term procrastination is much less visible and less talked about than short-term deadline-based antics.

Usually it suffers silently and privately.

And it can cause a lot of long-term unhappiness and regret.

So I figured that's why they're emailing, and why they're in such a bad situation.

I'm not cramming any projects.

Long-term procrastination can make your life feel like a bystander.

My frustration is not that I couldn't achieve my dream. It's that they couldn't even start chasing them.

So when I read those emails, I had a little epiphany that there is no one who doesn't procrastinate.

Yes, I think you are procrastinators.

Now, some of you, like some of us, may not all be messed up (laughs), and some of you may have a healthy relationship with deadlines, but remember. The monkey's most sneaky trick is when the deadline isn't there.

Now, I would like to show you one last thing.

I call it my life calendar.

That's the equivalent of one box every week of a 90-year life.

We don't have that many boxes, especially since we already use a lot of them.

So I think we all need to take a hard look at this calendar.

We all procrastinate something in our lives, so we need to think about what we're really procrastinating on.

We should always keep an eye out for instant gratification monkeys.

It's a job for all of us.

There aren't that many boxes, so that's probably the job to start today.

Well, maybe not today, but...

(Laughter) You know.

One of these days.

thank you.

(applause)

In ancient Greece, headache was considered a powerful disease.

Victims prayed to the god of medicine, Asclepius, for help.

And if the pain persists, the doctor will resort to the most common remedy, which is to make a small hole in the skull to drain the suspected infected blood.

This terrifying technique called trepanation often replaced headaches with more permanent conditions.

Luckily, today's doctors don't rely on power tools to cure headaches.

But we still have a lot to learn about this ancient disease.

Today we have classified headaches into two groups: primary headaches and secondary headaches.

The former show no symptoms of the underlying disease, injury, or condition. Those are the conditions.

However, while primary headaches account for 50% of reported cases, much more is actually known about secondary headaches, and these will be discussed later.

These are caused by other health problems, with triggers ranging from dehydration and caffeine withdrawal to head and neck injuries to heart disease.

Doctors have classified more than 150 diagnosable types, all with different potential causes, symptoms, and treatments.

But let's take just one common case, sinusitis, as an example.

The sinuses are a system of cavities that extend behind the forehead, nose, and cheeks.

When the sinuses become infected, the immune response heats the area and burns the bacteria, inflaming the cavity far beyond its normal size.

Sinus congestion puts pressure on the cranial arteries and veins and the muscles of the neck and head.

Pain receptors called nociceptors are triggered in response, signaling the brain to release large amounts of neuropeptides, causing cranial blood vessels to become inflamed and the head to become swollen and hot.

This discomfort, combined with overly sensitive head muscles, causes a throbbing, headache-like pain.

Not all headache pain comes from swelling.

Muscle tension and inflamed and sensitive nerves cause varying degrees of discomfort in each headache.

But all cases are reactions to some cranial irritant.

The cause of secondary headaches is known, but the cause of primary headaches is unknown.

Scientists are still investigating potential triggers for three types of primary headaches: Acute cluster headaches with severe pain. And the most common is tension headache.

As the name suggests, tension-type headaches are known to cause a feeling of a tight band tightening around the head.

These headaches increase the tenderness of the pericranial muscles, causing painful pulsations with blood and oxygen.

Patients report stress, dehydration, and hormonal changes as triggers, but these do not fully fit the symptoms.

For example, in dehydration headaches, the frontal lobes actually shrink away from the skull, resulting in swelling of the forehead that does not match the location of pain in tension headaches.

Scientists have theories about the actual cause, ranging from spasms of blood vessels to hypersensitivity of nociceptors, but no one knows for sure.

On the other hand, most headache research focuses on more severe primary headaches.

A migraine is a recurring headache that causes a vise-like sensation in the skull that can last from 4 hours to 3 days.

In 20% of cases, these seizures are so intense that they overload the brain with electrical energy, causing hyperexcitation of sensory nerve endings.

This causes hallucinations called auras, where you see flashing lights, geometric patterns, and experience tingling sensations.

Cluster headaches, another major type of headache, are bursts of burning, stabbing pain behind one eye, causing the eye to become red, the pupil to constrict, and the eyelid to droop.

What can be done about these symptoms that dramatically affect the quality of life for many people?

Most tension-type and secondary headaches can be treated with over-the-counter pain relievers, such as anti-inflammatory drugs that reduce swelling in the skull.

Also, many of the secondary headache triggers such as dehydration, eye strain, and stress can be actively avoided.

Migraines and cluster headaches are even more complicated, and no reliable treatment that works for everyone has yet been found.

Thankfully, however, pharmacologists and neurologists are working hard to unravel these pressing mysteries that weigh heavily on our minds.

Today's computers are so good that we don't realize how terrifying they actually are.

Today I want to talk about this problem and how neuroscience can solve it.

First of all, I would like to recall a story about a frosty night in Harlem in 2011 that had a profound effect on me.

I was sitting in a dive bar outside Columbia University, where I was studying computer science and neuroscience. And I was having great conversations with other students about the power of holograms to one day replace computers.

And when we got to the best part of our conversation, of course, his phone lit up.

Then he pulled it towards him, looked down and began to type.

Then he forces his eyeballs back into mine and says, "Go on. I'm with you."

But of course his eyes were cloudy and he was dead at that moment.

Meanwhile, on the other side of the bar, another student notices a cell phone, this time facing the group.

Kids were laughing hysterically as he swiped through his Instagram photos.

And this dichotomy between how boring I feel about the same technology and how happy they feel really got me thinking.

And the more I thought about it, the more I realized that it wasn't the digital information that was clearly the villain here, it was simply the position of the display that separated me from my friends and brought those kids together.

You see, they were connected around something, much like our ancestors who evolved social cognition by telling stories around a campfire.

And that's what I think tools should do.

They need to extend our bodies.

And I think today's computers do exactly the opposite.

Whether I'm texting my wife, composing a symphony, or just comforting a friend, I do it in much the same way.

You're bending over these rectangles, playing with buttons, menus, and other rectangles.

And I think this is the wrong way. I think you can start using a more natural machine.

We should use machines that put our work back into the world.

We need to use machines that use neuroscience principles to extend our senses, not against them.

Now such a machine happens to be here.

It's called Meta 2.

Let's try.

Now I can see the audience in front of me, and I can see my own hands.

And in 3, 2, 1, you'll see an immersive hologram appear. A very realistic hologram appears in front of the very glasses I am wearing now.

And of course, this can be anything we shop for or learn. I can use my hands to move it very well with fine control.

And Iron Man would be proud.

More on this later.

(Applause.) Now, if you're like me, you're already baffled by the possibilities of what you can do with this kind of technology. So let's look at some.

My mother is an architect, so naturally my first thought was laying out the building in 3D space rather than using a 2D floor plan.

She's now getting hands-on with graphics and choosing interiors.

This was all shot through a GoPro through our glasses.

And this next use case is very personal to me. This is Professor Adam Ghathery's Glass Brain Project, courtesy of UCSF.

As a neuroscience student, I always fantasized that these complex brain structures could be learned and memorized using real machines, and that I could touch and play with different brain structures.

Now, what you're seeing is called augmented reality, but to me it's part of a much more important story: how we can start augmenting our bodies using digital devices, not the other way around.

now ...

I believe that in the next few years, humanity will experience changes.

We begin to place whole layers of digital information into the real world.

Just imagine what this means for storytellers, painters, brain surgeons, interior decorators, and perhaps all of us here today.

And what I think we as a community need to do is not try to gamify our reality or clutter it with digital information, but really try to imagine how we can create this new reality in a way that augments the human experience.

And that's what I'm so passionate about.

Well, I would like to tell you a little secret.

In about five years this is not the smallest device, but in about five years these will all be visible to our eyes like pieces of glass projecting holograms.

And just as we don't care as much about which phone we buy from a hardware perspective, as neuroscientists, we've always dreamed of building the iOS of the mind.

And getting this right is very, very important. Because we've likely been living in these things for at least as long as we've been living with the Windows graphical user interface.

I don't know about you, but living in Windows is scary.

(Laughter) To isolate the one most intuitive interface out of the infinite, we use neuroscience to drive design guidelines instead of having dozens of designers competing in the boardroom.

And the principle we all center around is something called the "neural pathway of least resistance."

At every turn, we are connecting our brain iOS for the first time based on brain conditions.

In other words, we are trying to build a computer with a zero learning curve.

We build systems our users are familiar with.

Here are the first three design guidelines adopted in this brand new form of user experience:

First and foremost, you are the operating system.

Traditional file systems are complex and abstract, requiring extra steps for the brain to decode.

We are going against the neural pathways of least resistance.

On the other hand, in augmented reality, of course, you can put a holographic TED panel here and a holographic email on the other side of your desk, and spatial memory evolves just fine to pick them up.

You can put the holographic Tesla you're buying, or whatever model my legal team instructed me to put just before the show.

(Laughter) Perfect. And your brain knows exactly how to get it back.

The second interface guideline is called "touch to see".

What does your baby do when he sees something interesting?

They reach out and try to touch.

And that's just how nature's machines should work as well.

It turns out that the visual system is fundamentally reinforced by a sense called proprioception, the sense of our body parts in space.

Therefore, direct contact with your work not only allows you to better manage it, but also gives you a deeper understanding of it.

So touch and see.

But experiencing things for yourself is not enough.

We are essentially such social primates.

And this brings us to our third guideline, the first story holographic campfire.

Our mirror neuron subsystem suggests that if we could see each other's faces and hands in 3D, we could better connect with each other and work.

If you watch the video behind me, you can see two meta users playing with the same hologram, making eye contact and connecting around this thing without being distracted by an external device.

With neuroscience in mind, let's try this again.

Again, our favorite interface, iOS at heart.

I'll take this one step further and pick up these glasses and leave them here by my desk.

I am with you now, I am in this moment, we are connected.

My spatial memory kicks in and I can grab it and bring it right here, reminding me that I am the operating system.

And now my proprioceptive senses are working and I can also break these glasses down into a thousand parts and touch the very sensors that currently scan my hand.

But seeing things alone isn't enough, so soon my co-founder Ray will be making 3D calls -- Ray?

(ringing) Hi Ray, how are you doing?

Guys, you can see this guy in front of you in full 3D.

And he is realistic.

(Applause.) Thank you.

My mirror neuron subsystem suggests that this will soon replace the phone.

Ray, how are you?

Ray: Great. It's live today.

(Applause) MG: Ray, give the crowd the holographic brain you saw in the previous video.

Folks, this isn't just going to change your phone, it's going to change the way you collaborate.

Thank you very much.

Thank you Ray.

Ray: You're welcome.

(Applause) MG: Guys, this is the message I discovered at that bar in 2011. The future of computers isn't confined to one of these screens.

It's here inside us.

(Applause.) So, if there's an idea I'd like to share with you today, it's that natural machines aren't a picture of the future, they're right here in 2016.

That's why all 100 of us at Meta, including administrative staff, executives, designers and engineers, plan to ditch external monitors by TED2017 and replace them with real and more natural machines.

thank you very much.

(Applause.) Thank you, thank you.

Thanks guys.

Chris Anderson: So please help me with one thing. Over the past year or so, several augmented reality demos have been published.

And there's an occasional debate among technologists about whether we're really seeing the real thing on screen.

I have vision problems. Somehow, this technology allows you to see a wider field of view than you can actually see with your glasses.

Did we see the real thing there?

MG: It's the real deal.

Not only that, but in many of the videos you see here, we took the extra step of shooting the GoPro through a real lens.

I would like to have a simulated experience of the world that I actually see through my glasses without cutting corners.

CA: Thank you so much for showing me that.

MG: Thank you very much, I appreciate it.

The first thing I would like to suggest is that we all love music. It means a lot to us.

But music is more powerful when you make it yourself than just listen to it.

That's my first idea. And we all know about the Mozart Effect. The idea that's been around for the last 5-10 years is that just listening to music, or just playing music to a baby [in the womb] raises IQ points by 10, 20, 30 percent.

Great idea, but it doesn't work at all.

So you have to make music somehow, not just listen to it.

I would like to add that everyone in the world has the power to create and be a part of music in a very dynamic way, not just making music. That's one of the main parts of my job.

The MIT Media Lab has been working in a field called active music for quite some time.

What are all possible ways to get everyone in the middle of the musical experience of not just listening to music, but making it?

And we started by making instruments (we call these hyperinstruments) for some of the world's greatest performers: Yo-Yo Ma, Peter Gabriel, Prince, orchestras and rock bands. All kinds of sensors are built directly into the instrument so it can know how it is being played.

And just by changing the interpretation and feeling, my cello can be turned into a voice, or an entire orchestra, or something that no one has ever heard.

When we started making these, I started to wonder why we can't make such great instruments for everyone, people who aren't great Yo-Yo Mas and Prince.

So we made a series of instruments.

One of the largest collections is called Brain Opera.

It's an entire orchestra of about 100 instruments, all designed for anyone to play using their natural skill.

So you can play video games, drive music, use body gestures to control huge sonic masses, touch special surfaces to create melodies, and use your voice to create an overall aura.

And when we make Brain Opera, we invite the public to come and try out these instruments and work with us to make each performance of Brain Opera.

We toured it for a long time. It is now permanent in Vienna and we have built a museum around it.

And it resulted in something you probably know too.

Guitar Hero came out of our lab. My two teenage daughters and most of the students in the MIT Media Lab have proven that if you create the right kind of interface, people will be in the middle of the music and really interested in playing it over and over again.

So the model works, but that's just the tip of the iceberg. Because my second idea is that just wanting to make music with something like Guitar Hero isn't enough.

Music is a lot of fun, but it's also a transformative thing.

It's very, very important.

Music can change your life more than anything else.

It can change the way you communicate with others, it can change your body, it can change your mind. So we're taking the next step in how we build on top of things like Guitar Hero.

We are deeply involved in education. We have a long term project called Toy Symphony. They make all sorts of addictive instruments there, but for small children. That way kids will be addicted to making music, want to spend time making music, and then want to know how it works, how to make more, how to make. That's why we build fine-grained instruments, like the Music Shaper that measures the electricity in your fingers and the Beatbug that lets you tap to beat the rhythm. Collect rhythms and send them to your friends like hot potatoes, and they will have to imitate and react to your actions. And he's creating a software package called Hyperscore that allows anyone to create highly sophisticated music using lines and colors. It's very easy to use, but once you do, you'll be able to delve deeper into any style of music. Then press a button to turn it into sheet music, ready for live musicians to play your tunes.

We've used Hyperscore to have enough, really, very powerful effects on children all over the world, and now people of all ages.

As such, we are increasingly interested in harnessing this kind of creative activity in a broader context for all sorts of people who don't usually have the opportunity to make music.

One of the growing areas we are currently working on in the Media Lab is music, mind and wellness.

Many of you have probably seen the wonderful new book "Musicophilia" by Oliver Sacks. It is on sale at bookstores. Great book.

If you haven't seen it, it's worth reading. A pianist himself, he recounts his entire career observing the incredibly powerful impact music has on people's lives under extraordinary circumstances.

So, for example, music is often found to be the last response for people with advanced Alzheimer's disease.

Perhaps many of you have noticed this with your loved ones. Some people may not be able to recognize their own face in the mirror or tell anyone in their family, but you can find the snippet of music that makes them jump out of their chair and start singing. It can bring back some of people's memories and personalities.

Music is the best way to restore language for people who have lost it to stroke, and for people with Parkinson's who have lost it to exercise.

Very powerful for depression, schizophrenia and many other ailments.

So we're committed to understanding these fundamental principles and building actions that can really improve people's health through music.

And we do this in different ways. We work with various hospitals.

One of them is right near Boston and is called Tewkesbury Hospital.

This is a long-running state hospital that started working with Hyperscore and physically and mentally disabled patients several years ago.

It has become the center of care at Tewkesbury Hospital, and everyone at the hospital aspires to be involved in musical endeavors.

This is the activity that seems to accelerate people's treatment the most, and also unites the whole hospital as a kind of musical community.

Before we go any further, I'd like to show you some quick videos of this in action.

Video: They are manipulating each other's rhythms.

This is a real experience of not only learning how to play and listen to rhythms, but also training musical memory and playing music in groups.

It's about getting the music, shaping it, changing it, experimenting, and making our own music.

So with Hyperscore you can start from scratch very quickly.

Anyone can experience music deeply just by making various tools.

A third thought I would like to share with you, paradoxically, is that music, more than words, is one of the best ways to show that we are truly human. I love giving talks, but strangely, I get more nervous doing them than playing music.

If I were here to play the cello, or the synth, or share the music with you, I would be able to show you something more personal, maybe deeper than words can say about myself.

I think that's true for many of us. I would like to give two examples of how music is one of the most powerful interfaces from ourselves to the outside world.

The first is a really crazy project we're building right now called Death and the Powers. And it's a big opera, one of the big opera projects in the world right now.

And it's the story of a man who is rich, successful, powerful, and wants to live forever.

So he figured out how to download himself into his environment, actually a series of books.

So this guy wants to live forever and downloads himself into his environment.

At the beginning of the opera, the main singer disappears and the entire stage becomes the protagonist. It becomes his legacy.

And opera is about what we can share, what we can and cannot tell others, the people we love.

Every object in the opera is alive, a gigantic instrument like this chandelier. occupy the entire stage. It looks like a chandelier, but it's actually a robotic instrument.

So, as you can see in this prototype giant piano string, each string is controlled by a tiny robotic element: either a tiny bow that strokes the string, a propeller that tickles the string, or an acoustic signal that vibrates the string. There is also a robot corps on the stage.

These robots are like mediators between our protagonist, Simon Powers, and his family. There is a series of songs like Greek Choir.

they observe the behavior. We designed these square robots that we're currently testing at MIT, called OperaBots. These OperaBots follow my music.

They follow the characters. They're smart, so hopefully they don't bump into each other. they leave on their own accord.

And when you snap them, you can align them exactly the way you want.

Although it is a cube, it is actually full of individuality.

The largest stage set in an opera is called a "system". It's a series of books.

All the books are like robots, all move, all make sounds, and when put together they all turn into these walls with the gestures and personality of Simon Powers. That is, he disappeared, but the entire physical environment becomes this person.

This is how he chose to represent himself.

The spine of the book also contains high-density LEDs. So it's all display.

And here is the great baritone James Maddalena from The System.

This is a sneak preview.

It will premiere in Monaco -- September 2009. In the unlikely event that you can't participate, please think of another idea for this project -- this guy is building his own legacy through this highly unusual format, music and environment.

But we are also making this available both online and in public spaces as a way for each of us to use the music and images from our lives to create a legacy for ourselves, and a legacy for those we love.

In other words, this opera will not be a grand opera, but a personal one, as we think of it.

And if you're going to make a personal opera, what about personal instruments?

Everything I've shown you so far, whether it's a hypercello for a Yo-Yo Ma or a squishy toy for a child, the instrument remains the same and is valuable to a certain class of people: virtuosos and children.

But what if I could make an instrument that could adapt to my personal behavior, the way I use my hands, the movements I do very well or not very well?

I believe this is the future of interfaces, the future of music, and the future of musical instruments.

Now I want to invite two special people on stage to give an example of what a personal instrument can be.

So I would like to invite Dr. Adam Boulanger to help me. MIT Media Lab student Dan Elsie. Dan, thanks to TED and the Bombardier Flexjet, Dan came all the way from Tewkesbury to join us today. He is a resident at Tewkesbury Hospital.

This is the furthest he has gotten from Tewkesbury Hospital. All I can say is that he is full of desire to meet you today and show you his music.

So, first of all, Dan, would you like to say hello to everyone and tell them who you are?

Dan Elsey: Hello. My name is Dan Elsie. I am 34 and have cerebral palsy.

I have always loved music and am excited to use this new software to direct my music.

Todd Machover: And we're really excited to have you here, really Dan. (Applause.) So we met Dan about three years ago, three and a half years ago, when we started working in Tewkesbury. Everyone I met there was nice and playing great music. Dan had never made music before, but it turned out he was really good at it. He is a born composer.

He is also very shy.

So he turned out to be a great composer and has been our constant collaborator over the last few years. He made so many works.

He makes his own CDs. In fact, he's very well known in the Boston area, teaching people in hospitals and local children how to make their own music.

And let Adam tell you. So Adam has a Ph.D. MIT student and specialist in music technology and medicine. And Adam and Dan became close collaborators.

What Adam has been working on in this last period was not only how to make it easier for Dan to make his own work, but also how to make it easier for him to play his own work with this kind of personal instrument.

So, would you like to talk a little bit about how you guys work?

Adam Boulanger: Yes. So Todd and I started a discussion following Tewkesbury's work, and it was about how expressive Dan is, and how intelligent and creative he is. And it's in his face, his breath, his eyes. Why can't he play one of his songs? It's our responsibility, but it doesn't make sense.

So we set out to develop technology that would allow him to perform his songs with nuance, precision and control, and despite his physical disability.

So we needed process and technology, basically an engineering solution first. So it had a FireWire camera and was watching the infrared pointer.

We adopted the type of gestural metaphor that Dan was already accustomed to with his speaking controller.

And this was actually the least fun part of working on the design process. I needed input. I needed constant tracking. In the software we see what kind of shapes he is creating.

But the really interesting part of the job was following the engineering part, basically doing extensive coding over Dan's shoulder in the hospital to understand how he works.

What is useful for him as an expressive action?

What is his performance metaphor?

What does he think is important to control and convey in music?

So the fitting of all parameters, and the actual technology, was expanded to fit only Dan at that point.

And I think this is a shift in perspective. Our technology does not provide access, it enables creative work.

But what about expressions? What about the moment when an artist presents their work? Can our technology express it?

Do they provide structure for us to do that? And, you know, it's expression and personal relationships that are lacking in the realm of technology. So for Dan, it took a new design process, a new engineering process, to find a way of expression that would allow him to move and perform.

That's all for today.

TM: Let's do it. So Dan, do you want to tell everyone what you're going to play?

DE: This is "My Eagle Song."

TM: So Dan is going to perform his song called "My Eagle Song."

In fact, this is the score of Dunn's work, composed entirely by Dunn in hyperscore.

Thus, he has direct access to Hyperscore using an infrared tracker.

He's incredibly fast at it, actually faster than me.

(laughs) TM: He's really humble too.

So he can join Hyper Score. Start by creating a melody and rhythm.

He can place them exactly where he wants them.

Each one is colored. He goes back to his composition window, draws lines, and places everything the way he wants it. You can see that too when you look at the hyperscores. I also know where the section is. Anything can go on for a while, change, get really crazy, and end with a big bang.

That's how he made his piece, and as Adam says, we figured out the best way to get him to play his piece.

That's what this camera sees, analyzes his movements, and can bring out all the different aspects of the music that Dan wants.

And you will also notice the visuals on the screen.

We asked one of our students to see what the camera was measuring.

However, instead of putting the camera traces in a literal form that accurately shows them, we turned them into graphics that show the underlying movement and how it's being analyzed.

I hope this gives you an idea of ​​how Dan extracts movement from his movements, but also that movement is very purposeful, very precise, very disciplined and very beautiful when Dan makes music.

So, listening to this work, as I said earlier, the most important thing is that the music is great, and it tells you who Dan is.

So Adam, are you ready?

AB: Yes.

TM: OK, now Dan will play his piece "My Eagle Song."

(Applause) TM: Bravo.

(applause)

At Rice University in 1962, JFK told the nation about a dream he had—to land a man on the moon by the end of the decade.

Moonshot of the same name.

No one knew if it was possible, but I made sure there was a plan in place to do it if it was possible.

Dreams are so wonderful.

A great dream is not just a vision, but a vision combined with a strategy to make it a reality.

I have been incredibly fortunate to work at the Moonshot Factory.

At X (previously called Google X), aerospace engineers collaborate with fashion designers and former military operations commanders brainstorm with laser experts.

These inventors, engineers, and makers dream of technologies that can make the world a better place.

We use the term “moonshot” to remind us to keep visioning big—to keep dreaming.

And we use the word "factory" to tell ourselves that we want to have a concrete vision, a concrete plan to make it happen.

Here is the blueprint for the moonshot.

First, we want to find the big problems in the world that affect millions of people.

The second is to find or propose a fundamental solution to solve the problem.

And third, there must be some reason to believe that the technology that enables such a radical solution can actually be built.

But you have a secret.

The moonshot factory is a dirty place.

But rather than avoiding confusion, we have tried to take advantage of it by pretending it doesn't exist.

We spend most of our time breaking things or proving ourselves wrong.

That's it, that's the secret.

Do all the hardest parts of the problem first.

Enthusiastically cheer and say, “Hey! How are we going to finish the project today?”

We strike an interesting balance between allowing unbridled optimism and realizing our vision.

But on the other hand, we use fanatical skepticism to bring those visions to life and bring them to life.

I would like to show you some of the projects that we had to leave on the cutting room floor. I would also like to showcase some of the gems that have not only survived that process, but have been accelerated by it, at least so far.

Last year, we stopped the project of automated vertical farming.

This is part of the lettuce we grew.

1 in 9 people in the world suffer from malnutrition.

So this is the moonshot that should happen.

Vertical farming uses 10 times less water and 100 times less land than conventional farming.

Food can also be grown close to where it is consumed, eliminating the need to transport it long distances.

Advances have been made in many areas such as automatic harvesting and efficient lighting.

Unfortunately, however, staple crops such as cereals and rice could not be grown using this method.

So we stopped the project.

There is another big problem here.

We pay huge costs in resources and environmental damage to ship our products around the world.

The economic development of landlocked countries is limited by the lack of maritime infrastructure.

What's the ultimate solution?

Variable buoyancy cargo ship that is lighter than air.

This has the potential to reduce the cost, time and carbon footprint of transportation without the need for runways, at least overall.

We've come up with a series of clever technological breakthroughs that allow us to bring these ships down to the point where they can actually be cheaply manufactured in large numbers.

However, it turned out that designing and manufacturing the first product would cost nearly $200 million, even if it could be mass-produced cheaply.

$200 million is too high.

X is structured in a tight feedback loop of mistakes, learning, and new designs, so you can't spend $200 million to get the first data point about whether you're on the right track.

If our project has an Achilles heel, we want to know it now, not in the future.

Therefore, this project was also discontinued.

Finding critical flaws in a project does not necessarily mean that the project will be terminated.

In some cases, it can actually lead you down a more productive path.

This is a prototype of a fully self-driving car built without a steering wheel or brake pedal.

But that wasn't really our goal when we started.

With 1.2 million people dying on the roads worldwide each year, the development of self-driving cars was a natural progression.

Three and a half years ago, we tested these modified self-driving cars in a Lexus, and the results were so good that we handed them out to other Googlers and asked them what they thought of the experience.

And what we found was that the idea of ​​letting the car do most of the driving and just handing over to the user in an emergency was a very bad plan.

It wasn't safe because the user didn't do their job.

They were on alert in case the car needed to be manually regained control.

This was a big crisis for the team.

It brought them back to the drawing board.

And they came up with a beautiful new perspective.

Aim for a car in which you can become a true passenger.

Tell the car where you want to go, press a button, and the car will automatically take you from point A to point B.

I really appreciate that I was able to get this insight early on in the project.

And that has shaped everything we've done since then.

And now, our cars have over 1.4 million self-driving miles on the roads of Mountain View, California and Austin, Texas every day.

The automotive team has changed its perspective.

This is one of the tenets of X.

Sometimes changing your perspective is more powerful than being smart.

Consider wind energy.

This is one of my favorite examples of changing perspective.

There is no better way to build a standard wind turbine than the experts in that industry.

But we have found a way to rise high into the sky, and without needing hundreds of tons of steel to get there, we now have access to faster, more stable winds and more energy.

Our Makani Energy kite rises from its perch by rotating propellers along its wings.

And pull out the tether as it rises, pulling the energy up through the tether.

When the tether is completely out, it will enter a crosswind turn in the sky.

And now the propeller that lifted it has become a flying turbine.

And it sends the energy back to the tether.

I haven't found a way to stop this project yet.

And the longer it withstands that pressure, the more excited we are that this could become a cheaper and more deployable form of wind energy for the world.

Probably the craziest-sounding project we have is Project Loon.

We are trying to create a balloon-powered internet.

A network of balloons in the stratosphere that transmit Internet connectivity to rural and remote areas of the world.

This could bring an additional 4 billion people online who currently have little or no internet connectivity.

But it's not enough to just tie a mobile phone base station to a balloon and stick it into the sky.

The wind is so strong that it will blow you away.

The balloon is too high to be fixed to the ground.

Here comes the crazy moment.

What if, instead, we let the balloon drift and teach it how to ride the wind to where it needs to go?

It turns out that in the thin layers of the stratosphere, the winds blow at completely different speeds and directions.

So we hoped that, using smart algorithms and global wind data, we could tweak the balloon a bit, move it up and down the stratosphere just a little bit, and pick up winds in different directions and speeds.

The idea is to have enough balloons so that when one pops out of its area, another floats into place, ready to hand over internet connectivity, much like a cell phone is handed off between cell towers while driving on a highway.

I know how crazy that vision sounds, but there's a project name that reminds us of it.

So, since 2012, the Loon team has prioritized the tasks that are most likely to be the most difficult, the ones most likely to kill the project.

The first thing they did was attempt a Wi-Fi connection from a balloon in the stratosphere to an antenna on the ground.

done.

And I promise it might not have happened.

So we continued.

Could it be possible to allow the balloon to communicate directly with the handset so as not to require an antenna as a relay receiver?

yes.

Can you make the balloon bandwidth big enough to have a real internet connection?

How to enable people to do more than just SMS?

Early tests didn't hit even 1 Mbit/s, but it can now run up to 15 Mbit/s.

Enough to watch a TED talk.

Could it be possible to enable balloons to communicate through the air, sending signals deep into the countryside?

check.

For less than 5% of the cost of manufacturing traditional long-life balloons, can you get a balloon the size of a house that can last over 100 days?

yes. in the end.

But I promise you, getting there was a challenge.

I made a round silver balloon.

I made a giant pillow balloon.

I made a balloon about the size of a blue whale.

I popped a lot of balloons.

(Laughter) One of the things that most likely killed the Loon project was whether or not the balloon could be navigated into the sky, so one of our most important experiments was balloons within balloons.

So there are two compartments here, one for air and one for helium.

Air is pushed into the balloon to make it heavier, and air is released to make it lighter.

These weight changes then cause the balloon to rise and fall, and that simple movement is the balloon's steering mechanism.

Float up and down, trying to catch the wind in the desired speed and direction.

But is that enough to travel the world?

Barely at first, but getting better and better.

Our newest balloon, this balloon can fly 2 miles vertically and can self-navigate from 20,000 kilometers to within 500 meters of its destination.

There is still a lot of work to be done in terms of fine-tuning the system and reducing costs.

But last year, a cheaply manufactured balloon circled the world 19 times in 187 days.

So let's continue.

(Applause.) Our balloons today do almost everything a complete system should do.

We are in talks with telcos around the world and will be flying over Indonesia and elsewhere for actual service testing this year.

Perhaps this sounds too good to be true, but you are right.

Doing big things that are bold and risky makes people inherently uncomfortable.

You can't yell at people or force them to fail too quickly.

people resist. they are worried

"What will happen to me if I fail?

Will people laugh at me?

Will I be fired? ”

We started with our secret.

We'll see later how to actually do that.

The only way to get people to work on big, risky things — bold ideas — and tackle the hardest part of the problem first is to make it the path of least resistance for them.

We work hard to make it okay to fail at X.

The team invalidates their ideas as soon as the evidence is on the table. Because it rewards you.

They get applause from their peers.

Hugs and high fives from their manager, especially me.

They get promoted with it.

We've given bonuses to everyone on a team that finishes a project, from a small team of 2 people to a team of 30+ people.

At Moonshot Factory, we believe in dreams.

But fanatical skepticism is not the enemy of unbridled optimism.

It's the perfect partner for optimism.

Unleash the potential of any idea.

We can create the future in our dreams.

thank you very much.

(applause)

Your favorite athlete is nearing victory.

The crowd held their breath and at the crucial moment she missed the shot.

The contestant has just experienced a phenomenon known as "choking", in which he fails at the point that matters most, even after months or even years of practice.

Choking is common in sports where performance depends on critical moments under intense pressure.

But performance anxiety plagues speakers, spelling bee contestants, and even world-famous musicians.

Most people intuitively attribute it to nerves, but why would tension impair professional performance?

There are two theories, both primarily claiming that pressure suffocation leads to concentration.

First, there is the distraction theory.

These suggest that if your mind is preoccupied with worry, doubt, or fear instead of focusing your attention on performing the task at hand, your performance will suffer.

When relevant and irrelevant thoughts compete for the same attention, something has to be given.

There is a limit to how much information the brain can process at once.

Tasks that challenge working memory, the mental “scratchpad” we use to temporarily store phone numbers and shopping lists, are particularly vulnerable to pressure.

In a 2004 study, we asked a group of college students to solve some simple math problems, as well as more complex and memory-intensive math problems.

Half of the students completed both question types without risking anything, while the rest completed them when calm and under pressure.

All performed well on the easy tasks, but those who were stressed performed poorly on the more difficult and memory-requiring tasks.

Explicit monitoring theories constitute a second group of explanations for pressure-induced asphyxiation.

They are concerned that the pressure may cause people to overanalyze the task at hand.

The logic here is that when a skill is automated, thinking about exactly how it works hinders the ability to do it.

The work we do unconsciously seems to be most susceptible to this kind of suffocation.

A study of competitive golfers compared their performance when they were instructed to focus solely on putting as accurately as possible and when they were instructed to be acutely aware of the mechanics of their putting stroke.

Golfers typically perform this action subconsciously, so a golfer who suddenly pays attention to the precise details of their movements also finds it difficult to make accurate shots.

However, suffocation is not inevitable for everyone.

Research shows that some people are more susceptible than others, especially those who are self-conscious, insecure, and afraid of being negatively evaluated by others.

So how do you avoid choking when it really matters?

First, it helps you practice under stressful situations.

A study of darts professionals found that those who did not practice under stress performed worse when anxious compared to those accustomed to the pressure.

Second, many performers celebrate the benefits of pre-performance routines, such as taking a few deep breaths, repeating cue words, and doing rhythmic sequences of movements.

Studies on golf, bowling, and water polo have found that short rituals can lead to more consistent and accurate performance under pressure.

And third, researchers have shown that an external focus on the end goal is more effective than an inward focus on the mechanics of what you're doing.

A study of experienced golfers revealed that those who focused on ball flight when hitting chip shots performed significantly better than those who focused on arm movement when hitting chip shots.

So perhaps we can revise this old adage. Practice under pressure, with focus, and with a glorious end goal in mind, and you'll be perfect.

Thousands of years from now, we will look back on the century of computing as a fascinating but very special era. For the only time in history, humanity has been reduced to live in a 2D space and interact with technology as if it were a machine. A singular 100 years in the vastness of time, during which humanity communicated, entertained, and controlled life on the other side of the screen.

Today, we spend most of our time tapping and looking at screens.

How did you interact with each other?

I don't know about you, but I feel limited in this 2D world of monitors and pixels.

And it is precisely this limitation and desire to connect with people that inspires me as a creator.

Simply put, I want to create a new reality, a reality where technology brings us closer together, a reality where people, not devices, are at the center of everything.

I dream of a reality where technology senses what we see, touch and feel. A reality where technology no longer gets in our way but embraces us for who we are.

I dream of technology following the path of humans.

We are all experiencing technologies that enable people to act more like humans, products that enable natural interaction, voice control, or biometrics.

This is the next step in evolution.

This is Microsoft HoloLens, the first fully untethered holographic computer.

Such devices bring 3D holographic content into our world, enhancing our experience of life beyond our normal perception.

I'm not thinking about the far future now.

I am talking about today.

We're already seeing car companies like Volvo design cars differently with HoloLens. Universities like Case Western are redefining how medical students learn. And my personal favorite is that NASA is using HoloLens to allow scientists to holographically explore planets.

Now, this is the point.

Bringing holograms into our world isn't just about new devices and better computers.

I'm talking about liberating ourselves from the 2D limitations of traditional computing.

In other words, time-aligned us are like cavemen in computer parlance.

We finally found charcoal and started drawing our first stick figures in a cave.

Now, this is the perspective that I apply to my daily work.

So, in the next few minutes, I invite you to apply the same perspective to the journey that lies ahead of us.

Now that you're putting this HoloLens on, let's talk a little bit about setting it up.

This is probably the most dangerous demo I've ever done with HoloLens, and I can't think of a better place to do it than here at TED.

In an instant, I see a hologram on this stage as clearly as you do.

At the same time, we have a special camera that has just appeared on stage so that all of you can share this experience with me on every monitor.

Let the journey begin.

And there's no better place to start our journey than in a 2D computer cave.

Explore the world around us with this new lens and see the computer world from a whole new perspective.

The computer world is both wonderful and primitive.

It is a universe based on causality.

As developers, we dream of different causes and program different outcomes.

Double-clicking the icon causes it.

Open the application, that's the effect.

Now, comparing this to our physical universe is overly constrained because our universe is not digital.

Our world is analog.

Our universe does not think in terms of zero or one, true or false, black or white.

We exist in a world governed by quantum physics, a universe where zeros and ones exist simultaneously, a reality based on infinite probabilities and shades of gray.

We see how these two worlds collide.

So why are screens so pervasive in our analog lives?

We are staring at screens from the moment we wake up in the morning until we fall asleep.

why?

I think it's because computers give us super powers.

In the digital universe, we have the power to displace space and the power to displace time.

It doesn't matter if you use technology for entertainment, productivity or communication.

Think of it this way. Let's all go home tonight and watch our favorite shows on TV.

This is theater - time and space are replaced.

As soon as I finish this TED talk, I will call my dear family in Seattle.

That is spatial displacement.

Now, these are so great superpowers that we live with the two-dimensional limitations of our current digital world.

But what if you didn't have to?

What if we could have this same digital power in our world?

We're already seeing glimpses of it, but I think our children's children will grow up in a world without 2D technology.

It is amazing to dream of a world where technology truly understands us and where we live, work and communicate, using tools that enhance the human experience rather than machines that limit our humanity.

So how do we get there?

For me, getting that answer required looking at the problem from a different perspective.

I had to perceive the world from a machine's point of view.

If you are a machine trying to sense our world, how do you actually analyze the problem?

You probably try to categorize things as humans, environments, and objects.

But how will that machine interact with reality?

And I can think of 3 ways.

First, I observe and input reality as a machine.

Speech recognition and biometrics are good examples of machine-human interaction from an input perspective.

Second, as a machine, we can put digital information, or output information, into reality.

A hologram is an example of a machine that interacts with its environment in terms of output.

Finally, as a machine, I can exchange energy with the world through touch.

Now imagine being able to feel the temperature of virtual objects. Or imagine pushing a hologram and pushing it back with the same force.

With this perspective, we can decompose reality into simple matrices.

Here is the secret. As an engineer, I get really excited whenever I can bring something back to the Matrix.

From self-driving cars to smartphones to the holographic computer above my head, machines are making sense of our world.

And they are beginning to interact with us in a more personal way.

Now imagine having fine-grained control over everything in the world.

Move the dial in one direction and you get reality.

Move the dial in the opposite direction to get virtual reality.

Now imagine dialing your entire environment between the virtual and real worlds.

I love it here.

Now imagine if I could look at all of you and dial an elf from a real human.

Once technology truly understands our world, it will once again change the way we interact, work and play.

Less than half a century ago, two brave men landed on the moon with a computer that was less powerful than the cellphone in their pocket.

600 million humans watched them on grainy black-and-white TV.

And what about the world?

The world was fascinated.

Now imagine how our children and their children will experience the continuous exploration of space using this world-understanding technology.

We already live in a world with real-time universal translators.

And I can squint and see holographic telepresence already in our near future.

In fact, the demos so far have been lucky, so let's do something crazier.

For the first time in the world, experience real-life holographic teleportation here on the TED stage between me and my friend Dr. Jeffrey Norris from NASA's Jet Propulsion Laboratory.

I crossed my fingers. Hello Jeff.

Jeff Norris: Hi Alex.

Alex Kipman: Phew! It worked. How are you today, Jeff?

(Applause) JN: Great. We had a wonderful week.

AK: So Jeff, can you tell us a little bit about where you are?

JN: Well, we're actually in three places.

I'm standing in a room across the street, but while I'm standing on this stage with you, I'm standing on Mars a hundred million miles away.

AK: Wow, 100 million miles away. I'm crazy!

Can you elaborate a bit more on where this data from Mars is coming from?

JN: Of course.

It's an exact holographic replica of Mars, built from data captured by the Mars rover Curiosity, and as easy to explore as any place on Earth.

Humans are natural explorers.

We can instantly understand the environment just by being in it.

We've built tools like Mars rovers to broaden our horizons and extend our reach.

But for decades, we've been exploring from behind screens and keyboards.

Now, we're flying past all that, gigantic antennas and relay satellites, the vastness of the interworld, taking our first steps on this landscape as if we were really there.

Today, a group of scientists on our mission are observing Mars like never before. They're finally exploring Mars like humans should, so it's an alien world that's just a little more accessible.

But our dreams don't have to end with making our dreams come true to be there.

When you dial this real world into your virtual world, you can do magical things.

We can see things on invisible wavelengths and teleport to the top of mountains.

Perhaps one day we will be able to feel the minerals contained in rocks just by touching them.

We are taking the first steps.

But this is not a journey for some, it's a journey for all of us, and we want the whole world to join us on the next road.

AK: Thank you Jeff, that was great.

Thank you very much for joining us on the TED stage today.

(Applause) JN: Thank you, Alex, bye-bye.

AK: Goodbye Jeff.

(Applause) I dream of this future every day.

I draw inspiration from my ancestors.

We used to live in tribes where we interacted, communicated and worked together.

We are all starting to build technologies that will allow us to return to the humanity that has brought us to where we are today—technologies that will stop us from living in a 2D world of monitors and pixels and remind us what it feels like to live in a 3D world.

It's an amazing time for humans.

thank you.

(Applause) Helen Walters: Thank you very much. I have a few questions.

And: ok.

HW: So you're talking about it in the media as well.

Ask frankly and you'll get the answer right away.

There is a lot of talk about the difference between demos and real commercial products.

Talk about this vision problem.

Can people who buy your product get this kind of experience?

AK: That's a great question. More to the point, this is probably the question we've been getting in the media for the last year.

After looking it up, I haven't answered that question.

After all, it's the wrong question, so I deliberately ignored it.

It's like when I show someone a hologram for the first time and you say, "What is the size of your TV?"

The field of view of the product is almost irrelevant.

What we should talk about is the density of the light that appears, or the brilliance.

More to the point, what is the angular resolution of what we see.

From that perspective, the camera is wearing a HoloLens.

That's why I can't cheat even if I want to.

HW: But cameras have different lenses than our eyes. right?

AK: The camera has a fisheye lens.

It sees a much wider field of view than the human eye.

When we think of points of light that radiate out of the camera's field of view, what matters is how many points of light we can get within a given volume.

It's the same with this HoloLens as it is with that HoloLens.

Now, this camera captures an even wider world.

HW: Jesus Christ!

(laughs) AK: He did show up! I told him he was going to show up.

Please come over here.

(laughter) HW: Oh shit.

AK: And then there's Jeff Norris from Holographic.

HW: I knew something was going on, but I didn't know what was really going on.

AK: So, in a nutshell, the field of view that the camera sees on the screen is wider than the human eye.

But the angular resolution of visible holograms, i.e. points of light per unit area, is actually the same.

HW: So you spent a lot of time mapping the stages -- Jeff, I'll get back to you soon -- AK: Right.

HW: So please help here. After you buy a HoloLens and put it in your house, you don't need to map your apartment.

AK: HoloLens uses this technology called spatial mapping to map in real time at about 5 frames per second.

So, as soon as you place it in your home, the holograms will start appearing, and once you start placing them, the holograms will start learning about your home.

In a stage environment, I'm trying to put something on my head to communicate with something over there using a wireless connection that would normally bring all conferences down, but I wouldn't risk trying to do this live.

So what we do is pre-map the stage at 5 frames per second using the same spatial mapping technique we use in our home product and save it. This way, in an environment like this, things don't disappear when there's a wireless prank between the HoloLens on the camera and the HoloLens on my head.

Because ultimately the hologram is coming from this HoloLens and that hologram is just looking at the HoloLens.

So when the connection is lost, you will not see anything beautiful on your screen.

HW: And it was beautiful.

Um... Jeff?

JN: Yes?

HW: Hello.

AK: Take a step back.

HW: Jeff, you were on Mars, you were here, you were in the room across the street.

Can you elaborate on the fact that holograms have sight but no sense of touch or smell?

Is this currently scientifically useful?

That's my question about holograms.

JN: Thank you for your question.

Of course, we still believe these technologies are scientifically useful today, which is why we use them in various parts of NASA's work.

So we are using it to improve how we explore Mars.

Even astronauts on space stations use it.

We are now using it to design our next generation spacecraft as well.

HW: Great. Okay Jeff, go somewhere else. thank you very much.

(Laughter) Alex, it was really great. Thank you very much.

AK: Thank you.

HW: Thank you. thank you.

(applause)

It started with one question. If Africa were a bar, what would your country drink or do?

I started by speculating about South Africa, but South Africa is not my country, so I didn't follow the rules strictly.

But after decades devastated by apartheid, he tweeted that #ifafricawasabar South Africa would drink all kinds of alcohol and beg for belly-friends, alluding to the country's continued attempts to build a de-racialized society.

And I waited.

And I had the funny feeling that I had crossed a line.

So I sent out a few other tweets about my country and some countries in Africa that I know very well.

And then I waited again, but this time to convince myself, no, to tell myself that I'm really funny and that it's okay if no one understands me, I read almost every tweet I've ever tweeted.

Luckily, I didn't have to do that for very long.

People started joining in immediately.

In fact, by the end of that week in July, the hashtag #ifafricawasabar would have amassed nearly 60,000 tweets, lighting up the continent and appearing in publications around the world.

People were using hashtags to do different things.

To make fun of their stereotypes: [#IfAfricaWasABar Nigeria will explain that they pay entrance fees outside, all they need is the bouncer account details] (laughter) To criticize government spending: [#ifafricawasabar South Africa will be ordering bottles, can't say they are running a tab, can't pay] To downplay geopolitical tensions: [#IfAfricaWasABar South Sudan got serious anger Newcomer?] Just to remind you that there are countries in Africa that you don't even know exist: [#IfAfricaWasABar Lesotho is someone that no one really knows about but is always in the picture. ] And also to make fun of countries that don't think they are in Africa: [#IfAfricaWasABar Egypt, Libya, Tunisia, Algeria, Morocco are like ``What the hell are we doing here?!! [#African Wasabal Rwanda would come in with no money and no transport and leave drunk happy rich girl] But most importantly people were using hashtags to connect.

People connected through their Africanness.

So for a week in July, Twitter became a real African bar.

And I got really excited. Mainly because we realized that Pan-Africanism could work, that there is a platform in front of us, between us, at our fingertips, that only needs a small spark within us to ignite the hunger for one another.

My name is Sianda Movtsiwa, 22 years old, Pan-African by nature.

Now, I say I'm Pan-African by nature because my parents are from two different African countries.

My father is from a country called Botswana in Southern Africa.

A little bigger than Germany.

This year we celebrate the 50th anniversary of a stable democracy.

And there are also some very progressive social policies.

My mother's country is the Kingdom of Swaziland.

This is also a very, very small country in southern Africa.

It is the last full monarchy in Africa.

As such, it has been ruled by kings and royal families according to tradition for a very long time.

On paper, these countries look very different.

And as a child, I knew the difference.

In one country it rained a lot, in another it didn't.

But other than that, I didn't really understand why it mattered that my parents were from two different places.

But it ends up having a very strange effect on me.

As you know, I was born in one country and raised in another.

When I moved to Botswana, I was a toddler and spoke only Swati fluently.

So, as a complete outsider, I was introduced to a new home, a new cultural identity, unable to understand what the family and country with the traditions I was supposed to be moving forward were telling me.

But soon I will ditch SiSwati.

And when I return to Swaziland, I am constantly confronted with how I have become non-Swazi.

Add to that the fact that I went to a private school in Africa, whose purpose is to break down the Africanness, and I'm going to have a very strange adolescence.

But my interest in thinking about identity was born here. It's a strange intersection of belonging to two places at the same time, but really not much of either, and belonging to this vast space in between and around them at the same time.

I fell in love with the idea of ​​sharing an African identity.

Since then, I've been reading about politics, geography, identity, and what it all means.

I have also maintained a deep curiosity about African philosophy.

When I started reading, I was drawn to the work of black intellectuals like Steve Biko and Franz Fanon. They tackled complex ideas like decolonization and black consciousness.

And then, at 14, when I thought I had digested these grand ideas, I moved on to speeches by iconic African politicians like Thomas Sankara of Burkina Faso and Patrice Lumumba of the Congo.

I read every African novel I could get my hands on.

So when Twitter came along, I jumped at it with the enthusiasm of a teenage girl. The friend is very tired of hearing such ramblings.

In 2011, it became much easier to get affordable data packages for smartphones and internet surfing in southern Africa and across the continent.

So my generation was sending messages on this platform with just 140 characters and a little creativity.

During the long commute to work, during the lectures that some of us should be paying attention to, during our lunch breaks, we communicated as much as we could about young people and the everyday realities of being African.

But, of course, this luxury is not for everyone.

This means that if you are a teenage girl from Botswana and want to have fun on the internet, you should tweet in English.

Second, you must follow at least 3 other people you know online.

I had to follow South Africans, Zimbabweans, Ghanaians and Nigerians.

And suddenly your whole world unfolded.

And my whole world opened up.

I followed vibrant Africans traveling across the continent, took pictures of themselves and posted them with the hashtag #myafrica.

Because at that time, if you searched Africa on social media like Twitter or Google, you would think the whole continent was just pictures of animals and white men drinking cocktails in hotel resorts.

(Laughter) But Africans used this platform to take some ownership of the tourism sector.

Africans taking selfies on the beach in Nigeria.

They were Africans in a cocktail bar in Nairobi.

And these were the same Africans I met in my travels across the continent.

Discuss African literature, politics, and economic policy.

But almost without exception, we end up discussing Twitter every time.

And then I understood what this was.

We were in the midst of something amazing. Because for the first time, young people in Africa are able to discuss the future of the continent in real time, unconstrained by borders, finances or oversight governments.

Because the little-known truth is that many Africans know far less about other African countries than some Westerners about Africa as a whole.

This is accidental, but it could also be by design.

In apartheid South Africa, for example, the message was constantly bombarded with black South Africans that a country ruled by blacks was doomed to failure.

And this was done to convince them that it would be much better for them to live under the overwhelming dominance of the whites than to live in a black and free country.

Added to this is Africa's archaic colonial education system, unwittingly inherited from the 1920s. At the age of 15, I could name all the causes of the various wars in Europe over the last 200 years, but I could not name the president of my neighboring country.

For me this makes no sense. For like it or not, the destinies of the people of Africa are deeply intertwined.

When disaster strikes, when chaos strikes, we share the results.

When Burundians escape political turmoil, they go to us, other African countries.

Africa has six of the world's largest refugee centers.

What was once Burundi's problem becomes Africa's problem.

So for me there are no Sudan problems, no South African problems, no Kenyan problems, just African problems with which I end up sharing turmoil.

So if we share our problems, why not share our successes better?

How can we do that?

Well, in the long term, we can increase trade between Africa, remove borders, and pressure leaders to implement the regional agreements we have already signed.

But I think the greatest way Africa can share its success is by promoting what I like to call social Pan-Africanism.

Now, political Pan-Africanism already exists, so I'm not inventing anything entirely new here.

But political Pan-Africanism is usually the unification of Africa for political elites.

And who will it benefit?

Well, African leaders, almost without exception.

No, I'm talking about ordinary African pan-Africanism.

Young Africans like me are full of creative energy and innovative ideas.

But with bad governance and unstable institutions, all this potential can be wasted.

In a continent where a few leaders have been in power longer than the majority of our people have lived, we desperately need something new, something that works.

And I think that's social Pan-Africanism.

My dream is for young Africans to stop letting borders and the environment stifle our innovation.

My dream is that when young Africans come up with something great, they say, "Well, this won't work in my country," and don't give up.

My dream is for young people in Africa to start realizing that the whole continent is our canvas and our home.

With the internet, we can start thinking together and start innovating together.

In Africa, it is said that if you want to go fast, go alone; if you want to go far, go together.

And I believe that social Pan-Africanism is the way we go far together.

And this is already happening.

Access to these online networks has given young people in Africa what we have always had to violently address: their voices.

Now we have a platform.

In the past, if you wanted to hear the voices of the young people of Africa, you waited for the 65-year-old youth minister (laughs) to wake up in the morning, take heartburn pills, and tell you his plans for your generation 20 years from now.

In the past, if you wanted a potentially tyrannical government to be heard, you had to be forced to protest, suffer the consequences, and keep quiet that some Western newspaper might offend someone.

But now we have the opportunity to back each other up in ways we never could before.

We support South African students marching against the prohibitive cost of higher education.

We support the Zimbabwean women marching into parliament.

We support illegally detained Angolan journalists.

For the first time in history, African pain and African aspirations are being witnessed by those who can most sympathize with them: other Africans.

I believe that by using social Pan-African ideas and the Internet as tools, we can begin to help each other and ultimately save ourselves.

thank you.

(applause)

It's been 128 years since the last nation in the world abolished slavery and 53 years since Martin Luther King Jr. gave his "I Have a Dream" speech.

But we still live in a world where skin color not only makes the first impression, but remains permanent.

I was born into a colorful family.

My father was the son of a maid and inherited the intense dark chocolate color from his blood.

He was adopted by people I know as grandparents.

My grandmother, the head of the household, has porcelain skin and cottony hair.

My grandfather, like my uncles and cousins, was somewhere between vanilla and strawberry yogurt.

My mother is a cinnamon-skinned Brazilian girl, a pinch of hazel and honey, coffee and milk, but she drinks a lot of coffee.

She has two sisters.

One is a toasted peanut crust and the other is a beige dough that looks like a pancake.

(Laughter) Color was never important to me growing up in this family.

But outside the house, things quickly changed.

Color had many other meanings.

I remember my first drawing class at school as a mass of conflicting emotions.

It was exciting and creative, but I didn't understand the peculiar flesh-colored pencils.

Mine was made of meat but not pink.

My skin is brown and people said I was black.

I was a chaotic 7 year old.

After that, when I took my cousin to school, I was usually taken by a nanny.

People thought I was a maid because I helped in the kitchen at a friend's party.

I've even been treated like a prostitute for walking alone on the beach with my European friends.

And many times when visiting my grandmother or friends who live in upper-class buildings, they have advised me not to use the main elevator.

After all, with this color and this hair, there are places where I can't belong.

Somehow I get used to it and accept some of it.

But something keeps spinning inside me and I keep struggling.

A few years later I married a Spaniard.

But no Spaniards.

I chose the tanned lobster skin color.

(Laughter) Since then, new questions have followed me.

What color will your child be?

As you can see, this is my last concern.

But on second thought, my background led me to my personal career as a photographer.

Thus Humanae was born.

Humanae seeks to emphasize our true colors rather than the false whites, reds, blacks and yellows associated with our race.

It's the kind of game that makes us question our norms.

It is a work that is evolving from a personal story to a global history.

Draw the subject on a white background.

Next, select an 11 pixel square from the nose, paint the background, and find the corresponding color in Pantone, an industrial palette.

I started with family and friends, but more and more people joined the adventure thanks to public outreach through social media.

I thought that the main space for presenting my work would be the Internet. Because we need an open concept where anyone can press the share button on both their computer and their brain.

Snowballs started rolling.

The project received a great reception from invitations, exhibitions, physical formats, galleries, museums...

just happened.

My favorite among them is that when Humanae occupy public spaces and appear on the streets, they foster public debate and create a sense of community.

I have drawn over 3,000 people in 19 cities in 13 countries around the world.

From people on the Forbes list to refugees who crossed the Mediterranean by boat, just to name a few.

From Paris, UNESCO Headquarters to Refuge.

And there are students both in Switzerland and in the shanty towns of Rio de Janeiro.

Beliefs of all kinds, gender identities and physical disabilities, newborns and terminal illnesses.

Together we will build Humanae.

These portraits make us rethink how we see each other.

What does it mean to us to be black, white, yellow and red when modern science questions the concept of race?

Eyes, nose, mouth, hair?

Or does it have to do with where we are from, our nationalities, our bank accounts?

This personal practice was a discovery.

Suddenly I realized that Humanae is useful for many people.

It represents a kind of mirror for those whose self is not reflected in any label.

It was amazing when people started sharing their thoughts on the piece with me.

I have hundreds of them and will share them with you as well.

Mother of 11 -- A mother of an 11-year-old girl wrote to me. "Last weekend, one of her girlfriends claimed that she doesn't belong in Norway and shouldn't be allowed to live in Norway, so it was a very good tool to work on her confidence.

So your work has a special place in my heart and is very important to me. ”

One woman shared a portrait of herself on Facebook, writing, "Throughout my life, people all over the world have struggled to fit me into groups, stereotypes and frames.

You should probably stop.

Instead of framing, ask the person, "How would you label yourself?" Then I say, "Hello." I'm Maciel

I'm Dominican Dutch, I grew up in a mixed family and I'm a bisexual woman. "In addition to these unexpected and inspiring reactions, Humanae finds new life in many different areas.

Here are some examples that illustrators and art students use as reference for sketching and studying.

A collection of faces.

Researchers in the fields of anthropology, physics, and neuroscience use Humanae in a variety of scientific approaches related to human ethnicity, optophysiology, facial recognition, or Alzheimer's disease.

One of the most significant impacts of this project was the selection of Humanae for the cover of one of the most relevant political publications, Foreign Affairs.

And when it comes to diplomacy, I found the perfect ambassador for my project...

teachers.

It is they who use Humanae as a tool for educational purposes.

Encouraged by their passion, I started taking painting classes again. This time I am the teacher myself.

My students, both adults and children, draw self-portraits to discover their own unique colors.

As a photographer, I realize that I can be a channel for others to communicate.

As an individual, as Angelica, every time I take a picture, I feel like I am sitting in front of my therapist.

All the frustration, fear and loneliness I once felt...

become love

The last country, the last country in the world to abolish slavery, is the country where I was born, Brazil.

We still have to work hard to eliminate discrimination.

It remains a common practice globally and is not going away by itself.

thank you.

(Applause.) Thank you.

Chris Anderson: This is so weird.

Your software, Linux, is embedded in millions of computers and probably powers much of the Internet.

And I think there are about 1.5 billion active Android devices out there.

Your software is included in all of them.

It's kind of amazing.

There must be a great software headquarters driving all this.

I thought so, but when I saw the picture, I was shocked.

So this is the Linux World Headquarters.

(Laughter) (Applause) Linus Torvalds: It doesn't really seem like a big deal.

And I have to say that the most interesting part of this picture that people react to the most is the walking desk.

This is the most interesting part of my office, but I don't really use it anymore.

And I think the two are related.

the way i work...

I don't want external stimuli.

As you can see, the walls are light green.

Mental hospitals have them on their walls.

(Laughs) It's a calm color, not a very exciting color.

I can't see the computer here. I can only see the screen. But my biggest concern about my computer is that it doesn't have to be big and powerful, which I like, but it really needs to be dead quiet.

I know people who work at Google and they have a small data center at home, but I don't do that.

My office is the most boring office I have ever seen.

And I'm sitting there alone and quiet.

When the cat approaches, it sits on my lap.

And what I want to hear is the purring of a cat, not the noise of a computer fan.

CA: This is amazing. It's an amazing testament to the power of open source, because working this way allows us to run this vast technology empire, an empire.

How did you come to understand open source and how did it lead to the development of Linux?

LT: So I'm still working alone.

The truth is, I work alone at home and often wear a bathrobe.

I dress up when the cameraman comes, so I'm wearing clothes.

(Laughter) And that's how I've always worked.

That's how I got started with Linux.

I didn't start Linux as a collaborative project.

I started it as one of many projects I was doing for myself at the time. Partly because I wanted the end result, but more than that, simply because programming was fun.

So it was about the end of a journey that, after 25 years, still hasn't arrived.

But it was about the fact that I was looking for a project myself and there was absolutely no open source in sight for me.

And what happened is...

Your project will grow and become something you want to brag about.

As a matter of fact, it's like, "Wow, look what I did!"

Believe please. It wasn't that great back then.

I released it to the public, and at that point it wasn't even open source yet.

At that time the source was open, but there was no intention to use the open source methodologies we think of today to improve it.

It was like, "Hey, I've been working on this for half a year. I want your comments."

And others approached me too.

I had a friend at the University of Helsinki who was one of the open source (then mostly called "free software"), and he actually introduced me to the concept that we could use open source licenses that had existed before.

And I thought about it for a while.

As a matter of fact, I was worried that there would be commercial interest coming in.

So, I think that's one of the fears people have when they're just starting out. Worrying that someone might take advantage of your work.

And I decided, "What the hell?"

And -- CA: And at some point someone contributed code like you thought.

This may actually improve this issue. ”

LT: It didn't start with people contributing code, rather people started contributing ideas.

And the fact that someone else checks your project is true for others, too, if someone else is interested in your code and has seen it enough to actually give feedback or give ideas, but it definitely applies to code.

That was a big deal for me.

I was young at the time, 21, but I've basically been programming for half my life already.

All the projects up to that point were completely personal and when people started commenting and giving feedback on your code it was a real revelation.

And I think it was one of the big moments when I said "I love other people!" even before they started returning codes.

Don't get me wrong. I'm actually a socially awkward person.

(Laughter) I don't really love other people -- (Laughter), but I do love computers. I love communicating with others via email. Because e-mail gives you a kind of buffer.

But I love other people who comment and participate in my projects.

And it even made it happen.

CA: So, was there a moment when you looked at what was being built and it suddenly started to move and you thought, 'Wait a minute, this could actually be something huge.

LT: It's not.

So the biggest point for me was when it got smaller, not when it got huge.

The big point for me was that there are not one person involved, but 10, maybe 100 people. That was the big point.

Then everything else was very loose.

For me, going from 100 to 1 million is not a big deal.

Well, I mean, if you are -- (laughter) it's a big deal if you want to sell your results -- don't get me wrong.

But if you're into technology and you're into the project, the key was getting a community.

After that, the community gradually grew.

In fact, there's not a single point where I thought, "Wow, that worked!" because it took a relatively long time.

CA: I mean, every tech I've talked to really believes that your job has changed a lot.

It's not just Linux. A management system for software development called Git.

Tell us briefly about that and your role in it.

LT: So one of the issues we had was that it took a while for this to start showing up when...

As the number of people working on the project grows from 10 or 100 to 10,000 people, so now just on the kernel there are 1,000 people involved in every release, and it happens every two months, roughly every two to three months.

Some people don't do much.

Many people make small changes.

However, maintaining this depends on the scale.

And we went through a lot of pain.

There is also an entire project that only maintains the source code.

CVS was once the most commonly used and I hated CVS and refused to touch it, trying something new and interesting that everyone else hated.

CA: (laughter) LT: And we were in this bad situation, and there were thousands of people who wanted to join, but in many ways I kind of hit a breaking point and I just couldn't scale up to being able to work with thousands of people.

So Git is my second big project and was created only to maintain my first big project.

And this is literally how I work.

I don't code -- well, I code for fun -- but I want to write code for something meaningful, so every project I've ever done has been necessary for me. And -- CA: So, really, both Linux and Git came about as an almost unintended result of a desire not to work with too many people.

LT: Of course. yes.

(laughs) CA: That's amazing. LT: Yes.

(Applause.) Still, you're the one who changed technology not once, but twice, and we must try to understand why.

You gave us some hints but...

This is a picture of me as a child with a Rubik's Cube.

You said you've been programming since you were about 10 or 11 years old, half your life.

Ubernard, were you that kind of computer genius, the star of the school that could do anything?

What was your childhood like?

LT: Well, I guess I was a typical geek.

That is, I...

I wasn't human back then.

that's my brother

Clearly more interested in the Rubik's Cube than my younger brother.

(laughter) My sister, who is not in the picture, when we had a family meeting, she was not a big family, but she had some cousins, so she arranged for it in advance.

For example, before I entered the room she said: "Okay. That's so-so..."

Because I wasn't a geek.

I was into computers, mathematics and physics.

I was good at it.

I don't think I was any better.

Apparently my sister said that my greatest strength is that I don't give up.

CA: Okay, so let's go there, it's interesting.

you won't let go

I mean, it's not about being nerdy or smart, it's about being... stubborn?

LT: It's about being stubborn.

It's about starting something and not saying, "Okay, I'm done, let's do something else—look, it's shiny!"

And I've noticed that in many other parts of my life as well.

I lived in Silicon Valley for seven years.

And I worked for the same company in Silicon Valley all my life.

It's unheard of.

That's not how Silicon Valley works.

The whole point of Silicon Valley is that people are jumping between jobs and mixing pots of sorts.

And I'm not that kind of person.

CA: But during the actual development of Linux itself, that stubbornness sometimes clashed with other people.

Talk about it for a minute.

Was it essential to maintaining the quality of what was being built?

How would you describe what happened?

LT: I'm not sure if it's required.

Back to "I'm not human", but sometimes I am too...

They are "short-sighted" when it comes to other people's feelings, which can lead them to say things that hurt others.

And I'm not proud of it.

(Applause.) But at the same time, some people say I have to be kind.

And when I try to explain to them that maybe you're kind and maybe you should be more aggressive, they see me as unkind.

(Laughter) What I mean is that we are different.

I'm not human It's not something I'm particularly proud of, but it's a part of me.

And one of the things I really love about open source is that different people can actually collaborate.

we don't have to like each other. And sometimes we don't really like each other.

There are really, I mean, very heated discussions.

But in practice you can find that you don't agree to disagree, just that you're interested in something really different.

And going back to what I said earlier about the merchants taking advantage of your work that I was scared of, those merchants quickly turned out to be nice, nice people.

And they did all the things I didn't want to do at all, and they had completely different goals.

And they used open source in ways I didn't want.

But because it was open source, it was possible and it actually worked very beautifully together.

And actually I think it works the same way.

You need communicative, warm, friendly people who want to hug you and join your community. (smile)

But not everyone.

And it's not me.

I am careful with technology.

Some people care about UI.

I can't run UI to save my life.

I mean, if I was stranded on an island and the only way to get out of it was to make a clean UI, I would die there.

(Laughter) There are all kinds of people, and I'm not making excuses, I'm trying to explain.

CA: Well, when we spoke last week, you were talking about another aspect of yourself that I found very interesting.

It is this concept called taste.

And here are some images.

You'd think this would be an example of code that doesn't have very good taste, but you'll quickly see that this code has better taste.

What's the difference between these two?

LT: So this -- how many people here have actually coded?

CA: Oh my god.

LT: So to all of you who raised your hands, I assure you that they've done so-called singly-linked lists.

And it's taught -- this is the first not-so-tasteful approach, but it's basically how you're taught to do it when you start coding.

No need to understand code.

The most interesting part for me is the last if statement.

Because what's going on in a singly linked list, i.e. you're trying to remove an existing entry from the list, makes a difference whether it's the first entry or the middle entry.

Because if it's the first entry, you need to change the pointer to the first entry.

If you're in the middle, you'll need to change the pointer of the previous entry.

So these two are completely different cases.

CA: I'd prefer that.

LT: And this is better.

There are no if statements.

And it doesn't really matter. I don't want you to understand why there is no if statement, but I do want you to understand that sometimes if you look at the problem differently and rewrite it, the special case disappears and becomes the normal case.

And that's good code.

But this is simple code.

This is CS101.

This is not important, but the details are important.

For me, the trait of someone I really want to work with is that they have good taste.

I submitted this silly example, but it's too small to be relevant.

Good taste is much bigger than this.

Good taste is actually seeing the big patterns and knowing instinctively what the right way to do things is.

CA: Okay. So now we're putting the pieces together.

You have taste in a way that makes sense for software guys.

You -- (laughter) LT: I think it made sense to some people here.

CA: You're a very smart computer programmer, but you're also stubborn as hell.

But there should be something else.

So you changed the future.

You must be capable of realizing these grand visions of the future.

You are a visionary, aren't you?

LT: I've actually been a little uncomfortable at TED the last two days. Because there are a lot of visions happening.

And I'm not farsighted.

We don't have a five-year plan.

I am an engineer.

And that's really, I mean, I think I'm perfectly happy with all the people walking around and looking at the clouds and the stars and saying, 'I want to go there.

But I'm looking at the ground, and I want to fix the pothole in front of me before I fall.

I am this kind of person.

(Cheers) (Applause) CA: So you told me about these two guys last week.

Who are they and how are they related?

LT: Well, it's kind of a cliché in technology, the whole Tesla vs. Edison thing, Tesla is seen as a visionary scientist and a crazy idea man.

And people love Tesla.

I mean, someone would name their company after him.

(Laughter.) Another person there is Edison. He is in fact often vilified for being a walker, but his most famous quote is "Genius is 1 percent inspiration and 99 percent perspiration."

And I'm in the Edison camp, even if people don't necessarily like him.

Actually comparing the two, Tesla seems to have won over people's hearts these days, but who really changed the world?

Edison may not have been a good person, but he did a lot. He was probably not so intelligent, nor was he so far-sighted.

But I think I'm more Edison than Tesla.

CA: The theme for this week's TED is dreams—dream big, bold, bold.

You are really the antidote to it.

LT: Yes, we are trying to reduce it a bit.

CA: That's good.

(Laughter) We hug you, we hug you.

Google and many others probably make billions of dollars from your software.

Does it make you angry?

LT: No.

No, it doesn't make me angry, for some reason.

And one of them, I'm fine.

I'm really fine.

But another reason is that Linux would never have become what it is today without doing all that open source and really letting go.

And it gave me the experience of public speaking, which I don't really like, but at the same time, it's an experience.

trust me.

So there are a lot of things going on that make me very happy and I think I made the right choice.

CA: I think this is the end of the open source idea, but is the open source idea fully realized in the world today, or is there more that can be done with the open source idea?

LT: So I have two thoughts.

I think one of the reasons open source works so well with code is that code tends to be somewhat black and white, after all.

Often this is done right and there are pretty good ways to determine if this is not done properly.

The code either works or it doesn't, which means it's less controversial.

Nevertheless, there are arguments, right?

In many other fields, I mean, people talk about open politics and stuff like that, but just because white and black are going to be different colors instead of just gray, it's sometimes very hard to say that the same principles can be applied to some other fields.

So there is clearly a resurgence of open source in science.

Science was first.

But then science became very closed, with very expensive journals, etc., and some of it was going on.

And open source is making a comeback in science, with things like arXiv and open journals.

Wikipedia has also changed the world.

There are other examples, and I'm sure there will be more.

CA: But you're not a visionary, so it's not up to you to name them.

LT: No.

(laughs) It's up to you guys to make it, right?

CA: That's right.

Thank you Linus Torvalds, thank you Linux, thank you Internet, thank you all Android phones.

Thank you for coming to TED and revealing so much about yourself.

LT: Thank you.

(applause)

I am here today to tell you a story that we have all been led to believe is impossible.

This is the story of a vibrant start-up that thrives in the unlikely environment of the US government.

Now this startup is starting to fundamentally disrupt the way governments do business from within.

But before we get there, let's start with the problem.

For me the problem starts with the number 137.

137 days is the average number of days veterans have to wait for benefits to be processed by the Veterans Affairs Corps.

137 days.

Well, to first submit that application, she has to navigate over 1,000 different websites and over 900 different call-in numbers. They are all owned and operated by the US government.

We are living in a time of incredible change.

The private sector is constantly changing and constantly improving.

Moreover, it removes every inconvenience in my life that I can think of.

Order a hot gluten-free meal from your phone and have it delivered to your doorstep in less than 10 minutes, even if you're sitting on the sofa in your apartment.

But on the other hand, working mothers who rely on food stamps to support their families have to complete difficult and complicated applications that they may not even be able to do online.

And her inability to do the same work on the couch means she may have to take days or hours off work she can't afford.

And this growing dichotomy between beneficiaries and those left behind of the technological revolution is one of the greatest challenges of our time -- (applause) because government failures to provide effective digital services disproportionately affect the very people who need them most.

It affects students going to college, single mothers seeking medical care, and veterans returning from combat.

They can't get what they need when they need it.

And for these Americans, government is more than just a quadrennial presidential election.

Government is the lifeline that provides the services they need, depend on and deserve.

This is why, frankly, governments need to pull together and catch up.

just say

(Applause.) Now, this hasn't always been my passion.

When I joined President Obama's campaign in 2008, we brought tech industry best practices into politics.

We made more money, recruited more volunteers, and won more votes than any political movement in history.

We were a cutting-edge start-up that changed the game of politics forever.

So when the President asked a small group of us to bring that very same mess directly to government, I showed up eager and ready to get to work, even though I knew it would not be an easy task.

Well, on my first day in Washington, D.C.—my first day in government—they handed me a laptop when I walked into the office.

And the laptop was running Windows 98.

(Laughter) So it's been three presidential elections since the government updated its computer's operating system.

Three elections!

That's when we realized the problem was much bigger than we had imagined.

Let me draw a picture for you.

The federal government is the world's largest institution.

It spends more than $86 billion annually on federal IT projects, or $86 billion.

For context, this is more than the entire venture capital industry spends on everything annually.

The problem here is that 94% of federal government IT projects are over budget or behind schedule, so we taxpayers aren't getting what we pay for.

94 percent!

For those who keep track of scores, the number 94 is very close to 100.

(Laughter) I have another problem. 40% of them will never see the light of day.

They are discarded or abandoned entirely.

Now, this is a very painful moment of existential crisis for any organization. It means failure is almost inevitable as long as the government continues to operate as planned.

And if maintaining the status quo is the riskiest option, that means we have no choice but to radical destruction.

So what do you do?

How can I fix this?

Now, the irony of all this is that we don't really need to look beyond our own backyard. Because right here in America, there are the very ideas, and the very people, that have pushed our world to a radically different place than it was 20 years ago.

So what if it was actually possible to get student loans and veteran benefits as easy as ordering cat food home?

What if the entrepreneurs and innovators who have disrupted our tech industry came along and had an easy path to disrupt governments?

Well, friends, we're here to talk about some of the exciting new formulas we've discovered to bring about change in government.

Entry into US digital services.

United States Digital Services is a new network of startups, a team of teams, organized across government to create radical change.

U.S. Digital Services' mission is to help governments deliver world-class digital services at significantly lower costs to students, immigrants, children and seniors alike.

We are essentially building a better government today, for the people, by the people.

We don't care -- (Applause) Thank you.

(Applause.) Who wouldn't want a better government?

We are not interested in politics.

We are interested in improving the functioning of government because it is the only thing we can do.

(Applause) Now think about our team. Well, it's very funny. You can think of our team a bit like SEAL Team 6, where the Peace Corps and DARPA met.

We are like a peace corps for geeks, but instead of traveling to crazy, interesting, far-flung places, we spend a lot of time indoors in front of our computers, helping restore the fabric of our democracy.

(Laughter) So this team, the strategy for US Digital Services is very simple.

The first strategy is to recruit the best talent our country has to offer and recruit them for short mission tours within the government.

They are the people who have helped build the products and companies that have made our technology field one of the most innovative in the world.

Second, we combine these amazing people at the core of technology with dedicated civil servants who are already making change on the ground within government.

Third, deploy strategically in targeted formations to the most mission-critical and life-changing critical services that governments provide.

And finally, we provide massive air support, from leaders within government agencies to the President himself, to transform these services for the better.

Now this team is starting to disrupt the way governments do business from the inside.

Studying the classic patterns of confusion, one very common pattern is fairly simple.

It's about taking what's routine and standard in one industry and applying it to another in a radical departure from the status quo.

Think about how Airbnb embraced hospitality conventions to revolutionize my apartment.

US Digital Services does just that.

We are taking what Silicon Valley and the private sector have worked hard to learn about how to build low-cost, user-pleasing, global digital services, and applying it to government, making a radical departure from the status quo.

Well, the good news is that it's starting to work.

We know this because we've already seen the results when some early projects, like the Healthcare.gov rescue effort, don't get off the ground.

Amending Healthcare.gov was the first place we took this effort, and now we're taking the same effort and expanding it across many of the government's most important citizen services.

Now, if I can take a moment to brag about this team, it's the best rogue concentration I've ever dreamed of.

We currently have top talent on staff from Google, Facebook, Amazon, Twitter, and more, all of whom have chosen to join the government.

And the amazing thing is that everyone is intelligent, enthusiastic and kind at the same time.

By the way, more than half of us are women.

(Applause.) The best way to understand this strategy is to actually look at how it works in practice through some examples.

I'll give you two examples right away.

The first is about immigration.

Guys, this is a typical immigration application.

Yes, as you can imagine, it's almost entirely paper-based.

At best, it takes about 6-8 months to process your application.

Physically transported thousands of miles. -- Between 6 or more processing centers.

Now, on a whim, about 10 years ago, the government thought that putting this system online would save taxpayers money and serve them better. This was a great idea.

After six years and $1.2 billion, no working product was delivered. It got a "B" at $1.2 billion.

At this point, the agency responsible, the U.S. Citizenship and Immigration Service, may have continued to fund the failed program.

Sadly, it happens all too often.

That is the situation today.

But they didn't.

Dedicated civil servants within the agency decided to stand up and demand change.

We sent a small team of just 6 people, but what many people don't know is that it's the same size as the Healthcare.gov rescue effort (only 6 people).

And that team joined together to support the agency in transitioning this project to more modern business practices, more modern development practices.

Now, in non-technical terms, what this basically means is breaking up a large multi-year project into bite-sized chunks. That way you can reduce the risk and actually start seeing results every few weeks instead of waiting years in a black box.

So, less than three months after our team was in the field, we were already able to move our first product into production.

First, this is the I-90 format.

This will be used to apply for a replacement green card.

Now, for immigrant visa holders, getting a green card replacement is a big deal.

Your green card is your identity document, your work permit, and proof that you can stay in the country.

So waiting six months for the government to process the replacement is not cool.

Today, I am happy to announce that for the first time anyone can apply for a green card replacement completely online without touching paper.

It's faster, cheaper, and offers a great user experience for applicants and officials alike.

(Applause) Quick, one more.

Last fall we just released a brand new mock civics test.

Therefore, as part of becoming a U.S. citizen, you must pass a civics test.

For those taking this test, it can be a very stressful process.

So our team has released a tool written in plain language that is extremely simple and easy to use to help people be prepared, less nervous and confident about taking the next step in pursuing the American Dream.

Because all this work, this work on immigration, is about making it more human through a complex process.

The other day, one of the dedicated civil servants on the ground said something incredibly profound.

She said she had never been so hopeful and optimistic about a project in her entire career in government.

And she's been doing this for 30 years.

That is exactly the hope and cultural change we are trying to create.

As a second example, I would like to turn a little back to our veterans and explain what we are doing to build a Veterans Corps worthy of their service and sacrifice.

Just a few months ago we were proud to release a new beta version of our new website, Vets.gov.

Vets.gov is a simple, easy-to-use website that brings together all the online services a veteran needs in one place.

One website, not thousands.

The site is a work in progress, but it's a big step forward as it was designed with the most important user in mind: the veterans themselves.

This may sound incredibly obvious, but sadly, this is not normal for governments.

Product decisions are often made by stakeholder committees that do their best to represent the interests of users, but not necessarily users themselves.

So our team from the Veterans Corps went out into the field, looked at the data, talked to the veterans themselves, and started simple and small with the two services that matter most to them: Education Benefits and Disability Benefits.

We are proud to say that this site is now up and running. As the team continues to streamline services further, they will be ported here and the old site will be shut down.

(Applause) For me, this is the change in 2016.

When I walked out of the Oval Office for the first time, I noticed a quote embroidered by the president on the rug.

This is a classic JFK quote.

"The question of human destiny is not beyond human beings."

That's true.

We have tools to solve these problems.

We have the tools to come together as a society and as a nation to solve this problem together.

Yes, it's hard.

It's especially hard when you have to fight, when you have to refuse to give in to the belief that things won't change.

But in my experience, the hardest things are often the most rewarding things.

This is the responsibility of all of us, as government is not an abstract institution or concept.

Our government is us.

(Applause.) Today, it no longer matters whether change is possible.

The question is not "can it be done?"

The question is "Do you want to do it?"

will you?

thank you.

(Applause.) Thank you.

(applause)

When I was seven years old, a well-meaning adult asked me what I wanted to be when I grew up.

"I'm an artist," I said proudly.

"No," he said, "I cannot make a living as an artist!"

My 7-year-old Picasso dream was dashed.

But I picked myself up, went on a search for new dreams, and eventually settled on being a scientist, perhaps the next Albert Einstein.

(Laughter) I always loved math and science, and later I loved coding.

So I decided to study computer programming at university.

In my junior year, my computer graphics professor showed me these amazing short films.

It was the first computer animation that any of us had ever seen.

I was amazed and riveted by these movies, watching fireworks go off in my head and thinking, "This is what I want to do with my life."

The idea that I could combine all the math, science, and code I learned to create these worlds, characters, and stories that I connected with was pure magic to me.

Only two years later, I started working at Pixar Animation Studios, which produced these films.

Here I actually learned how to run these movies.

Create a three-dimensional world in your computer to create your animation.

The lines that form the faces of the characters and the trees and rocks that eventually become the forest are drawn from points.

And since it's a 3D world, you can move the camera around in that world.

I was fascinated by it all.

But for the first time I got a taste of lighting.

Real lighting is about placing light in this three-dimensional world.

There is actually a light icon moving around there.

Here you can see that I added a light. I have a rough version of lighting turned on in the software and shadows turned on to place the lights.

When placing lights, think about what it would look like in real life, but balance it with what you need artistically and for your story.

It may look like this at first, but after a few weeks of work tweaking and moving this, it looks like this in rough form, and this in the final form.

There are moments in lighting that I completely fell in love with.

I will move from here to here.

It's the moment when all the pieces come together and suddenly the world comes to life as if it were a real place.

This moment never gets old, especially for a seven-year-old girl who wanted to be an artist.

As I learned about lighting, I learned how to use it to tell a story, set the time of day, create atmosphere, guide the audience's eye, make characters engaging, and stand out on a busy set.

Have you seen Wally?

(Laughter) There he is.

As you can see, you can create any world you want inside your computer.

You can create a world with monsters, you can create a world with robots falling in love, you can make flying pigs.

(Laughter) That's great, but this unfettered artistic freedom can be confusing.

You can create incredible worlds, incredible movements, and surprises your audience.

So to combat this, we connect with science.

We use science and the world as we know it as our backbone, grounding ourselves in what is relevant and recognizable.

"Finding Nemo" is a good example.

Most of the film takes place underwater.

But how do you make it visible underwater?

Early research and development involved taking clips of underwater footage and recreating them on the computer.

We then took it apart to see what elements made up its underwater appearance.

One of the most important factors was how light travels through water.

So we coded the lights to mimic this physics. First is water visibility, then what happens with color.

Objects closer to the eye have fuller, richer colors.

As light travels deeper into the water, it loses red wavelengths, then green wavelengths, leaving blue at depth.

Two other important elements can be seen in this clip.

The first is swells and swells, or invisible underwater currents, that sweep particulate debris into the water.

The second is caustics.

These are ribbons of light, such as those found at the bottom of a pool, created when the sun bends through ripples and wave crests on the surface of the ocean.

Here is the fog beam.

Not only do these give a hint of color depth, but they also indicate which direction is up in shots where the water is not visible.

Another really cool thing you can see here is the lighting of the particles with caustics only. So the microparticles appear and disappear as they enter and exit the ribbon of light, giving the water a subtle, magical glow.

See how we harness science—the physics of water, light, and motion—to unite artistic freedom.

But we are not stuck with that.

We looked at each of these elements and considered which elements needed to be scientifically accurate and which could be pushed or pulled to fit the story and mood.

We realized early on that it was a color with some leeway.

Here is an underwater scene in traditional colors.

But here you can take Sydney Harbour, and add quite a bit more greenery to match the sad vibe that's going on.

Seeing deep underwater is very important in this scene. So you can understand what the East Australian Current is and what turtles are up to on this roller coaster.

So we made water visible far beyond what we can actually see.

Because, at the end of the day, we're not trying to recreate a scientifically correct real world, but rather creating a believable world that the audience can immerse themselves in to experience the story.

We use science to create amazing things.

We use stories and artistic touches to take us to magical places.

This guy, Wally, is a prime example.

He finds beauty in the simplest things.

But when he came to the lighting job, we realized we had a big problem.

We went so far in making Wally this convincing robot that his binoculars are almost optically perfect.

(Laughter) His binoculars are one of the most important pieces of acting equipment he has.

Moreover, he has no face or even traditional speech.

As such, animators relied heavily on binoculars to market his acting and emotions.

We started to turn on the lights, but noticed that the triple lenses in his binoculars had diffuse reflections.

He was beginning to see cloudy eyes.

(Laughter) Now, when you're trying to convince an audience that robots have personalities and can fall in love, glassy eyes are fundamentally terrible.

So we set out to develop an optically perfect pair of binoculars to find a solution to this problem of reflection while preserving the original materials of the robot.

That's where I started with the lens.

This is a plane lens, and there are concave and convex lenses.

And here all three are shown together to show a reflection of all of them.

We tried turning them down, trying to block them, but nothing worked.

As you can see here, sometimes he had to see something specific - usually Eve.

Therefore, a fake abstract image could not be used in the lens.

Here I put Eve on the first lens and Eve on the second lens, but it doesn't work.

I declined and it still doesn't work.

And we have a new moment.

Adds light to Wally that accidentally leaks into Wally's eyes.

You can see those gray aperture blades glowing.

Suddenly, the aperture blades pierce through that reflection in a way that nothing else has.

Now we know Wally has eyes.

As humans, we have white eyes, colored irises, and black pupils.

Wally now has black eyes, gray aperture blades, and black pupils.

Suddenly, Wally feels like he has a soul, as if he has a character with feelings inside him.

At the end of the film, Wally loses his personality and practically dies.

This is the perfect time to bring back those glassy eyes.

Wally comes to life in the next scene.

When we get that light back and put the aperture blades back on, he's back to being that sweet, soulful robot we came to love.

(Video) Wall-E: Eva?

Daniel Feinberg: There's beauty in these unexpected moments. The moment I discovered what I wanted to do with my life when I found the key to unlocking the robot's soul.

The jellyfish in Finding Nemo was one of those moments for me.

Every movie has scenes that don't fit together.

This was one of those scenes.

The director had a vision for this scene based on great footage of jellyfish in the South Pacific.

As we moved on, we struggled.

In my review with the director, I moved away from the usual look and feel conversations to questions about numbers and percentages.

Maybe it was because it was based on something real, unlike the norm, or maybe it was just because I got lost.

But it was supposed to use brains without eyes, science without arts.

That scientific bond was strangling the scene.

But despite all the setbacks, I believed it could be beautiful.

So I worked really hard on the lighting.

While trying to balance blues and pinks, caustics dancing on jellyfish bells, and billowing fog beams, something started to look promising.

One morning I went to work and checked last night's work.

And I got excited.

I showed it to the lighting director and she was thrilled.

Soon I was shown to the director in a dark room with 50 people.

With a director's review, it's common to expect to get a good word, then notes and corrections.

And hopefully we'll get a final that will signal us to move on to the next stage.

I played the intro and played the jellyfish scene.

And the director was silent for an uncomfortably long time.

Long enough to make you think, "Oh, this is fate."

And he started clapping.

Then the production designer started clapping.

And the whole room was applauding.

It is in this moment that I live in lighting.

The moment when everything becomes one and a world you can believe in is born.

We use math, science and code to create these amazing worlds.

We use storytelling and art to bring them to life.

This interweaving of art and science elevates the world to a place of wonder, a place of soul, a place of belief, a place where imagination becomes reality. And a world where a girl suddenly realizes that she is not only a scientist, but also an artist.

thank you.

(applause)

Cancer affects us all. In particular, cancers that recur many times, aggressive drug-resistant cancers, and cancers that resist medical treatment even with the best drugs.

Molecular engineering that works at the smallest scale can offer exciting new ways to combat the most aggressive cancers.

Cancer is a very smart disease.

Cancer comes in several forms, but fortunately we've learned how to deal with it relatively well with known and established drugs and surgeries.

However, some types of cancer do not respond to these approaches, and tumors may survive or recur after an onslaught of drugs.

You can think of these highly aggressive cancers like supervillains in comic books.

They are smart, adaptable, and very good at staying alive.

And like most supervillains these days, their superpowers come from genetic mutations.

Modified genes within these tumor cells can enable and encode new, unimagined survival modalities, allowing cancer cells to survive even the best of chemotherapy.

One example is the trick that allows the cell to push the drug out, even if it approaches the cell, but before the drug has a chance to take effect.

Imagine -- cells effectively pumping out drugs.

This is just one example of the many genetic tricks our supervillain Gunn has.

All due to mutated genes.

In other words, there will be supervillains with incredible superpowers.

And we need new and powerful attack methods.

In fact, genes can be turned off.

The key is a set of molecules known as siRNAs.

siRNAs are short sequences of genetic code that direct cells to block specific genes.

Each siRNA molecule can turn off specific genes in the cell.

In the years since their discovery, scientists have been very excited about how these gene blockers could be applied medically.

But there is a problem.

siRNAs work well inside cells.

However, when exposed to enzymes present in the bloodstream and tissues, they are degraded within seconds.

On its way to its final target within the cancer cell, it must be packaged and protected as it passes through the body.

So, our strategy is:

First, the cancer cells are given siRNA, a gene blocker, to suppress survival genes, and then the cancer cells are attacked with chemotherapeutic agents.

But how do we do that?

With molecular engineering, we can actually design superweapons that can travel through the bloodstream.

It must be small enough to pass through the bloodstream, small enough to penetrate tumor tissue, and small enough to be taken inside cancer cells.

You need about 1/100th the size of a human hair to do this job well.

Let's take a closer look at how to build this nanoparticle.

First, let's start with the nanoparticle core.

These are small capsules that contain chemotherapy drugs.

This is the poison that actually ends the life of tumor cells.

A very thin nanometric siRNA blanket is wrapped around this core.

This is our gene blocker.

Because siRNAs are strongly negatively charged, they can be protected with an excellent protective layer of positively charged polymers.

The two oppositely charged molecules stick together due to their attractive charge, providing a protective layer that prevents siRNA degradation in the bloodstream.

It's almost over.

(Laughter) But there is another big obstacle that we have to consider.

In fact, that may be the biggest obstacle.

How do we deploy this superweapon?

So every good weapon has to be targeted, and this superweapon has to be aimed at the supervillain cells inside the tumor.

However, our bodies have a natural immune defense system. Cells are present in the bloodstream and are capable of finding, destroying or eliminating unwanted matter.

And what do you think? Our nanoparticles are considered foreign substances.

Nanoparticles must evade tumor defense systems.

We have to overcome this mechanism of camouflaging and eliminating foreign substances.

So we add another negatively charged layer around this nanoparticle. This serves two purposes.

First, this outer layer is one of the naturally charged, highly hydrated polysaccharides found in our bodies.

Creates a cloud of water molecules around the nanoparticles, creating an invisible cloaking effect.

This invisibility cloak allows the nanoparticles to travel long enough in the bloodstream to reach tumors without being expelled into the body.

Second, this layer contains molecules that specifically bind to tumor cells.

Upon binding, cancer cells take up the nanoparticles. The nanoparticles are now placed inside the cancer cell and ready to unfold.

are you OK! I felt the same way. Alright, let's go!

(Applause) First the siRNA is expanded.

It works for hours, giving enough time to silence and block survival genes.

We have now disabled those genetic superpowers.

Only cancer cells with no special defenses remain.

Chemotherapeutic drugs then come out of the nucleus to cleanly and efficiently destroy the tumor cells.

With enough gene blockers, many different types of mutations can be addressed, giving us the chance to wipe out tumors without leaving the bad guys behind.

So how does our strategy work?

We tested these nanostructured particles in animals using high-grade triple-negative breast cancer.

This triple-negative breast cancer has a gene that causes it to spit out anticancer drugs as soon as they are administered.

Doxorubicin (referred to as “dox”) is usually the anticancer drug of choice for breast cancer treatment.

Therefore, we first treated animals with dox core, dox alone.

The tumor slowed growth but still grew rapidly, doubling in size in two weeks.

Then I tried the combined superweapon.

In addition to nanolayer particles with siRNA against chemical pumps, the core contains dox.

And look, we found that not only did the tumors stop growing, but they actually decreased in size and in some cases disappeared.

In fact, the tumor had regressed.

(Applause.) The beauty of this approach is that it can be personalized.

Different layers of siRNA can be added to address different mutations and tumor defense mechanisms.

And various drugs can be loaded into the nanoparticle core.

Learning how to test patients and understanding the genotype of a particular tumor can help doctors determine which patients might benefit from this strategy and which gene inhibitors can be used.

Ovarian cancer has a special resonance for me.

It is a highly aggressive cancer and one of the reasons is that it is found at a very late stage when it is very advanced and has many genetic mutations.

The cancer recurs in 75% of patients after initial chemotherapy.

It then recurs, usually in a drug-resistant form.

High-grade ovarian cancer is one of the world's biggest supervillains.

And we are now turning our superweapons towards its overthrow.

As a researcher, I don't usually interact with patients.

But I recently met mother Mimi and daughter Paige, both ovarian cancer survivors.

I was deeply inspired by the stories of optimism and strength that mothers and daughters displayed, as well as their courage and support.

At the event, we talked about different technologies targeting cancer.

Through tears, Mimi explained that learning about these initiatives will give hope to future generations, including her daughter.

This really moved me.

It's not just about building really sophisticated science.

It's about changing people's lives.

It's about understanding the power of engineering at the molecular scale.

I know that as students like Paige progress in their careers, new possibilities will open up to address some of the world's greatest health problems, such as ovarian cancer, neurological disorders, and infectious diseases, in the same way that chemical engineering has found a way to open doors for me, providing molecular engineering methods on the smallest scales to heal on a human scale.

thank you.

(applause)

It is my job and responsibility as an astronomer to remind people that extraordinary claims require extraordinary evidence, and that the alien hypothesis should always be a last resort.

I would like to talk about it this time.

It includes data from NASA missions, the public, and one of the galaxy's most extraordinary stars.

It started in 2009 with the launch of NASA's Kepler mission.

Kepler's main scientific objective was to discover planets outside our solar system.

It did this by staring at a single empty field full of small boxes.

And this one field continuously monitored the brightness of over 150,000 stars for four years, taking data points every 30 minutes.

It was looking for what astronomers call a transit.

This is when the planet's orbit coincides with our line of sight and the planet just crosses in front of the star.

When this happens, a little bit of starlight is blocked and can be seen as a dip in this curve.

So a team at NASA developed a very sophisticated computer to search for all Kepler data transits.

Simultaneously with the release of the first data, astronomers at Yale University had an interesting thought. It was what if the computer missed something.

So we launched a citizen science project called Planet Hunters to get people looking at the same data.

The human brain has an amazing ability to recognize patterns, and in some cases even outperforms computers.

However, there was a lot of skepticism about this.

My colleague Debra Fisher, founder of the Planet Hunters Project, said people at the time were saying, "You're crazy. Your computer can't miss a signal."

And then the classic man-versus-machine gambling began.

And when we find one, we will be overjoyed.

When I joined the team four years ago, I already found a couple.

And today, with the help of over 300,000 science enthusiasts, we've discovered dozens of stars, and one of the most mysterious stars in the galaxy.

To understand this, let's show what a normal transit of Kepler data looks like.

On the left side of this graph is the amount of light, and at the bottom is the time.

The white lines are the light from the stars, what astronomers call light curves.

Now, when a planet passes a star, this light is slightly blocked, and the depth of this passage reflects the size of the object itself.

Consider Jupiter, for example.

The planet doesn't get as big as Jupiter.

Jupiter reduces the brightness of the star by 1 percent.

On the other hand, Earth is 11 times smaller than Jupiter, so the signal is barely visible in the data.

Now let's get back to the mystery.

A few years ago, Planet Hunters were combing through data looking for a transit when they discovered a mysterious signal from the star KIC 8462852.

Their observation in May 2009 was their first discovery and they started talking about it on discussion forums.

They objected, saying Jupiter would make drops like this in the starlight, but they also said it was huge.

Usually layovers last only a few hours, but this time it lasted almost a week.

They also said that this Jupiter looks asymmetrical. This means that instead of the nice U-shaped depression seen on Jupiter, it has a strange tilt like the one seen on the left.

This seems to indicate that what is in the way and blocking the starlight is not circular like the planets are.

It's been pretty quiet for a few years, though there have been a few more dips.

And in March 2011, we found out.

Starlight is reduced by 15 percent overall, which is far greater than the 1 percent reduction for planets.

We described this feature as smooth and clean.

It is also asymmetrical, fading gradually over almost a week and then returning to normal in just a few days.

And after this, not much happens until February 2013.

Things start to get really crazy.

The emerging light curve has a huge, complex dip that lasts almost 100 days until Kepler's mission ends.

The shapes of these dips vary.

Some are very sharp, others are wide, and vary in duration.

Some last only 1-2 days, others last more than a week.

Some of these dips also have uptrends and downtrends, as if several independent events were overlapping each other.

And at this point, the star will drop in brightness by more than 20 percent.

This means that the area of ​​what is blocking light is over 1,000 times the area of ​​the Earth.

This is really amazing.

And a citizen scientist who saw this notified the science team that he had discovered something strange enough that it might be worth tracking down.

So when the science team looked into it, we thought, 'Oh, maybe there's just something wrong with the data.

But we looked really, really, really hard and the data was good.

So what is happening must be astrophysical. That means something in space is getting in the way and blocking the starlight.

So at this point we started learning everything we could about this star to see if we could find any clues as to what was going on.

And the citizen scientists who helped us with this discovery joined us on the drive, observing first-hand science in action.

First, someone said, What if the star was so young that it still had clouds of material from its surroundings?

And another said what if the star had already formed planets and two of those planets collided, similar to the Earth-Moon formation event.

Well, both of these theories can explain some of the data, but the problem is that the star showed no signs of being young, and there was no luminescence from matter heated by starlight. This would be expected if the star was young or if a collision had occurred and produced a large amount of dust.

So another said, what about a huge swarm of comets passing near this star in highly elliptical orbits?

As it turns out, this is indeed consistent with our observations.

But I also agree, it feels a little unnatural.

Hundreds of comets are needed to reproduce what we are observing.

And these are just comets that happened to pass between us and the stars.

And really, we're talking about thousands to tens of thousands of comets.

But of all the bad ideas we came up with, this one was the best.

So we decided to publish the results of our investigation.

Now, let me tell you, this was one of the most difficult papers I've ever written.

Scientists are expected to publish their results, but this was far from the case.

So I decided to give it a catchy title and named it "Where's The Flux?"

Makes you think of abbreviations.

(Laughter) So the story doesn't end here.

Around the same time I was writing this paper, I met my colleague Jason Wright, who was also writing a paper on Kepler data.

And he said that with Kepler's extreme precision, we could actually detect alien megastructures around stars, but they didn't.

And when I showed him this strange data that a citizen scientist had discovered, he said to me, 'Horrible, Tubby.

Now I have to rewrite my thesis. ”

Yes, the natural explanation was weak and we were interested now.

Therefore, it was necessary to find a way to eliminate the aliens.

So together we convinced our colleagues working on SETI (Extraterrestrial Intelligence Exploration) that this was a tremendous goal to pursue.

We wrote a proposal to observe this star with the world's largest radio telescope at the Green Bank Observatory.

A few months later, news of this proposal leaked to the press, and now there are thousands, more than 10,000 articles on this star alone.

Do a Google image search and you'll find this.

Now you might be wondering, ok Tubby, so how do aliens actually explain this light curve?

Now imagine a civilization far more advanced than ours.

In this hypothetical situation, this civilization would exhaust its home planet's energy supply. So where can we get more energy?

They have a host star, just as we have a sun, so if they could capture more energy from this star, their energy needs would be solved.

So they went to build a huge structure.

These massive megastructures, like giant solar panels, are called Dyson spheres.

This image above is an impression of a Dyson sphere by many artists.

It's really hard to provide perspective on these vastnesses, but we can think of it this way.

The distance between Earth and Moon is 250,000 miles.

The simplest element in one of these structures is 100 times the size.

they are huge.

Now imagine one of these structures moving around a star.

You can see how the data introduces anomalies such as uneven, unnatural-looking dips.

However, even alien megastructures cannot defy the laws of physics.

As you know, anything that uses a lot of energy produces heat, but we don't observe this.

But it could be something as simple as just re-radiating in another direction, not the Earth.

Another one of my personal favorite ideas is that we've just witnessed interplanetary space battles and catastrophic destruction of planets.

Now, I admit that this creates more dust than we can see.

But if you're already citing aliens in this description, who's to say they didn't efficiently clean up all this mess for recycling purposes?

(Laughter) You can see how quickly this captures your imagination.

Yes it did.

We are in a situation that may be played out by natural phenomena we do not understand, or by alien technology we do not understand.

Personally, as a scientist, my money lies in the natural explanation.

But don't get me wrong, I think it would be great if we could find aliens.

Either way, there are new and really interesting discoveries.

So what happens next?

We need to keep watching this star to find out what's going on.

But professional astronomers like me have limited resources for this sort of thing, and Kepler is on a different mission.

And I'm glad that once again, citizen scientists have come together to save the day.

As you know, this time around amateur astronomers with telescopes in their backyards jumped into action and began observing the star nightly from their own facilities. I can't wait to see what they discover.

What's surprising to me is that this star was never discovered by a computer. Because we weren't looking for stars like this.

What's even more interesting is that more data will be available in the future.

A new mission is planned to observe millions more stars across the sky.

And think about it. What does it mean to find another star like this?

And what does that mean if no other star like this is found?

thank you.

(applause)

Imagine you received the following email from a friend: "You won't believe what just happened.

I'm so angry now ”

So you act like a friend, ask for details, and they tell you what happened at the gym, at work, or last night on a date.

You listen and try to understand why they are so angry.

Maybe you're secretly judging whether or not you should be so angry.

(Laughter) Maybe they can give me some suggestions.

Now, in that moment, you are essentially doing what I do every day to be an anger researcher. As an anger researcher, I spend a good part of my professional life – just kidding, my personal life as well – (laughter) studying why people get angry.

I have studied what thoughts they have when they are angry and what they do when it gets into fights, breaking things, and even yelling at people in all caps on the internet.

(Laughter) As you can imagine, when people hear that I'm an anger researcher, they want to talk to me about their anger and share their anger stories.

It's not because they need a therapist, it happens sometimes, but actually anger is universal.

It's something we all feel and can relate to.

When we didn't get what we wanted, we were like, 'What do you mean you don't pick up the rattle, Dad?

i want it! "

(Laughter) We feel it throughout our teenage years, as my mother certainly attests with me.

I'm sorry, mother.

We feel it to the end.

In fact, the worst moments of life are accompanied by anger. It's a natural and expected part of our grief.

But it is also in the best moments of our lives. Special occasions such as weddings and vacations are often marred by everyday frustrations such as bad weather or travel delays that make the moment feel terrifying but ultimately forgotten when things go well.

So I have a lot of conversations about anger with people. Through that conversation, I learned that a lot of people, and I'm sure a lot of people here right now, see anger as a problem.

You can see how it interferes with your life and how it damages your relationships, perhaps even in a horrible way.

It's all understandable, but I see anger a little differently. Today I want to tell you something important about your anger. That's it. Anger is a powerful and healthy force in your life.

It would be nice if you could feel it. you have to feel it.

But to understand all of this, we need to go back and talk about why we get angry in the first place.

A lot of it goes back to the work of an anger researcher named Dr. Jerry Deffenbacker, who wrote about this in 1996 in a chapter in his book on how to deal with problematic anger.

Most of us, and most of you, feel as simple as this. It means "getting angry when provoked". right? You hear it in the language people use.

They say things like, "It makes me angry when people drive so slowly."

Or, "I got mad because she forgot to give her milk again."

Or my favorite saying, "I don't have anger issues. People just need to stop making fun of me."

(Laughter.) Now, in the spirit of better understanding those types of provocations, I am asking many, including friends, colleagues, and even family members, "What really irritates you? What makes you angry?"

By the way, one of the perks of being an anger researcher is that I've spent over a decade compiling a comprehensive list of all the things that really annoy my colleagues. right?

just in case you need it.

(Laughter) But their answers are interesting, like, "when the sports team loses," "who chews too loud."

By the way, it's surprisingly common.

(Laughter) "Those who walk too slowly." That's mine.

And of course the roundabout. right? roundabout.

(Laughter) To be honest, there is no anger like roundabout anger.

(Laughter) Sometimes their answers are not trivial.

Sometimes we talk about big global issues facing us all, such as racism and sexism, bullying and environmental destruction.

But sometimes their answers are very specific, sometimes even strangely specific.

"Those wet lines on your shirt when you accidentally lean against a public restroom counter."

(laughs) Yeah, super gross, right?

Or "Flash drive - there are only 2 ways to connect, why do I always have to try 3 times?"

(Laughter) Whether it's minor or major, general or specific, you can look at these examples and draw out some common themes.

We get angry when situations make us feel uncomfortable, feel unfair, hinder our goals, could have been avoided, or make us feel helpless.

It's a recipe for anger, but you also know that anger is probably not the only thing we're feeling in situations like this, right?

Anger does not occur in isolation.

We can experience fear, sadness, and many other emotions at the same time.

But here comes the problem.

These provocations do not make us angry.

At least we know that if we weren't alone, we would all be offended by the same thing, but we wouldn't be offended.

There must be something else going on because the reason I am angry is not the reason you are angry.

is it something else?

Well, we know what we are doing and feeling in that moment of provocation matters.

This is called the pre-anger state. Are you hungry or tired?

Are you worried about something else, are you likely to be late for something?

The provocation feels even worse when you are feeling that way.

But what matters most is not the provocation, nor the pre-anger state, it is how we interpret the provocation and how we make sense of it in our lives.

When something happens to us, we first decide whether it is a good thing or a bad thing. Is it fair or unfair? Should it be blamed? Is it punishable?

That is the first evaluation, when you evaluate the event itself.

We decide what it means in the context of our life, and when it's done, we decide how bad it is.

This is the secondary evaluation.

We say, "Is this the worst thing that ever happened or can I handle this?"

To illustrate it, imagine you are driving somewhere.

Before I go any further, if I were an evil genius and wanted to create a situation that would make you angry, the situation would be a lot like driving a car.

(laughs) It's true. By definition, you're on your way somewhere, so everything that happens—traffic, other drivers, roadworks—feels like it's getting in the way of your goals.

Some traffic rules are written and some are unwritten, and while those rules are routinely violated in front of our eyes, they usually do not have serious consequences.

And who is violating those rules?

Anonymous strangers, people you'll never see again, are very easy targets for your anger.

(Laughter.) I mean, you're driving somewhere, and therefore you're driving in anger, and the person in front of you is driving well below the speed limit.

It's frustrating because I don't understand at all why they are driving so slowly.

right? That is the primary evaluation.

You saw this and said, "That's bad and deserves reproach."

But maybe you decide it's not a big deal.

It's okay if you're not in a hurry. This is the secondary evaluation.

Don't get angry.

But now imagine you're on your way to a job interview.

Nothing he does has changed. right?

Therefore, the primary rating remains unchanged. Still bad, still reprehensible.

But suddenly you will be late for the interview, so you certainly have the ability to deal with it.

All of a sudden, you can't get your dream job, the job that would have paid you so much money. don't you?

(Laughter) Someone else will get your dream job and you will go bankrupt.

I'll be poor

You might as well quit now, turn around, and move in with your parents.

(laughter) Why? Because of that person in front of me.

Scratch it. this is not a person. This is a monster.

(Laughter) And this monster is here to ruin your life.

(laughter) Well, that thought process is called catastrophic, and it's what makes things so bad.

This is one of the main types of thinking we know to be associated with chronic anger.

But there are also a few others.

False attribution of causality.

Angry people tend to place blame not only on people, but in fact on inanimate objects.

If that sounds silly, remember the last time you lost your car keys. "Where did the car keys go?" he said.

I know they escaped alone.

(Laughter) They tend to overgeneralize. They use the words "always," "never," and "always."

"This happens to me all the time." "You never get what you want."

Or, "I pushed all the lights on my way here today."

Demanding - They put their own needs ahead of those of others.

"I don't care why this person is driving so slowly.

They have to speed up or move in order for me to go to the interview. ”

And finally, the inflammatory labeling.

They call people idiots, idiots, monsters, or a bunch of other things I'm told not to say in this TED Talk.

(Laughter) For a long time, psychologists have called these cognitive distortions, or even irrational beliefs. True, they are irrational at times.

Probably in most cases too.

But in some cases, these thoughts are perfectly reasonable.

There is injustice in the world.

Some people are cruel and selfish, but it's not only okay to be angry when you're treated badly, it's right to be angry when you're treated badly.

If there's one thing I want you to remember from my talk today, it's this. Your anger exists within you as an emotion. That's because anger provided an evolutionary advantage to both human and non-human ancestors.

Anger warns of injustice just as fear warns of danger.

This is one of the ways your brain tells you that you've had enough.

In addition, it gives us the energy to confront that injustice.

Think for a moment about the last time you got angry.

My heart rate increased, my breathing rate increased, and I started sweating.

It's the sympathetic nervous system, or fight-or-flight system, and it works to provide the energy you need to respond.

And that's just what you noticed.

At the same time, it slows down your digestive system and helps you save energy.

That's why I was thirsty.

Blood vessels dilated to deliver blood to the extremities.

That's why your face turned red.

It's all part of the complex patterns of physiological experience that exist today. For they helped your ancestors deal with the cruel and unforgiving forces of nature.

The problem is that physical fighting, which your ancestors used to deal with anger, is no longer rational or appropriate.

You cannot and should not swing your club every time you are provoked.

(Laughter) But here's the good news.

You have the ability to control your emotions, something your non-human ancestors could not.

When you want to vent your anger, you can stop yourself and channel that anger into something more productive.

When we talk about anger, we often talk about how to avoid getting angry.

We tell people to keep calm and relax. We even tell people to let it go.

All of this assumes that anger is bad and that it is wrong to feel angry.

But instead, I like to think of anger as motivation.

Just as thirst makes us want to drink water, and hunger makes us want to eat, anger can be a motivation to respond to injustice.

Because you don't have to think too hard to find out what to be angry about.

Back to the beginning, yes, some of those things are stupid and not worth getting angry about, but racism, sexism, bullying, environmental destruction, they're real, they're terrible, and the only way to fix them is to get angry first and channel that anger back.

There is no need to fight back with aggression, hostility or violence.

There are endless ways to express anger.

You can protest. You can also write a letter to the editor. You can donate or volunteer for the cause.

You can also create art. You can also create literature. You can compose poetry or music.

We can create a community that cares for each other and prevents such atrocities from happening.

So the next time you feel angry, instead of trying to stop it, I want you to listen to what that anger is telling you and channel it into something positive and productive.

thank you.

(applause)

People returning to work after a career break. I call them "restarters".

These are people who have taken a career break to care for the elderly, for childcare reasons, or to pursue personal interests or personal health issues.

All types of career changers are closely related, including veterans, military spouses, retirees, or repatriating aliens.

Returning to work after a career break is difficult because of the chasm between employers and re-employers.

Employers may view hiring someone with a gap in their resume as a risky proposition, and those on a career break may question their ability to resume their careers, especially if they have been out of work for an extended period of time.

This disconnect is the problem I'm trying to solve.

Today, companies that have successfully rebooted are in every sector and everywhere.

I'm Sami Kafala.

He was a British nuclear physicist who had taken a five-year career break to return home with his five children.

The Singapore media recently wrote about a nurse returning to work after a long career break.

And speaking of long career breaks, it's Mimi Khan.

She is a social worker in Orange County, California, and has left her 25-year career to work for a social agency.

This is the longest career hiatus I've ever seen.

Supreme Court Justice Sandra Day O'Connor took a five-year leave of absence early in her career.

And here is Tracy Shapiro on a 13-year career hiatus.

Tracy responded to a call for essays by The Today Show from people trying to return to work but facing difficulties.

Tracy wrote that she was a mother of five who loved spending time at home, but was going through a divorce, needed to get back to work, and loved her job so much she really wanted it back in her life.

Tracy was doing what many of us do when we feel like we've had a good day on the job hunt.

She was looking for a finance or accounting position, but has spent the last nine months very diligently researching companies online and applying for jobs with no results.

I met Tracy in June of 2011 when she asked me if I could work with her on the Today Show to help turn things around for her.

The first thing I said to Tracy was that I had to move out of the house.

I told her she needed to go public with her job search and tell everyone she knew that she wanted to go back to work.

I also said to her, "You will have a lot of conversations that go nowhere.

Expect it and don't be discouraged by it.

Only a handful of people will end up with job opportunities. ”

I'll explain what happened to Tracy later, but I wanted to share with you what I discovered as I was trying to get back to work after an 11-year career hiatus as a full-time worker.

And that means that the way people see you is frozen in time.

The point is, when you start contacting people and contacting them again with people from the past, people you worked with or went to school with, they will remember you before you took a break from your career.

And that's even if, as many of us do, the further away we are from our professional identities, the less self-conscious we become over time.

For example, you might think of yourself as someone who:

This is me freaking out after driving around in a minivan all day.

Or here I am in the kitchen.

But people from the past know nothing of this.

They only remember you as you are. Getting back in touch with these people and hearing their enthusiasm for being interested in returning to work is a huge confidence booster.

There is one other thing I remember vividly about my own career hiatus.

It's just that I barely keep up with the business news.

My background is in the financial industry, but when I was at home caring for my four young children, I barely caught on to the news.

So I was afraid that I would go to the interview and start talking about a company that no longer existed.

So I had to resubscribe to The Wall Street Journal and read it cover to cover for six months until I felt like I could understand again what was going on in the world of business.

I believe re-entrepreneurs are gems of the workforce. Here's why.

Think about our life stages. Maternity leave will be reduced or eliminated for those who take time off from their careers to care for their children.

I've already done it.

Transfers of spouses and partners are rare.

We live in a time when life is more stable.

we have great work experience.

We have a more mature perspective.

We are not trying to be at the expense of our employers.

Plus, we've been away from work for a while, so we have the energy and enthusiasm to get back to work.

On the other hand, I have been talking to employers and there are two concerns employers have about hiring rehired workers.

First, employers are concerned that relaunchers are technically outdated.

I've been technically obsolete at some point myself, so all I can say is that it's a temporary state.

I was doing financial analysis a long time ago, so I used Lotus 1-2-3.

I don't know if anyone remembers that far, but I had to re-learn in Excel.

It wasn't that difficult actually. Many commands are the same.

I found PowerPoint much more difficult, but now I use PowerPoint all the time.

I tell re-entrepreneurs that employers expect them to come to the table with a working knowledge of basic office management software.

And if they aren't up to speed, it's up to them to get there.

And they do.

A second concern that employers have about returning workers is that they may not know what they want to do.

I tell people who have returned to work that they should try to figure out if their interests and skills have changed or not during their career hiatus.

That's not the employer's job.

It is the rebooter's responsibility to show employers where they can add the most value.

In 2010 I started noticing something.

I've been following return-to-work programs since 2008, and in 2010, I began to notice that paid short-term work opportunities were being used as a way for professionals to return to work, whether they were called internships or not, as an internship-like experience.

I saw Goldman Sachs and Sarah Lee launch corporate re-entry internship programs.

I have seen returning engineers, non-traditional re-entry candidates, apply to the military's entry-level internship program and then land a regular job.

I've seen two colleges incorporate internships into their mid-career education programs.

So I wrote a report on what I was seeing, which became the Harvard Business Review article "The 40-Year-Old Intern."

I also have to thank the editor for this title and for this artwork that shows a 40-year-old intern in the midst of college interns.

And, courtesy of Fox Business News, they've dubbed the concept "The 50-Year-Old Intern."

(Laughter) That's why five of the biggest financial services companies have outplacement internship programs to get you back into the financial profession.

And at this point, hundreds of people are on board.

These internships are paid and those who get regular jobs earn competitive salaries.

And now, seven major engineering firms are piloting outplacement internship programs for returning engineers as part of an effort with the Society of Women Engineers.

So why are companies actively incorporating reentry internships?

Because internships allow employers to make hiring decisions based on a sample of actual work rather than a series of interviews, employers don't have to make that permanent hiring decision until the end of the internship period.

This testing period removes the risks some managers perceive in hiring returnees, attracting top candidates and turning them into top recruits.

Consider how far we've come.

Until now, most employers have had no interest in engaging with re-entrepreneurs.

But now, not only are programs developed specifically with rebooters in mind, but you can't even apply to these programs if you don't have a blank on your resume.

This is a sign of real change, real institutional change. If we can solve this problem for re-employed people, we can solve it for other career transitioners as well.

In fact, one employer told me that their veterans' return-to-work program is based on their re-entry internship program.

And there's no reason a retiree internship program can't exist.

Different pools, same concept.

Now let's talk about what happened to Tracy Shapiro.

Remember, she had to tell everyone she knew that she wanted to go back to work.

Well, an important conversation with another parent in the community led to Tracy's job offer. It was an accounting job in the finance department.

But it was a temporary job.

The company told her it could be more, but there was no guarantee.

It was the fall of 2011.

Tracy loved the company and the people, and the office was less than 10 minutes from her home.

So, even though she had a second job offer as a full-time employee at another company, she decided to take the chance and hope for the best in this internship.

Well, she finally blew all their expectations. And the company not only gave her a permanent offer in early 2012, but they knew what Tracy could handle, which made it all the more interesting and challenging.

Fast forward to 2015 and Tracy got a promotion.

They paid her to do her MBA at night.

She even hired another fresh starter to work for her.

Tracy's temporary job was more of an internship-like tryout, but it ended up being a win-win for both Tracy and her employer.

My goal now is to spread the Reentry Internship concept to more employers.

But in the meantime, if you're returning to work after a career break, don't hesitate to offer an internship or internship-like arrangement to employers who don't have formal outplacement internship programs.

Be their first success and you can set an example for more restarters in the future.

thank you.

(applause)

One of the problems with writing, working, and browsing the internet is that it's very difficult to separate fashion from deep change.

So, to help with that, let me go back to 1835.

In 1835, James Gordon Bennett founded New York City's first mass-print newspaper.

The starting cost is about $500, equivalent to $10,000 today.

Fifteen years later, by 1850, it would have cost $2.5 million to do the same thing—begin what we experienced as a high-volume daily.

10,000, 2.5 million, 15 years.

That is the major change that is being reversed by the internet.

That is what I want to talk about today and how it relates to the emergence of social production.

Starting with newspapers, what we have seen is the high cost as an initial requirement to create information, knowledge and culture, which has led to a clear dichotomy between producers who, like any other industrial organization, must be able to raise financial capital, and passive consumers who can choose from the particular set that this industrial model can produce.

The terms "information society" and "information economy" have long been used as something that will come after the industrial revolution. But really, for the purpose of understanding what's going on today, it's wrong. Because we have enjoyed the information economy for 150 years.

It was just industrial. So the people producing it had to have the means to raise the money to pay that $2.5 million. Then more money was paid for telegraphs, radio transmitters, televisions, and eventually mainframes.

And that meant they were either market-based or government-owned, depending on what system they belonged to. And it characterized and anchored the way information and knowledge were produced for the next 150 years.

Okay, let's talk about something else. Around June 2002, a shocking event occurred in the world of supercomputers.

The Japanese were the first to develop the fastest supercomputer, the NEC Earth Simulator, inherited from the United States, and about two years later, by the way, this measures the number of floating-point operations a computer can perform - with a sigh of relief: IBM [Blue Gene] slightly surpassed the NEC Earth Simulator.

All of this completely ignores the fact that another supercomputer (SETI@home) is running around the world during this period.

4.5 million users around the world provide their remaining computer cycles by running a screen saver whenever their computers are not working, sharing resources to build the giant supercomputer that NASA uses to analyze data from its radio telescopes.

What this situation suggests to us is that the way information production and exchange is capitalized is fundamentally changing. It's not that it's less capital-intensive, it's not that less money is needed, it's that ownership of this capital, the way in which it's capitalized, has been fundamentally decentralized. In these developed countries, each of us has one of these computers, or something similar.

They are fundamentally no different than routers in the middle of the network.

And computing, storage, and communication power, in the hands of nearly everyone connected, are the basic physical capital instruments needed to generate information, knowledge, and culture in the hands of the 600 million to 1 billion people on the planet.

This means that for the first time since the Industrial Revolution, the most important instrument, the most important component of the core economic activity of the advanced economies, and more than anywhere else, is in the hands of the entire nation. This is very different from what we have seen since the industrial revolution. So we have the ability to communicate and calculate in the hands of the entire population, human creativity, human wisdom, human experience, another major experience, another major input, which is different from simple labour, standing here and turning this lever all day long, which is neither the same nor replaceable among people.

A person who has taken on someone else's work, or who has attempted to delegate his work to others, cannot communicate what he knows or what he instincts in a particular situation, even with the most detailed manuals.

We are unique in that respect and each of us has a significant input into production when we get our hands on this machine.

What is the effect of this? So most people are talking about free or open source software.

This is the market share of the Apache web server, one of the key applications in web-based communications.

In 1995, two groups of people said, "Wow, this is really important, Web! We need a better Web server!"

One is a motley group of volunteers who have decided that this is really necessary, let's write this, what to do, and share it. and allow others to develop it.

Another was Microsoft.

Now, 10 years later, it would be amazing to tell you that 20 percent of the market has been red-lined by motley people who have no control over what they produce. right?

Think of it in a minivan. A group of weekend auto engineers are competing with Toyota. right?

But the reality is, of course, that 70 percent of the critical applications that run web-based communications and applications, including major e-commerce sites, are written in this format, competing directly with Microsoft. It's not a side issue, it's the core strategic decision to acquire the building blocks of the net.

Software has achieved this in a very visible way because it is measurable. But what's interesting is that this is actually happening all over the web.

So at some point NASA conducted an experiment in which they took images of Mars and mapped them. And instead of having three or four well-trained PhDs doing this all the time, they said let's break it down into small components, publish it to the web, and use a very simple interface to see if people actually spend 5 minutes here and 10 minutes there clicking. Six months later, 85,000 people have used it to generate mappings faster than images can be input. According to the citation, after showing it to multiple people and calculating the average, it was "almost indistinguishable from the mark of a well-trained Ph.D."

Now, if you have a little girl and she goes to write a letter to find out about Barbie, well, it's not that small.

And she comes to Encarta, one of the leading online encyclopedias.

Now you can know about Barbie. Only this. "Manufacturer" (plural) is nothing more than the definition that "now it is more common to manufacture ethnically diverse dolls like this black Barbie doll." This is so much better than the Barbie dolls you find in encyclopedias, Klaus. (Laughter) On the other hand, if you go to Wikipedia, you'll find the real article. It doesn't say much about Wikipedia, since Jimmy Wales is here, but you'll find articles written in a different way, roughly equivalent to what you'll find on Britannica, including controversies over body image and commercialization, and claims about how she's a good role model.

Another part is not just how content is created, but how relevance is created.

Yahoo!'s claim to fame is that we hire people to watch. Originally they didn't, but they hired people to take a look at the website and tell them that as long as it's in the index, it's fine. On the other hand, it's the result of 60,000 dedicated volunteers in the Open Directory project, each spending an hour or two doing something they really care about, saying, "This is good." So, it's an Open Directory project, with 60,000 volunteers, each giving a little bit of their time as opposed to hundreds of fully paid employees. Nobody owns it, nobody owns the output. It is free for anyone to use and is the output of people acting according to their social and psychological motives to do something interesting.

This is not just outside the enterprise. If you think about what Google's key innovation is, that key innovation is to outsource one of the most important things: decisions about what's relevant to the entire web community, and let them do whatever they want. In other words, page rank.

The key innovation here is that instead of engineers and employees telling you which ones are the most relevant, people on the web count the things that create links and interconnect for whatever reason, be it vanity or joy. I will count them.

And here, too, you'll see Barbie.com, but soon you'll also see Adiosbarbie.com, body images for each size. A contested cultural object, not readily found anywhere in Overture. Overture is a classic market-based mechanic, with the person who paid the most money at the top of the list.

So it's all about creating content, relevance and basic human expression.

But remember that computers are physical too. We only share the physical material, the PC. This is also seen wirelessly.

Previously, radios were licensed and transmitted by one person within an area, but a decision had to be made whether to obtain a license or to do so based on property.

What we are seeing now is that computers and radios have become so sophisticated that people own machines such as Wi-Fi devices and develop algorithms to overlay shared protocols onto them. This will enable such communities to build their own wireless broadband networks from simple principles. So when I'm listening, when I'm not using it, I can help forward messages. Help move your stuff when you're not using it.

And this is not the idealized version. These are working models that have been put in place, at least in some places in the United States, at least for public safety.

If in 1999 I had said let's build a data storage and retrieval system.

I need to store terabytes. Must be available 24 hours a day, 7 days a week. It should be available from anywhere in the world.

We need to support over 100 million users at any given time. It must be robust against attacks such as closing the main index, inserting malicious files, and armed seizure of some key nodes. I would say it takes years.

It will cost millions. But of course, what I'm talking about is P2P file sharing.

right? We always think of this as stealing music, but it's basically a distributed data storage and retrieval system where people are willing to share their bandwidth and storage to create something for very obvious reasons.

So essentially what we're seeing is the emergence of a fourth transaction framework. It was once thought that there were two main dimensions by which things could be divided. It can be market-based or non-market-based. It can be decentralized or centralized.

The pricing system was a market-based decentralized system.

If only there was someone actually organizing, or companies if they wanted to participate in the market, or government and possibly larger non-profit organizations that were non-market, and things worked better.

It has been too expensive to decentralize social production and to decentralize activities in society. It wasn't about society itself.

In fact it was economical.

But what we are seeing now is the emergence of this fourth social sharing and exchange system.

This is not the first time that as social beings we do good to each other or for each other. we always do.

This is the first time it has had a major impact on the economy.

Their characteristic is the decentralization of authority.

There is no need to ask for permission like in property-based systems.

can i do this? Properties are one of the coordinating mechanisms, so anyone can create, innovate, and share on their own or with others as they see fit.

But that's not all.

Instead, what we see is a social framework for all the important things we use and contract property on the market. It is the flow of information to decide what is the interesting problem. A person who is free and suitable for something. The Structure of Motivation -- Remember that money isn't always the best motivation.

Leaving a $50 check after dinner with a friend doesn't increase your chances of being invited again.

If you're not sure about dinner, think about sex. (Laughter) It also requires a certain new organizational approach.

In particular, we have seen task organization.

You have to hire people who know what they are doing.

I have to hire them to spend a lot of time.

Now, splitting the same problem into smaller modules makes the motivation trivial.

Five minutes instead of watching TV?

Spend five minutes just because it's funny. Because it's just fun.

Either because it gives me a sense of meaning, or because it gives me a certain social relationship in a more complicated place like Wikipedia.

A new social phenomenon is emerging.

It's creative, and it's most visible when viewed as a new form of competition.

A peer-to-peer network attacking the recording industry. Free and open source software steals market share from Microsoft. Skype can threaten traditional communications. Wikipedia competing with online encyclopedias.

But it is also a source of new opportunities for businesses.

As new social relationships and behaviors emerge, new opportunities arise. Some of them are tool makers.

Instead of building well-behaved appliances (that you know in advance what they're going to do), start building more open tools. There are new values, new values ​​that people value.

Build a platform for self-expression and collaboration.

Like Wikipedia and the Open Directory project, you're starting to build a platform and take it as a model.

And then there are the surfers, the people who have seen this happening and in a way built it into the supply chain, which is very interesting. right?

You have a belief that things flow from the people you connect with.

If I do that, I'll get something I can use, so I'm going to sign a contract with someone.

We bring you something based on what happened. That's pretty scary. Essentially, that's what Google does.

IBM does this with software services, and it works pretty well.

In other words, social production is a fact, not a fad.

This is a significant long-term change caused by the Internet.

Social relationships and interactions have never been more important as economic phenomena. In some situations, the quality of information, the ability to find the best talent, and the reduction in transaction costs make them even more efficient. Sustainable and fast growing.

But this is the dark lining, threatened by the existing industrial system as much as it is threatened.

So next time you open a paper and see a decision about intellectual property or a decision about communications, it's not about small technical stuff.

It is about the future of freedom to exist with each other as social beings and how information, knowledge and culture are produced.

Because in this context we see a battle over how easy or how hard it will be for the industrial information economy to simply go on, or new models of production will begin to develop along its lines, changing the way we see the world and start reporting what we see.

thank you.

There are two reasons why companies fail. It's either just repeating the same thing or just doing new things.

For me, the real solution to quality growth is finding a balance between two activities: exploration and exploitation.

Both are necessary, but can be too much of a good thing.

Please consider.

In fact, I'm old enough to remember them.

Facit has been a great company.

They were born deep in the forests of Sweden and built the world's best mechanical calculators.

everyone used it.

What did Facit do when the electronic calculator came along?

They kept doing exactly the same thing.

In 6 months, we got the maximum return.

And they are gone.

Had disappeared.

For me, the irony of Facit's story is that I heard that Facit's engineers bought cheap, small electronic calculators in Japan and used them to recheck their calculators.

(Laughter) Fasit exploited too much.

But exploration can get wild, too.

A few years ago I worked closely with a European biotech company.

Let's call them oncosearch.

The company was great.

They had applications that promised to diagnose and even treat certain forms of blood cancer.

Every day was about creating something new.

They were very innovative and their mantra was 'only if done right' and even 'seek perfection'.

Sadly, they became obsolete before they were perfect, before they were good enough.

OncoSearch searched too much.

I first heard about exploration and exploitation about 15 years ago while working as a visiting fellow at Stanford University.

The originator of this idea is Jim March.

And to me, the power of this idea is its practicality.

expedition.

Exploration is about discovering new things.

It's searching, discovering, new products and new innovations.

It's about changing our frontiers.

Our heroes are Madame Curie, Picasso, Neil Armstrong, Sir Edmund Hillary and others who made the expedition.

i am from norway. All our heroes are and deserve to be explorers.

We all know that exploration can be dangerous.

We don't know the answer, and we don't know if we will find it. And we know the risks are high.

Exploitation is the opposite.

Exploitation is about using the knowledge we have to create something better.

Exploitation is keeping trains running on time.

It's about making better products faster and cheaper.

Exploitation is not dangerous in the short term.

But just exploiting it can be very dangerous in the long run.

And I think we all have memories of famous pop groups singing the same song over and over until it becomes obsolete or pathetic.

That's the risk of exploitation.

Therefore, consider it from a long-term perspective.

In the short term, it is exploitative.

Little kids explore all day long.

I spend all day exploring.

As we get older, we explore less because we have more knowledge available to us.

The same is true for companies.

Companies are inherently less innovative as they become more capable.

And, of course, this is a big concern for CEOs.

And I often hear questions asked in various ways.

For example, "How can I run my company effectively and reinvent it?"

Or, "How can we ensure change before the company becomes obsolete or in crisis?"

So it's hard to do one well.

Doing both well at the same time is an art and encourages both exploration and exploitation.

So, one of the things we've found is that only about 2% of companies can effectively research and leverage at the same time.

But when it does, the payoff is huge.

So there are many great examples.

Examples include Nestle developing Nespresso, Lego getting into animated movies, Toyota developing hybrid cars, Unilever pushing sustainability, and the benefits are enormous.

Why is it so hard to balance?

I find it difficult because there are so many traps to keep us here.

I'll tell you about two, but there are many.

Now let's talk about the perpetual search trap.

We discover something but don't have the patience or tenacity to make it happen.

So create something new instead of keeping it.

But it's the same, and even if you actually put out an idea, you'll fall into a vicious circle of frustration.

OncoSearch was a good example.

A famous example is, of course, Xerox.

But this is not just seen in enterprises.

The same is true in the public sector.

We all know that any effective reform of education, research, health care or even defense takes 10, 15 or even 20 years.

But still, we change much more often.

We really don't give them a chance.

Another trap is the success trap.

Facit fell into the trap of success.

They literally had the future in their hands, but they couldn't see it.

They were simply so good at making what they love that it didn't change.

So are we.

When you know something well, it's hard to change it.

Bill Gates said, "Success is a terrible teacher.

It makes us believe that we cannot fail. ”

That is the challenge with success.

So there are some lessons that I think apply to us as well.

And they also apply to our company.

The first lesson is to stay ahead of the crisis.

And companies that can innovate can actually buy insurance in the future.

Netflix -- They could easily have been satisfied with the delivery of previous generations, but they have always, and I think will always, continue to move forward into the next battle.

I see other companies saying, "We will win the next innovation cycle by any means."

Second: Think on multiple timescales.

I think it's a great chart, so I'm sharing it.

If you look at any company, and look at the company's valuation from a one-year perspective, the percentage of innovation is usually only about 30%.

In other words, given the year, innovation is less important.

Now let's look at the same company ten years into the future. All of a sudden, innovation and ability to update is 70%.

But companies have no choice.

They need to fund the journey and lead for the long term.

Third, invite talent.

I don't think any of us can balance exploration and exploitation on our own.

I think it's a team sport.

I think you should allow the challenge.

I think the hallmark of a great company is being open to challenges, and the hallmark of a good corporate board is constructively challenging.

I think that's good parenting.

The last one is to be skeptical of success.

Perhaps it might be helpful to recall the triumphal processions of old, when generals celebrated their great victories in Rome.

When they rode into Rome in carriages, they always had companions whispering in their ears, "Remember, you are only a human being."

I hope that you can see that striking a balance between exploration and exploitation can yield great benefits.

But it's hard, so you have to be conscious.

I just want to point out two questions that I think are useful.

The first question is looking at your own company. In what areas do you think your company is at risk of falling into the trap of success—on autopilot?

And what can you do to challenge yourself?

The second question is when was the last time I explored something new and how did it affect me?

Is it something I should do more of?

In my case it is.

Well then, let me conclude with this.

Whether you're an explorer by nature or tend to use what you already know, remember that beauty lies in balance.

thank you.

(applause)

Therefore, there is very little human-friendly land on Earth, but we survive.

When our primitive ancestors found their homes and livelihoods in danger, they ventured into unfamiliar lands in search of better opportunities.

And as descendants of these explorers, we have their nomadic blood in our own veins.

But at the same time, distracted by bread and circuses, caught up in the wars we wage against each other, we seem to have forgotten this desire to explore.

As a species, we have evolved uniquely for, on and by the Earth, so complacent and too busy to realize that our resources are finite and the life of the Sun is finite that we are content with our living conditions.

While Mars and every movie named after it has reinvigorated the ethos of space travel, few seem to truly understand that our species' fragile constitution is horribly unprepared for long journeys into space.

For a quick reality check, trek into the local national forest.

So just raise your hand here. How many of you think you can survive a few days in this lush wilderness?

Well, that's a lot of you.

A few weeks?

That's a good amount.

What about in a few months?

That's pretty good too.

Now imagine that this local national forest experiences an eternal winter.

Same question: How many of you do you think can survive for a few days?

That's quite a lot.

A few weeks?

So, for an interesting twist, let's imagine that the only source of water available is trapped as a frozen block several miles below the surface.

There is very little vegetation, and of course very little atmosphere, as the soil has very little nutrients.

Examples like this are just a few of the many challenges we will face on a planet like Mars.

So how do you prepare for a voyage whose destination is far from your tropical vacation?

Will we continuously transport goods from Earth?

Build a space elevator? Or will you build an impossibly miles-long transport belt that connects your planet of choice with our home planet?

And how do we grow things like food that grew on Earth as we do?

But I'm ahead.

In the journey of mankind to find a new home under a new sun, we will probably spend many generations on the journey itself, in space, on ships, on sealed flying cans.

The longest continuous time humans have spent in space is about 12-14 months.

Astronauts' experiences in space show that living in microgravity means bone loss, muscle wasting, cardiovascular disease, and many other complications ranging from physiological to psychological.

And what about massive gravitational forces and other variations in the gravitational pull of our planet Earth?

This means that our space travel will come with known and unknown dangers.

So far, we've been looking at this new mechanical technology and the next generation of great robots as part of our line-up to ensure the safe movement of mankind in space.

As wonderful as they are, I believe the time has come to complement these gigantic electronics with what nature has already invented: microbes, self-generating, self-replenishing, living machines: single-celled organisms.

It requires little maintenance, is highly flexible in design, and can be transported in a single plastic tube.

The field of research that has made it possible to harness the power of microorganisms is known as synthetic biology.

It has its roots in molecular biology and has provided antibiotics, vaccines, and better ways to observe the physiological nuances of the human body.

The tools of synthetic biology have made it possible to edit the genes of nearly any organism, microscopic or otherwise, with amazing speed and fidelity.

Given the limitations of our artificial machines, synthetic biology will provide us with a means of manipulating not only food, fuel, and the environment, but also ourselves to compensate for our physical imperfections and ensure our survival in space.

To give an example of how synthetic biology can be used for space exploration, let's return to the Mars environment.

The soil composition on Mars is similar to Hawaiian volcanic ash, with trace amounts of organic matter.

What if Martian soil could actually support plant growth without the use of earth-based nutrients?

Perhaps the first question to consider is how to make the plant hardy.

Because the average temperature on Mars is a very uncomfortable minus 60 degrees Celsius.

The next question we should ask is how do we make plants more drought tolerant?

Given that most of the water that forms as frost evaporates faster than the word "evaporates", the word "evaporates" cannot be said.

Well, it turns out we've already done something like this.

By borrowing antifreeze protein genes from fish and drought tolerance genes from other plants such as rice and sewing them into plants in need, we have created plants that can tolerate most droughts and freezes.

They are known on Earth as GMOs, or genetically modified organisms, and we rely on them to feed every mouth of human civilization.

Nature has already done this without our help.

We just found a more precise way to do it.

So why would you want to change the genetic makeup of plants for space?

Failure to do so would mean that we would have to develop infinite acres of land on an entirely new planet by releasing trillions of gallons of atmospheric gas and building giant glass domes to contain it all.

This is an unrealistic engineering undertaking that quickly turns into a high cost cargo transport mission.

One of the best ways to ensure that we have the food and air we need is to introduce organisms designed to adapt to new and harsh environments.

Essentially, it is the use of artificial life to assist in planetary terraforming in the short and long term.

These organisms can also be genetically engineered to make medicines and fuels.

So, synthetic biology can be used to bring in highly engineered plants, but what else can we do?

Earlier we said that as a species we evolved uniquely for Earth.

That fact hasn't changed much in the five minutes you've been sitting here and I've been standing there.

So if any of us were jettisoned to Mars right now, even given enough food, water, air and a suit, we could experience some very unpleasant health problems from the massive amount of ionizing radiation that rains down on the surface of a planet with little or no atmosphere like Mars.

Unless we intend to remain underground for the entire duration of our stay on a new planet, we must find better ways to protect ourselves without wearing armor that weighs as much as us or hiding behind lead walls.

So let's look to nature for inspiration.

Among the myriad life forms on Earth, there is a subset of organisms known as extremophiles, or organisms that prefer extreme living conditions, as you probably remember from high school biology.

And among these microbes, there is also a bacterium named Deinococcus radiodurans.

It is known to be able to withstand cold, dehydration, vacuum, acid and most notably radiation.

Although its radiation resistance mechanism is known, the relevant genes have not yet been adapted to mammals.

It's not particularly easy to do so.

Radiation tolerance has many facets and it is not as simple as introducing one gene.

But given a little human ingenuity and a little time, I don't think it would be too difficult to do so either.

Even if it borrowed a fraction of its ability to withstand radiation, it would be far superior to what we already have: the melanin in our skin.

Synthetic biology tools can exploit the ability of Deinococcus radiodurans to grow even under extremely lethal doses of radiation.

It's hard to see, but Homo sapiens, or humans, are evolving day by day and are still evolving.

Thousands of years of human evolution have not only given us humans like the Tibetans, who can thrive in low-oxygen environments, but also Argentines, who can ingest and metabolize arsenic, a chemical element that can kill the average human.

The human body evolves every day by chance mutations, which likewise happen to allow certain humans to endure dire situations.

But, and this is a big deal, such evolution requires two things that we don't always have or can afford. It's death and time.

As our species struggles to find its place in space, we do not always have the time necessary for the natural evolution of additional capabilities to survive on planets other than Earth.

We live in E.O. Wilson dubbed the "age of gene avoidance" the treatment of genetic defects such as cystic fibrosis and muscular dystrophy with temporary external supplements.

However, with each passing day, we are approaching an age of volitional evolution, when we, as a species, will have the capacity to determine our own genetic destiny.

Augmenting the human body with new abilities is no longer a question of how, but of when.

Using synthetic biology to alter the genetic makeup of any organism, especially ours, is not without moral and ethical issues.

Does engineering ourselves make us less human?

But then again, what is the non-star humanity that happens to be conscious?

Where should human genius go?

Certainly, it's a little wasteful to just sit and watch.

How do we use knowledge to protect ourselves from external dangers and even protect ourselves?

I ask these questions not to provoke fear about science, but to reveal the many possibilities it has given us and continues to give us.

We need to come together as human beings to discuss and embrace solutions not only cautiously but courageously.

Mars is a destination, but it is not our final destination.

Our true final frontier is the red line that must be crossed in determining how the improbable intelligence of our species can be harnessed and what decisions must be made.

The universe is cold, cruel, and unforgiving.

Our road to the stars will be full of challenges that will make us question not only who we are, but where we are going.

The answer lies in the choice we make to use or abandon the technology we glean from life itself, which will define us for the rest of our tenure in this universe.

thank you.

(applause)

Well, I confess. I have always been strangely obsessed with advertising.

I remember watching cartoons on Saturday mornings, focusing more on commercials than shows, trying to understand how they were trying to get into my head.

Ultimately, it led to my dream job.

I became a partner of a large advertising agency in New York.

But that all changed abruptly on February 23, 1997, when my brother Matt was shot in the head during a shooting on the observation deck of the Empire State Building.

Suddenly, my family was thrown into the middle of a nightmare, told that my brother was going to die, given a chance to actually say goodbye to him, then had several emergency brain surgeries, and now, for Matt, it's been a lifetime spent recovering bravely from a traumatic brain injury.

He is definitely my hero.

But as much as that (applause) -- yes, it deserves it -- (applause) But while this tragedy was a nightmare for my family, I often think about how bad it was. In fact, how sad every day for the 90 families who are not so lucky and who lose loved ones - brothers, sisters, sons, daughters, parents.

Not all of them make national headlines.

In fact most of them don't.

They get little attention in a country that has come to accept shameful pandemics as some kind of new normal.

So I quit my job in advertising to do something about this shameful nationwide epidemic. Because I realized that the challenge of preventing gun violence is actually the same one that made me love advertising. It's about trying to find ways to attract people.

I'm not doing it to sell a product, I'm just doing it to save lives.

And it ends up finding common ground where what I want overlaps with what you want.

And you might be surprised to learn how much we have in common when it comes to gun violence.

Take, for example, those who love hunting, a sport enjoyed by millions across the United States.

It's a proud tradition. family.

In some areas, the first day of hunting season is actually a school holiday.

what does the hunter want?

Yes, they want to hunt. they love guns

They believe deeply in their Second Amendment right to own a gun.

But that doesn't mean they have nothing in common.

In fact, it's a lot, starting with the basic idea of ​​keeping guns out of dangerous hands.

This is not about taking certain guns out of everyone.

It's about keeping all guns away from certain people, and at the end of the day, it's people like convicted violent criminals, domestic abusers, and dangerous mentally ill people who all agree they shouldn't have guns.

Everyone can see how incredibly effective Brady's background check was in keeping the gun out of dangerous hands.

Brady's background checks at federally licensed gun dealers have blocked 2.4 million gun sales in 20 years to people who all agree they shouldn't own a gun.

(Applause.) And whether you love guns or hate them, you also know that thousands of guns shouldn't be sold every day at gun shows and online without Brady's background checks. Just like you shouldn't split into two lines to board an airplane. One is guarded and the other is unguarded.

And -- (applause) And the numbers show the overwhelming agreement of the American public. Ninety percent of Americans support extending Brady's background checks to all gun sales. This includes 90 percent of Republicans, over 80 percent of gun owners, and over 70 percent of NRA members.

This is not a controversial idea.

In fact, only 6 percent of Americans are against it.

That's about the same percentage of Americans who believe the moon landing is fake.

(Laughter) And it has to do with the percentage of people who believe that governments are embedding mind control technology into their television broadcast signals.

That's the extent to which we agree on background checks.

But what about the 300 million guns already in homes across America?

First of all, it's important to realize that most of these guns are in the hands of decent, law-abiding people like you and me who want what we all want, including keeping our families safe.

In fact, that's why more and more people are choosing to own guns.

A decade ago, 42 percent of Americans believed—wrongly—that guns would make their homes safer.

Today that percentage is 63%.

why?

I hate to say it too much, but it's all about the dark underside of advertising, where you tell big lies over and over again, and eventually those lies become the truth.

And that's exactly what happened here.

Corporate gun control advocates have spent billions of dollars blocking CDC research into the prevalence of public health gun violence. Prevent pediatricians from talking to parents about the dangers of guns in the home. Block smart gun technology and other life-saving technologies that prevent children from firing their parents' guns.

They are desperate to hide the truth because they see it as a threat to their bottom line.

And every day people die as a result.

And many of those people are children.

Nine children are unintentionally shot dead every day in the United States.

900 children and teens take their own lives each year.

And the thing is, they pretty much all have their parent's guns.

Even two-thirds of all school shootings, including the horrific tragedy in Sandy Hook, happen with guns taken from home.

I have met many of these parents. It's the most heartbreaking part of my job.

These people are not bad people.

They just live with the unimaginable consequences of very bad decisions made on the basis of very bad information implanted in their minds by very bad people who are well aware of the misery they are causing but who do not care.

And the result is a nightmare. Not just for families like mine, but for all of us, after all.

But I'm not here to talk about gun violence nightmares.

I am here to talk about our dream, and it is the dream we all share, the dream of a better, safer future.

For my organization, The Brady Campaign, that dream is reflected in the ambitious goal of halving US gun deaths by 2025.

And I want all of you here tonight to feel strongly why that dream is absolutely within reach.

Because with every big move in the world, there's a moment where you can look back and say, "That's when things really started to change."

And I'm here to say that the moment is here for the movement to end gun violence in America.

(Applause.) Clearly, we are at a tipping point. Because, like never before, millions of Americans are uniting on that common ground to say, "Enough is enough."

No more shopping malls, movie theaters, churches, school shootings.

The daily terror of gun violence in homes and on the streets claims the lives of an alarming number of women and young black men.

It's enough that guns were easily obtained by people who all agree they shouldn't have them.

And enough is enough of the small group of deranged politicians who put the interests of the corporate gun lobby above those they were elected to represent.

very.

(Applause.) And what's really interesting is that it's no longer just the usual suspects like me saying that.

Much bigger than that.

If you want proof, let's start with where most of the conversation in the US seems to start with Kim Kardashian.

(Laughter) The point here is that this is not a joke.

In other words, think about when the problem changes.

That's when they move from political and advocacy issues to being part of pop culture, voices from everywhere, celebrities, musicians and athletes who take to the platform.

The NBA came forward.

Conservative commentators you never imagined came forward.

A real cultural shift is taking place. I heard there will be a TED talk about it this year as well.

That is the extent to which this cultural shift is happening.

And yes, Kim Kardashian has vehemently urged her 35 million Twitter followers to expand background checks.

Let's take a look at the raging political elections.

This used to be the quintessential third rail problem for Democrats.

I couldn't get away from it fast enough.

Candidates are now running on that basis.

Some are being reversed from very bad positions that until very recently they had held comfortably.

For someone like me, seeing people waving at a negative NRA rating is almost unreal.

Indeed, we are still overfunded by corporate gun control bodies, and ultimately that needs to change.

But do you know?

We are smarter, we are rougher, we have the truth on our side.

And we are under attack.

The Internet is said to democratize information.

Social media and some of the organizing tools connected to it have democratized activity.

This allowed us to show what 90% endorsements really look like.

Sometimes I remember that we are like white blood cells, in the millions, concentrating and attacking instantly.

This allowed us to really begin to dissolve the ignominious disconnect between what the American people want and what our elected leaders are doing to it. This is the bottom line.

Until recently, there was talk in Congress that the number of calls from the other side, or 6 percent of them, outnumbered calls from this side by 10 to 1.

We turn that narrative upside down.

After the recent horrific tragedy in San Bernardino, we sabotaged the congressional switchboard.

We made 15,000 calls to Congress in 24 hours.

And what do you know?

We voted yes on a bill that no one thought would see the light of day any time soon.

We are witnessing a serious move to repeal some of the most evil and ugly gun lobby laws passed in this dark decade.

The stranglehold on the gun control lobby is clearly being broken.

We have seen President Obama's historic executive action.

It won't be perfect, but it will save lives as it expands Brady's background checks to thousands of gun sales that have never been done before.

And we are marching across the country. We are not just waiting for Congress to act. That would almost be the definition of insanity.

We are marching across the country state by state in the style of marriage equality.

And what do you know? we are winning

Most of the time Congress is the last to wake up and find themselves on the wrong side of history.

And when they do, it's always because the American public rocks them.

And that is exactly what we are doing now at this tipping point.

You know, I was on a plane recently across the country to give a speech in front of such a large group, and while it wasn't overly intimidating, the woman sitting next to me happened to be devouring one of my favorite TV shows, the period drama about 1960s advertising, Mad Men.

And as I was trying to figure out how to end my remarks, I looked up at her screen from time to time, and every time I saw someone smoking in the office, around the kids, smoking while pregnant, driving drunk or without a seatbelt, or sexually harassing a colleague.

And finally, I realized what an inspiration it would be for those of us who dream of ending gun violence.

I mean, think how much the world has changed in a relatively short time, and how all the behaviors that were once considered commonplace or normal, even if they were glamorous and sexy, became stigmatized after becoming, in just a generation or two, conversations about what we have in common.

That's the magnitude of the change we can make on gun violence.

That's my dream. One day, period drama TV shows will portray terrifying nightmares of gun violence, and future generations of children may only be able to imagine how terrifying it must have been.

thank you.

(Applause.) Thank you.

(Applause.) Thank you.

(applause)

As of 2018, there are approximately 2.5 billion smartphone users in the world.

If we were to crack open all the modern mobile phones, which are only a fraction of all products ever made, and break them down into their component parts, we would produce about 85,000 kilograms of gold, 875,000 kilograms of silver and 40 million kilograms of copper.

How did this precious cache get into our phones and can we get it back?

Gold, silver, and copper are actually just a few of the 70 or so chemical elements that make up the average smartphone.

These can be classified into different groups, but two of the most important are rare earth elements and precious metals.

Rare earths are selected from 17 elements commonly found in the Earth's crust and present in low concentrations in many parts of the world.

These elements possess a wide range of properties such as magnetism, phosphorescence and conductivity, making them essential to modern technology.

In fact, phones and other electronic devices can contain up to 16 of the 17 rare earth metals.

In smartphones, these create screens and color displays, help conduct electricity, and generate characteristic vibrations, among other things.

But despite its importance, extracting these elements from the earth is associated with alarming environmental impacts.

Rare earth elements are common, but in many regions their concentrations are too low to economically extract them.

Extracting them often requires a method called open pit mining that exposes vast tracts of land.

This form of mining destroys vast areas of natural habitat, causes air and water pollution, and threatens the health of nearby communities.

Another group of ingredients in smartphones poses similar environmental risks. Metals such as copper, silver, palladium, aluminum, platinum, tungsten, tin, lead, and gold.

Magnesium, lithium, silica and potassium are also mined to make mobile phones, all of which lead to the destruction of vast habitats as well as air and water pollution.

Mining is also fraught with worrying social problems, such as large-scale displacement of humans and animals to make way for industrial operations, and often poor working conditions for workers.

Finally, making phones also requires oil, which is one of the main contributors to climate change.

As such, our smartphones are closely intertwined with this growing global challenge.

Moreover, the materials mined to make mobile phones are not endless.

Eventually they will run out, but some viable replacements have yet to be found.

Nevertheless, the number of smartphones is steadily increasing. Nearly 3 billion are projected to be in use by 2019.

This means there is an urgent need to bring back rewards within mobile phones.

So if you have an old cell phone, consider your options before throwing it away.

To minimize waste, you can donate to charity for reuse, take to an e-waste recycling facility, or look for a company that refurbishes old models.

However, even recycling companies need our scrutiny.

Just as the manufacturing of smartphones entails social and environmental problems, the dismantling of smartphones also entails social and environmental problems.

E-waste is sometimes intentionally exported to countries with low labor costs but poor working conditions.

A large workforce, often made up of women and children, is poorly paid, untrained to disassemble mobile phones safely, and may be exposed to elements such as lead and mercury that can permanently damage the nervous system.

Mobile phone waste ends up in huge landfills, where toxic chemicals can leach into the soil and water, reflecting the problems of the mines where the substances originate.

A phone is more than it seems on the surface.

It is a collection of multi-national factors related to impacts unfolding on a global scale.

So until someone invents a fully sustainable smartphone, we need to understand how this technology will affect a wide range of places and people.

There are 200 million clinical cases of falciparum malaria in Africa each year, resulting in 500,000 deaths.

I would like to talk about the malaria vaccine.

What we have made so far is simply not good enough.

why?

We have been doing this for over 100 years.

Technology had its limits when we started.

We were able to see just a few of the parasites in action.

Today we are flooded with technology, advanced imaging and omics platforms such as genomics, transcriptomics and proteomics.

These tools have given us a clearer picture of how complex parasites really are.

Nevertheless, our approach to vaccine design remains rather rudimentary.

To make a good vaccine, we need to go back to basics and understand how our bodies handle this complexity.

People who get malaria frequently learn how to deal with it.

You get infected, but you don't get sick.

The recipe is coded into the antibody.

My team went back to the complex protozoa, working with samples from African survivors of malaria, to answer the question, "What does a successful antibody response look like?"

We have discovered over 200 proteins, many of which have not attracted attention as malaria vaccines.

My research community may be missing an important piece of parasites.

Until recently, once a protein of interest was identified, cohort studies were conducted to test whether it would be important for vaccines.

This typically involved about 300 participants in African villages, and samples were analyzed to see if antibodies to the protein could predict who had malaria and who did not.

Over the past 30 years, these studies have tested a small number of proteins in relatively small numbers of samples, usually at a single location.

Results are inconsistent.

My team has essentially wrapped up 30 years of this kind of research into one exciting experiment, and conducted it in just 3 months.

Innovatively, we collected 10,000 samples from 15 locations in 7 African countries across the time, age and intensity of malaria experienced in Africa.

We used omics intelligence to prioritize parasite proteins, synthesized them in the lab, and essentially recreated the malaria parasite on a chip.

We have done this in Africa and we are very proud of it.

(Applause.) Chips are tiny glass slides, but they give us incredible power.

We collected data on over 100 antibody responses simultaneously.

what are we looking for?

The recipe behind a successful antibody response. This will allow us to predict what will make a good malaria vaccine.

We are also trying to figure out exactly what the antibodies do against the parasite.

how will they kill it?

Attack from multiple angles? Are there synergistic effects?

How many antibodies do you need?

Our research suggests that having just one antibody is not enough.

High concentrations of antibodies to multiple parasite proteins may be required.

We also know that antibodies kill parasites in multiple ways, and studying any one of these alone may not adequately reflect reality.

Now that we can see parasites in more detail, me and the team are focused on understanding how our bodies overcome this complexity.

We believe this could provide the breakthrough needed to write malaria history through vaccination.

thank you.

(Applause) (Cheers) (Applause) Shoham Arad: OK, how close are we really to developing a malaria vaccine?

Faith Oshie: We are just beginning the process of trying to understand what we need to put in a vaccine before we actually start manufacturing it.

So we're not that close to developing a vaccine, but we're getting there.

SA: And we are hopeful.

FO: And we are very hopeful.

SA: Tell us about SMART. Tell us what it means and why it's important to you.

FO: So SMART stands for South-South Malaria Antigen Research Partnership?

South-South refers to us working side-by-side with each other in Africa, as opposed to always looking to America and looking to Europe when there is considerable power within Africa.

So SMART, apart from its goal of developing a malaria vaccine, is also training African scientists. Because the burden of disease is so high in Africa, we need people who will continue to push the boundaries of science in Africa.

SA: Yes, yes, that's right.

(Applause) So, one last question.

Tell me, I know you mentioned this a bit, but how would things really change if a malaria vaccine existed?

FO: We will save half a million lives each year.

200 million pieces.

Africa's losses from malaria are estimated at US$12 billion annually.

So this is economics.

Africa will just thrive.

SA: Okay. Thank you Faith.

Thank you very much.

(applause)

There is an actor called Dustin Hoffman.

And many years ago he made a movie called "The Graduation" that you may have heard of.

And there are two important scenes in that movie.

First, the seduction scene.

I'm not going to talk about that tonight.

(Laughter) The second scene is where he's taken to the pool by an old man, but as a young college graduate, the old man basically says one word, just one word.

And of course you all know what the word is.

It's "plastic".

(Laughter) And the only problem with that is that it was completely wrong advice.

(Laughter.) Let me tell you why it was so wrong.

This word should have been "silicon".

And the reason why it had to be silicon is that the basic semiconductor patents had already been created, filed, and built.

In 1967, when this movie was released, Silicon Valley had just been built.

And the year after the movie was released, Intel was founded.

So if the alumni had heard the right word, he probably would have been on stage—oh, I don't know—probably with these two.

(Laughter) So when you're thinking about that, let's think about what advice we'd give your next graduate not to become a Tupperware salesman.

(Laughter) So, in 2015, if you took a college graduate by the pool and said one word, one word, what advice would you give people?

I think the answer is "life code".

So what is a "life code"?

Life codes are the different ways we program our lives.

So, instead of programming computers, we use things to program viruses, retroviruses, proteins, DNA, RNA, plants, animals, or whole series of living things.

And when you think about what you want life to do, this amazing ability that life is programmed to do, what you end up doing is what we have been doing for thousands of years, which is to take in breeding, changing, mixing and adapting all kinds of life forms, and we will accelerate it.

And this is nothing new.

This humble mustard plant has been modified in some way to become broccoli.

Change this to the second method and you get kale.

And if you change it to the third method, you get cauliflower.

So when you go to an all-natural, organic market, you're really going to a place where people have long changed the life code of plants.

The difference today is that if you choose a completely politically neutral term -- [intelligent design] (laughter) we're starting to do intelligent design.

So instead of doing this randomly and watching what happens over generations, you're inserting specific genes, inserting specific proteins, and changing your life code for very deliberate purposes.

And that can speed up the process by which this happens.

Let me give you an example.

Some may think about sex from time to time.

And in a way, we take it for granted that we have changed genders.

Therefore, we consider it perfectly normal and natural to change it.

What happened with sex over time is that sex usually equates to having a baby in the end.

But in today's world, you can't have a baby if you combine sex with the pill.

(Laughter) And again, we think it's perfectly normal and natural, but for most of human history it hasn't been.

And that's not the case with animals.

It means giving us control and separating sex from pregnancy.

When we're thinking about the outcome, we're playing with something a little more advanced, like art.

Not in the sense of painting or sculpture, but in the sense of assisted reproductive technology.

So what is assisted reproductive technology?

Assisted reproductive technology is like in vitro fertilization.

And when it comes to in vitro fertilization, there are good reasons to do it.

Sometimes you can't think of anything else.

But when you do that, you separate sex, pregnancy, and babies.

In other words, not only do we control when the baby is born, but we also separate when the baby is born and where it is fertilized.

It means separating the baby from the body from the action.

As we think about other things we've been doing, let's think about twins.

This means that sperm, eggs and fertilized eggs can be frozen.

And what does that mean?

Well, if you're a cancer patient, that's good.

I'm going to have chemo and radiation treatments in the future, so I'm going to save these things.

You don't irradiate them.

But if they can be saved, cryopreserved, and surrogate mothered, that means they have cut sex out of time.

That means twins could be born -- oh, in 50 years?

(laughs) 100 years from now?

Two hundred years?

These three very breaking changes are not for the future.

This is what we take for granted today.

So this life code turns out to be a superpower.

It turned out to be this incredibly powerful way of changing viruses, changing plants, changing animals, and perhaps even evolving ourselves.

That's something Steve Garlands and I have been thinking about for a while.

Take some risks.

Like all powerful technologies such as electricity, automobiles, and computers, these things can be abused.

And it scares a lot of people.

And by applying these technologies, we can also turn humans into chimeras.

Remember the Greek myth of mixing animals?

Well, some of these treatments actually change your blood type.

Or putting male cells in a woman's body, or vice versa, which sounds totally awful until you realize it, but the reason you're doing that is because you're replacing bone marrow during cancer treatment.

So by harvesting someone else's bone marrow, you might be changing a fundamental aspect of yourself, but you're also saving your own life.

And as you think about this, this is what happened 20 years ago.

Emma Ott.

She is a recent college entrant.

She is studying accounting.

She played two national team sports. She graduated as valedictorian.

That's nothing special, except that she's the first human born of three parents.

why?

Because she has a fatal mitochondrial disease, which she may have inherited.

So swapping someone's DNA and putting it in there would save people's lives.

But you are also doing germline engineering. So, if she has children, her children will be saved and will not have such experiences.

And [their] children will be saved, and their grandchildren will be saved, and this will be inherited.

It makes people nervous.

So 20 years ago various authorities said, "Why don't you study this for a while?"

There is risk in doing anything, and there is risk in doing nothing. Dozens of people have been saved by this technology, and we've been thinking about it for the next 20 years.

So when we think about it and take the time to say, “Maybe I should study more, maybe I should do this, maybe I should do that,” action has consequences, and inaction has consequences.

It's like curing a fatal disease, which, by the way, is completely unnatural.

Polio, smallpox, and tuberculosis epidemics are normal and natural for humanity to be destroyed.

When we administer vaccines to people, we think the benefits outweigh the risks, so we end up putting unnatural things into their bodies.

We created unnatural plants and unnatural animals so we could feed about 7 billion people.

It can even create new life forms.

And when you spawn new lifeforms, it also sounds terrifying and terribly annoying, until you realize that those lifeforms live on your dining room table.

These flowers on the dining room table don't have much in the way of nature. Because people have bred flowers to be this color, this size, and keep for a week.

Wildflowers do not last long, so they are not often given to loved ones.

What this does is completely flip Darwin.

For four billion years, what lived and what died on this planet depended on two principles: natural selection and random mutation.

And the living and the dead, the structured are now being turned upside down.

And what we've done is create this fully parallel evolutionary system that practices unnatural selection and non-random mutation.

Now let's talk about these things.

This is natural selection.

This is an unnatural choice.

(Laughter) So what happens is that we started breeding wolves into dogs in Central Asia thousands of years ago.

And started turning them into big dogs and little dogs.

But if you release a Chihuahua in a Hermès bag on Fifth Avenue onto the plains of Africa, you can see natural selection taking place.

(Laughter) Few things on earth are less natural than a cornfield.

Under no circumstances will you ever walk through a primeval forest and see the same plants growing in neat rows at the same time, with nothing else living there.

When you build a cornfield, you get to choose what lives and what dies.

And it is done by unnatural selection.

The same is true for wheat fields and rice fields.

It's the same in the city as it is in the suburbs.

In fact, half of the earth's surface has been unnaturally manipulated so that what lives and dies there is what we want, and that's why no grizzly bears walk downtown Manhattan.

What about this random mutation?

Well this is a random mutation.

Antonio Alfonseca.

He is also known as Octopus.

He was named Best Relief Pitcher in 2000.

And he had a random mutation that gave him six fingers on each hand. I've found this very useful if you're a pitcher.

(Laughter) What about non-random mutations?

A non-random mutation is beer.

Wine. Yogurt.

How many times have you found natural cheese while walking in the woods?

Or is it natural yogurt?

So we have developed something like this.

Now, the interesting thing is that we can know more about things.

We have found one of the single most powerful gene-editing machines, CRISPR, in yogurt.

And as it begins engineering cells, it produces 8 of the top 10 drugs, including Humira, a drug used to treat arthritis (#1 bestseller).

So, this life code.

It's just a superpower.

This is how we actually program things, and nothing changes us more than this life code.

As you think about your life code, think of five principles about how to start your guide. I would appreciate it if you could tell me more.

So principle number one is that we have to take responsibility for this problem.

The reason we have to be responsible is because we are responsible.

These are not random mutations.

This is what we do and what we choose.

It's not that "something happened".

It didn't happen by chance.

It was not decided by someone else's verdict.

We're designing this, and that's the Potteryburn rule: you break it, you own it.

Principle 2: We must recognize and celebrate diversity in this field.

There were at least 33 versions of hominids roaming this planet.

Almost all have become extinct except us.

But in this Earth's normal, natural state, we have different versions of humans walking around at the same time, which is why we have Neanderthals among most of us.

Some of us have Denisova.

Some in Washington have more of it.

(Laughter) Principle #3: We must respect other people's choices.

Some choose to never change.

Some choose to change everything.

Some people change plants without changing animals.

Some people choose to change themselves.

Some choose to evolve themselves.

Diversity is not a bad thing. Because we think of humans as very diverse, we are endangered and we are all descended from a single African mother, resulting in more genetic diversity in 55 African chimpanzees than in 7 billion humans.

Principle #4: We should occupy about a quarter of the planet and only let Darwin run the show there.

They don't have to be contiguous or all contiguous.

It should be partly on the sea and partly on land.

However, we should not make any evolutionary decisions here on Earth.

We want the evolution system to work.

We want to get Darwin's evolutionary system up and running.

And it's very important to do these two things in parallel and not overwhelm the evolution.

(Applause) Finally.

This is the most exciting adventure mankind has ever undertaken.

This is the single greatest supernatural power humans have ever possessed.

It is a crime not to participate in this because it is scary, because it is hidden.

You can participate in ethics. can participate in politics.

You can participate in the business.

You can participate by just thinking about where healthcare is going, where industry is going, and where we are taking the world.

It's a crime for all of us if we don't listen when someone shows up at the pool and says just one word, just one word, if that word is a "life code."

thank you very much.

(applause)

Seven years ago, a student approached me and asked me to invest in his company.

"I'm working with three friends to try to change the industry by selling things online," he said.

And I said, "Okay, you guys spent all summer on this, didn't you?"

"No, we all had internships in case it didn't work out."

"Okay, but when I graduate, I'm going to work full-time."

"Not exactly. We all set up backup jobs."

It's been half a year, the day before the company was founded, and the website is still not working.

"You know that the whole company is a website.

That's literally it. ”

Therefore, I clearly declined the investment.

And they finally named the company Warby Parker.

(laughs) We sell glasses online.

The company was recently recognized as the world's most innovative company with a valuation of over $1 billion.

and now? My wife is in charge of our investments.

Why was I so wrong?

To find out, I've been studying the people who came to be called "original."

Original people are unconventional people, people who not only have new ideas but also take action to defend them.

They are the ones who speak out.

Originals drive creativity and change in the world.

Those are the people you want to bet on.

And they are nothing like what I expected.

Today I'd like to share with you three things I've learned about recognizing the original and becoming a little more like it.

So the first reason I passed on Warby Parker was because they were really slow to get off the ground.

Now, you all know the psychology of procrastinators.

Well, I have a confession for you. I am the opposite. I am a procrastinator.

Yes, that's the actual term.

You know the panic you feel when you're hours before an important deadline and you haven't done anything yet?

It feels like it's only a few months away.

(Laughter) So this started early on. When I was a kid, I took Nintendo games very seriously.

I got up at 5am, started playing, and didn't stop until I mastered it.

Eventually it got so out of hand that a local newspaper came along and ran an article about the dark side of Nintendo with me in the lead role.

(Laughter) (Applause) Since then, I've traded hair for teeth.

(Laughter) But I finished my senior thesis four months before the deadline, so it worked for me in college.

And until a few years ago I was proud of it.

A student named Ji-hye came to me and said, "The most creative ideas come to me when I'm procrastinating."

So I thought, "That's cute, where are the four documents you owe me?"

(Laughter) No, she was one of our most creative students. As an organizational psychologist, this is the kind of idea I test.

So I requested her to get the data.

She works for many companies.

She asked people to fill out a survey about how often they procrastinate.

She then has her boss rate how creative and innovative they are.

And sure enough, procrastinators like me score less creatively than moderate procrastinators because they rush to get everything done quickly.

So I'm curious to know what happens to chronic procrastinators.

She said, "I don't know. They didn't answer my questionnaire."

(Laughter) No, this is our result.

In fact, it turns out that those who wait until the last minute are so silly that they don't have any new ideas.

And on the other hand, the people who attend the race are so frantic that they have no thoughts of their own.

There is a sweet spot where the original seems to come alive.

why is this?

Perhaps the former people just have bad work habits.

Maybe procrastination doesn't breed creativity.

To find out, we planned some experiments.

We asked people to generate new business ideas and had independent readers rate how creative and helpful they were.

And some are asked to do the job right away.

Randomly assign others to procrastinate by hanging the Minesweeper in front of them for 5 or 10 minutes.

And sure enough, moderate procrastinators are 16% more creative than the other two groups.

Now, Minesweeper is great, but that's not what drives the effect. Playing the game before learning the task doesn't improve creativity.

Even if you are told to work on this issue and start procrastinating, it's only when the issue is still active in the back of your head and you start to warm it up.

Procrastination gives you time to consider divergent ideas, think in non-linear ways, and take unexpected leaps.

So, just as I was finishing up these experiments, I was starting to write a book about the original and I thought, "This is the perfect time to teach myself to procrastinate while writing a chapter on procrastination."

So I'm a meta-procrastinator and, like all self-respecting procrastinators, I woke up early the next morning and made a to-do list with step-by-step instructions on how to procrastinate.

(Laughs) And I worked hard towards the goal of not progressing towards the goal.

I started writing the procrastination chapter, and one day, halfway through, I literally left it in the middle of a sentence for months.

It was painful.

But when I went back, various new ideas came to my mind.

As Aaron Sorkin said, "You call it procrastination, I call it thinking."

And along the way, I discovered that many of history's greatest originals are procrastinators.

Take Leonardo da Vinci, for example.

He worked on the Mona Lisa off and on for 16 years.

he felt like a failure.

He wrote the same thing in his diary.

But some of the turns he took in optics transformed the way he modeled light and made him a better painter.

What about Martin Luther King Jr.?

On the eve of the biggest speech of his life, the March on Washington, he got up after 3:00 a.m. and rewrote his speech.

He sits in the audience waiting for his turn to take the stage, still scribbling notes and scribbling lines.

On stage 11 minutes into the session, he left a prepared statement with four words that would change the course of history. "I have a dream."

It wasn't in the script.

By delaying finishing his speech until the last minute, he made sure he was open to the widest possible range of ideas.

And since the text was not fixed, he was free to improvise.

Procrastination is a vice when it comes to productivity, but it can also be a virtue when it comes to creativity.

A lot of great original work is that they start early and finish late.

And this is what I missed with Warby Parker.

When they were holding back for six months, I looked at them and said, "You know, a lot of other companies are starting to sell eyeglasses online."

They missed the first mover advantage.

But what I didn't realize was that they were spending all their time finding ways to make people feel safe ordering glasses online.

And it turns out that first mover advantage is mostly a myth.

Browse classic studies on over 50 product categories. We compare the first movers who created the market to the innovators who introduced something different and better.

As you can see, the first migrated companies had a failure rate of 47 percent, while the improved companies had a failure rate of just 8 percent.

Please see Facebook. I'm waiting for Myspace and Friendster to finish building my social network.

Look at Google, which has been waiting years after Altavista and Yahoo.

It's much easier to improve someone else's idea than to create a new one from scratch.

So the lesson I learned is that you don't have to be the first to be original.

It just has to be different and better.

But that wasn't the only reason I passed on Warby Parker.

They were full of questions, too.

They had preliminary plans, but wondered if they had the guts to be original. I expected the original to be something like this.

(Laughter) Now, many creative people appear confident on the surface, but behind the scenes, they have the same fears and doubts as we do.

They just manage it differently.

This is how the creative process works for most of us.

(Laughter) Well, after some research, I've found that there are two different kinds of suspicion.

There is self-doubt and suspicion of ideas.

Self-doubt paralyzes.

it freezes you.

But doubts about ideas are energizing.

As with MLK, it creates incentives to test, experiment, and improve.

So the key to being original is simply to avoid jumping from step 3 to step 4.

Instead of saying, "I'm shit," say, "The first few drafts are always shit, I'm just not there yet."

So how do you get there?

As it turns out, the clue is in the internet browser you're using.

Just knowing which web browser you use can predict your work performance and engagement.

Now, some of you may not like the findings -- (laughter), but there's ample evidence that Firefox and Chrome users perform significantly better than Internet Explorer and Safari users.

yes.

(Applause) By the way, they stay in the job 15% longer.

why? It's not a technical advantage.

The four browser groups averaged similar typing speeds and had similar levels of computer knowledge.

It's about how you got the browser.

If you're using Internet Explorer or Safari, it's because they were pre-installed on your computer and you accepted the default options passed to them.

If I wanted Firefox or Chrome, I had to doubt the defaults, ask if there was another option, and be a little resourceful and download a new browser.

So when people hear about this study, they think, "Great, if you want to do better at work, why not just upgrade your browser?"

(Laughter) No, it's important to be the kind of person who doubts default and takes the initiative to look for better options.

And if you do it well, you can open yourself up to the opposite of deja vu.

it has a name. It is called Buja De.

(Laughter) 'Vuja de' is about suddenly seeing something you've seen many times before with fresh eyes.

He is a screenwriter who has been staring at movie scripts that have not gotten the go-ahead for more than half a century.

In all previous versions, the main character was the Evil Queen.

But Jennifer Lee begins to question whether that makes any sense.

She rewrote the first act, reinventing the villain as an anguished hero, and Frozen became the most successful animated film of all time.

This story has a simple message.

When in doubt, don't let it go.

(Laughter.) What about fear?

Even the original is terrifying.

They are afraid to fail, but what makes them different is that they are even more afraid to try and fail.

They know they can fail by starting a business and going bankrupt, or by failing to start a business in the first place.

They know that in the long run, our greatest regrets are inactions, not actions.

From a scientific point of view, what I want to do again is that the opportunity was not taken advantage of.

Elon Musk recently told me he didn't expect Tesla to succeed.

He was convinced that SpaceX's first few launches would never get into orbit, let alone get into orbit, but it was very important not to try.

And most of us don't bother trying when we have an important idea.

But I have good news for you.

Don't be judged by your bad ideas.

Many people think so.

When we looked across industries and asked people about their biggest ideas and most important propositions, 85% of people remained silent.

They were afraid to be ashamed, afraid to look stupid.

But guess what? There are a lot of bad ideas in the original, and there are actually a lot of them.

Take for example the man who invented this.

Do you mind that he came up with a spooky talking doll that would scare adults as well as kids?

No, you credit Thomas Edison for pioneering the light bulb.

(Laughter) If you look at all fields, the greatest originals are the ones who fail the most. Because they are the hardest working people.

Take for example the best classical composers of the best.

Why do some people have more encyclopedia pages than others, and why do their works get re-recorded so many times?

One of the best predictors is the sheer volume of songs being generated.

The more products you have, the more variety you have and the more likely you are to find something truly original.

Even Bach, Beethoven and Mozart, three icons of classical music, had to produce hundreds of works to produce far fewer masterpieces.

Now, you may be wondering, how did this guy become great without doing much?

I don't know how Wagner managed to do that.

But for most of us, if we want to be more original, we need to generate more ideas.

When the Warby Parker founders decided on a name for their company, they needed something sophisticated and unique without negative associations to build their retail brand. We tested over 2,000 possibilities before finally merging Warby and Parker.

Putting all this together, we can see that the original is not that different from us.

They feel fear and suspicion. They procrastinate.

they have a bad idea.

And sometimes we succeed not in spite of those qualities, but because of them.

So when you see something like this, don't make the same mistake I did.

don't write it down.

And if that's who you are, don't exclude yourself either.

Know that starting early and finishing late boosts creativity, that doubting your ideas and fear of failure can motivate you, and that it takes a lot of bad ideas to get a few good ideas.

Being original is not easy, but there is no question about this. That's the best way to improve the world around us.

thank you.

(applause)

I want you to rethink how life on Earth is organized.

Think of the Earth like the human body we live in.

Its skeleton is a transportation system such as roads, railroads, bridges and tunnels, airports and ports that enable movement between continents.

The vascular system that powers the body is the oil and gas pipelines and power grid.

The one that distributes the energy.

And the nervous system of communication is the Internet cables, satellites, cellular networks, and data centers that make information sharing possible.

This ever-expanding infrastructure matrix already comprises 64 million kilometers of roads, 4 million kilometers of railroads, 2 million kilometers of pipelines and 1 million kilometers of internet cables.

What about borders?

Our borders are less than 500,000 kilometers.

Let's create a better world map.

And you can start by overcoming ancient myths.

A well-known proverb to anyone who studies history is that "geography is destiny."

Very serious don't you think?

It's a very fatalistic maxim.

It tells us that landlocked countries are condemned as poor, that small countries cannot escape from their big neighbors, and that vast distances are insurmountable.

But every time I travel around the world, I see an even greater force sweeping the globe: connectivity.

The global connectivity revolution in all its forms, including transport, energy and communications, has so far advanced the movement of people, goods, resources and knowledge that geography can no longer be considered in isolation from geography.

In fact, I believe that these two forces will merge into what I call 'connectography'.

Connectography represents a quantum leap in the fluidity of people, resources and ideas, but it is the evolution of the world, from political geography, the way we legally divide the world, to functional geography, the way we actually use the world, from nations and borders to infrastructure and supply chains.

Our world system is evolving from vertically integrated empires of the 19th century, through horizontally interdependent states of the 20th century, to global networked civilizations of the 21st century.

Connectivity, not sovereignty, has become the organizing principle of humanity.

(Applause) We are literally building this global network civilization, so we are becoming this global network civilization.

The combined global defense budget and military spending is just under $2 trillion a year.

Meanwhile, global infrastructure spending is projected to grow to $9 trillion annually within the next decade.

And, well, it should.

With a population of 7 billion, 8 billion, and eventually over 9 billion, we have lived on infrastructure stock equivalent to 3 billion people in the world.

As a rule of thumb, we need to spend about $1 trillion on basic infrastructure needs for every billion people in the world.

Not surprisingly, Asia leads.

In 2015, China announced the establishment of the Asian Infrastructure Investment Bank, which aims to work with a network of other organizations to build a network of iron and silk roads stretching from Shanghai to Lisbon.

And as all this terrain engineering unfolds, we are likely to spend even more on infrastructure in the next 40 years, building more infrastructure in the next 40 years than we have in the last 4,000 years.

Now let's stop and think for a moment.

Spending so much on building the foundations of global society instead of on the tools to destroy it can have serious consequences.

Connectivity is a way to optimize the distribution of talent and resources around the world.

In this way, humanity becomes more than the sum of its parts.

I think that's what's happening.

There are two megatrends in connectivity in the 21st century: global urbanization.

Cities are the infrastructure that most characterizes us.

By 2030, more than two-thirds of the world's population will live in cities.

And these aren't just tiny dots on the map, they're vast archipelagos that span hundreds of kilometers.

Here in Vancouver, we are at the end of the Cascadia Corridor, which stretches south across the US border to Seattle.

Silicon Valley's tech powerhouse begins north of San Francisco as far as San Jose and continues across the bay to Oakland.

The sprawling Los Angeles now stretches through San Diego and across the Mexican border to Tijuana.

San Diego and Tijuana now share an airport terminal, and you can depart to either country.

Ultimately, a high-speed rail network may connect the entire backbone of the Pacific.

The megacities of the northeastern United States begin in Boston, New York, Philadelphia, and Washington.

It has a population of over 50 million and plans for a high-speed rail network.

But in Asia we actually see megacities clustered together.

Stretching from Tokyo to Nagoya to Osaka, this belt of light encompasses more than 80 million people and much of Japan's economy.

It's the world's largest megacity.

At this point.

In China, however, megacities with populations reaching 100 million people are accumulating.

The Bohai Delta around Beijing, the Yangtze River Delta around Shanghai, and the Pearl River Delta north of Hong Kong to Guangzhou.

And in the middle are the megacities of Chongqing and Chengdu, whose geographical area is almost as large as the country of Austria.

And the GDP of these megacities is at most approaching $2 trillion. This is about the same as all of India today.

Now imagine what it would be like if a global diplomatic body such as the G20 composed its membership based on economic size rather than national representation.

Some of China's big cities may come and sit at the table, but whole countries like Argentina and Indonesia will not.

Looking at India, whose population will soon exceed that of China, India also has many megacities such as the Delhi metropolitan area and Mumbai.

In the Middle East, the Tehran metropolitan area is absorbing a third of Iran's population.

Most of Egypt's 80 million people live in the corridor between Cairo and Alexandria.

And in the Gulf, a string of city-states is forming, from Bahrain and Qatar through the United Arab Emirates to Muscat, Oman.

And then there's Lagos, Africa's largest city and the commercial center of Nigeria.

There are plans for a rail network to anchor a vast Atlantic coastal corridor across Benin, Togo and Ghana to Abidjan, the capital of Côte d'Ivoire.

But these countries are suburbs of Lagos.

In the world of megacities, countries can also be suburbs of cities.

By 2030, there will be 50 such megacity clusters worldwide.

So which map tells us more?

Is it the traditional map of 200 independent nations on most of our walls, or this map of 50 megacities?

But even this is incomplete. You cannot understand individual megacities without understanding their connections with other megacities.

People move to cities to connect, and that connectivity is what makes these cities thrive.

There are many countries, such as São Paulo, Istanbul, and Moscow, whose GDP is close to or above one-third of one-half of the national GDP.

But just as important, their individual value cannot be calculated without understanding the role of human, financial and technological flows in enabling their prosperity.

Take the Gauteng province of South Africa, which includes Johannesburg and the capital Pretoria, for example.

This is also equivalent to just over a third of South Africa's GDP.

But just as importantly, nearly all multinational companies that invest directly in South Africa, or even the entire African continent, have their offices here.

Cities want to be part of global value chains.

They want to be part of this global division of labor.

That's the idea of ​​the city.

I've never met a mayor who said, "I want my city cut off."

They know that their city belongs to a global network civilization as much as their home country.

Urbanization is currently causing great disappointment for many people.

They think cities are destroying the planet.

But now there are over 200 thriving city-to-city learning networks.

That's as many intergovernmental organizations as we have.

And all these intercity networks are dedicated to one purpose: sustainable urbanization, which is humanity's top priority in the 21st century.

Is it working?

Consider climate change.

We know that no amount of summits in New York or Paris will reduce greenhouse gas emissions.

But what we are seeing is that the transfer of technology, knowledge and policies between cities is actually starting to reduce the carbon intensity of the economy.

Cities are learning from each other.

How to set up a zero-emission building, how to introduce an electric car sharing system.

Major cities in China impose quotas on the number of cars on their streets.

In many Western cities, young people don't even want to drive anymore.

Cities were once part of the problem, but now they are part of the solution.

Inequality is another major challenge to achieving sustainable urbanization.

When I travel from end to end in a big city, which takes hours and days, I experience the tragedy of extreme disparities within the same geography.

But the global stock of financial assets is greater than ever, approaching $300 trillion.

This is almost four times the world's actual GDP.

Since the financial crisis, we have taken on so much debt, but have we invested it in inclusive growth?

No, not yet.

Only if we build enough affordable public housing and invest in robust transportation networks that allow people to connect to each other physically and digitally will cities and societies that have been divided will feel united again.

(Applause.) Infrastructure is included in the United Nations Sustainable Development Goals because it enables all other goals.

Our political and economic leaders are learning that connection is about opportunity, not charity.

That is why our financial community needs to understand that connectivity is the most important asset class of the 21st century.

Cities can now make the world more sustainable and the world fairer. I also believe that connections between cities can make the world more peaceful.

A look at the regions of the world with close cross-border ties shows increased trade, investment and greater stability.

We all know the story of post-WWII Europe. There began the process of industrial consolidation and the birth of today's peaceful European Union.

By the way, it turns out that Russia is the least connected of the great powers in the international system.

And it goes a long way to explain today's tension.

Countries with fewer stakes in the system have less to lose by sabotaging it.

In North America, the most important lines on the map are not the US-Canada border or the US-Mexico border, but the dense network of roads, railroads, pipelines, power grids and even canals that make up the unified North American Union.

North America doesn't need more walls. We need more connections.

(Applause.) But the real promise of connectivity lies in the postcolonial world.

Both of these regions have historically had the most arbitrary borders and generations of leaders at odds with each other.

But now, a new group of leaders have seized power and are trying to fill in Nata.

Take Southeast Asia for example. In Southeast Asia, a high-speed rail network is planned to connect Bangkok and Singapore, as well as trade corridors from Vietnam to Myanmar.

Today, the region of 600 million people is adjusting agricultural resources and industrial output.

It is evolving into what I call Pax Asiana, peace between Southeast Asian nations.

A similar phenomenon is underway in East Africa, with six countries investing in railroads and multimodal transport corridors to help landlocked countries get their goods to market.

These countries are now coordinating their public works and investment policies.

They too are evolving into Pax Africana.

One region where we have found this type of thinking particularly useful is the Middle East.

With the Arab nations tragically falling apart, what remains but the ancient cities of Cairo, Beirut and Baghdad?

In fact, about 400 million people in the Arab world are almost fully urbanized.

As a society, as a city, we are either water-rich or water-poor, or energy-rich or energy-poor.

And the only way to fix these discrepancies is not with more wars and borders, but with more pipeline and waterway connections.

Unfortunately this is not yet a map of the Middle East.

But it should be Pax Arabia, internally integrated and productively linked to its neighbors in Europe, Asia and Africa.

Now, for the world's most disrupted region, it may seem like connectivity isn't what we want right now.

But we know from history that increasing connectivity is the only way to bring stability in the long run.

Because we know that connectivity is the new reality in every region.

Cities and nations are learning to converge into a more peaceful and prosperous whole.

But the real test will be in Asia.

Can connectivity overcome the conflict patterns between the Far Eastern powers?

After all, this is where World War III should break out.

At least six major wars have been predicted in the region since the end of the Cold War a quarter of a century ago.

But none have erupted.

Take China and Taiwan for example.

In the 1990s, this was the primary scenario for World War III.

Since then, however, the volume of trade and investment across the Straits has become so intense that last November the leaders of both sides held a historic summit to discuss eventual peaceful reunification.

And even the election of a pro-independence Kuomintang in Taiwan earlier this year does not undermine this basic dynamic.

China and Japan have a longer history of confrontation and have deployed air and naval forces to prove their strength in island disputes.

In recent years, however, Japan has made its largest foreign investment in China.

Japanese cars are selling in record numbers there.

And where did the most foreigners living in Japan today come from?

As you might have guessed, it's China.

China and India have fought a major war and have three unresolved border disputes, but India is now the second largest shareholder of the Asian Infrastructure Investment Bank.

They are building trade corridors from northeastern India through Myanmar and Bangladesh to southern China.

Their trade has grown from $20 billion a decade ago to $80 billion today.

Nuclear-armed India and Pakistan, which have gone to war three times and are still in conflict over Kashmir, are also negotiating a most-favored-nation trade agreement and hope to complete a pipeline from Iran through Pakistan to India.

And let's talk about Iran.

Wasn't it just two years ago that war with Iran seemed inevitable?

So why are all the major countries rushing to do business there today?

Ladies and Gentlemen, I cannot guarantee that World War III will not break out.

But it's clear why it hasn't happened yet.

These same countries are investing billions of dollars in each other's infrastructure and supply chains, even though Asia is home to the world's fastest growing military.

They are more interested in their functional geography than each other's political geography.

That is why their leaders have thought twice and decided to step back from the brink and focus on economic ties rather than territorial tensions.

The world often seems to be falling apart, but building more connectivity can bring Humpty Dumpty together again, much better than before.

And by enveloping the world in such seamless physical and digital connectivity, we will evolve towards a world where people can transcend geographic constraints.

We are the cells and blood vessels that pulse these global networks of connections.

Every day, hundreds of millions of people go online to do business with people they've never met.

More than 1 billion people cross borders every year, and that number is expected to rise to 3 billion over the next decade.

We don't just build connectivity, we embody it.

We are a global networked civilization and this is our map.

A world map where geography is no longer destiny.

Instead, the future bears a new, more hopeful motto: "connection is destiny."

thank you.

(applause)

I will train it well and go to Mars.

Thousands of people will move to Mars, not just a few astronauts.

And I'm saying they're going to do this soon.

Some of you will be working on projects on Mars, and some of your children will be living on Mars.

It may seem silly, so I'll tell you when and how it happens.

But first, I would like to discuss the obvious question. Why would you want to do this at all?

Twelve years ago, I gave a TED talk on 10 ways the world could suddenly end.

We are incredibly vulnerable to our own galactic whims.

One big asteroid could wipe us out forever.

To survive, we must reach beyond our home planet.

Think how tragic it would be if all human achievement suddenly disappeared.

And there is another reason why we should go. Because exploration is in our DNA.

Two million years ago, humans evolved in Africa, then reached out into the wilderness beyond the horizon and slowly but surely spread across the globe.

Something like this is in us.

And they succeeded in doing so.

Some of the greatest advances in civilization and technology have come from our exploration.

Yes, a lot of good could be done with the funds needed to set up a thriving colony on Mars.

And yes, we should all value our home planet more.

And yes, I'm afraid we're going to screw up Mars just like we screwed up Earth.

But think for a moment about John F. Kennedy when he said he would land humans on the moon.

He inspired an entire generation to dream.

How excited would we be if we could see a landing on Mars?

Perhaps then we will look back at Earth and realize that it is one person instead of many, and perhaps then, as we struggle to survive on Mars, we will look back at Earth and realize how precious our home planet is.

Now let's talk about the extraordinary adventure we're about to embark on.

Before we get to that, let me give you some interesting facts about where we're headed.

This photo actually represents the actual size of Mars compared to Earth.

Mars is not our sister planet.

It is much smaller than half the size of the Earth, but despite being smaller, the Earth is mostly covered with water, so the surface area of ​​Mars on which a person can stand is the same as the surface area of ​​the Earth.

Mars' atmosphere is very thin, 100 times thinner than Earth's, impermeable, and 96% carbon dioxide.

It's really cold over there.

Temperatures vary considerably, but the average temperature is -81 degrees Celsius.

A day on Mars is about as long as a day on Earth plus about 39 minutes.

Mars has twice as many seasons and years as Earth.

And for those who want to one day put on wings and fly, Mars is the kind of place where gravity is so much less than Earth that you can jump over cars instead of walking around them.

As you can see, Mars doesn't look like Earth at all, but it's the most habitable place in the entire solar system.

Here is the problem.

Mars is far away, a thousand times further away than our own moon.

The moon is 450,000 miles away and it took the Apollo astronauts three days to reach the moon.

Mars is 250 million miles away and it takes eight months, or 240 days, to get there.

And only if it launches at a very specific time on a very specific day when Mars and Earth are aligned once every two years, so the distance the rocket has to travel is minimal.

240 days in a can with my colleagues is a long time.

On the other hand, our track record of reaching Mars is terrible.

We and the Russians, Europeans, Japanese, Chinese and Indians actually sent 44 rockets there, most of which either failed or crashed.

Only about a third of missions to Mars are successful.

And at the moment there are no rockets big enough to get there anyway.

We used to have a rocket called the Saturn V.

Two Saturn Vs would have gotten us there.

It was the most amazing machine mankind has ever built, the rocket that took us to the moon.

But the last Saturn V was used to launch the Skylab Space Station in 1973, and after we landed on the moon, instead of heading to Mars, we decided to do something called a shuttle.

The largest rockets we have today are only half big enough to carry anything to Mars.

So getting to Mars won't be easy, and that raises very interesting questions...

How long before the first humans actually land here?

Now, some experts believe that getting there by 2050 would be quite an accomplishment.

Recently, NASA seems to be saying that humans could reach Mars by 2040.

Maybe you can.

I believe they can put humans in Mars orbit by 2035.

But frankly, I don't think they're going to bother sending a rocket to Mars in 2035. Because we are already on Mars.

We plan to land on Mars in 2027.

And it's because this guy has the determination to make it happen.

His name is Elon Musk, CEO of Tesla Motors and SpaceX.

In fact, he told me we'll land on Mars by 2025, but Elon Musk is more optimistic than I am, and it's a lot further along. That's why I'm giving him a few years.

not yet ...

You have to ask yourself, can this person really achieve this by 2025 or 2027?

Now, let's take a moment to reflect on our ten years with Elon Musk.

Where was this place 10 years ago?

That's the Tesla electric car.

In 2005, many in the auto industry said there wouldn't be a decent electric car for the next 50 years.

and where was it?

It's SpaceX's Falcon 9 rocket that will carry 6 tons of cargo to the International Space Station.

Ten years ago, SpaceX wasn't launching anything, and it wasn't launching rockets anywhere.

So I think it's pretty likely that someone who's revolutionizing the auto industry in 10 years and who founded an entire rocket company in 10 years will get us to Mars by 2027.

Well, you should know this. Governments and robots no longer control this game.

Private companies are venturing into space and are happy to take us to Mars.

And that really raises big questions.

Is it possible to actually live there?

Today, NASA may not get us to Mars until 2040, or even a long time before NASA does, but NASA has a huge responsibility in figuring out how we can live on Mars.

Let's look at the problem this way.

Food, water, shelter and clothing are the basic necessities of life on earth.

All of the above plus oxygen is needed to live on Mars.

So let's take a look at the most important things on this list first.

As we know, water is the basis of all life and it is too heavy to carry it from Earth to Mars for us to live. So we have to find water to sustain life on Mars.

If you look at Mars, it's so dry that the whole planet looks like a desert.

However, it turned out not to be the case.

Mars soil alone contains up to 60 percent water.

And the many orbiters we still have around Mars have shown us that there are sheets of water ice inside many of Mars' craters. By the way, this is a real photo.

Not a bad place to start a colony.

Well, here's a little drilling done by the Phoenix lander in 2008. You can see that there is ice just below the surface of the soil. That white stuff is ice.

The second photo, four days after the first, shows some evaporation.

The rover also tells us that Mars has a lot of groundwater, not just glaciers.

In fact, if only the polar water ice on Mars melted, most of the Earth would be under 30 feet of water.

So there's a lot of water out there, but most of it is ice, most of it is underground, and it takes a lot of energy and a lot of human labor to get to it.

This is a device developed at the University of Washington in 1998.

It's basically a low-tech dehumidifier.

And it turns out that the Martian atmosphere is often 100% wet.

In other words, the device could easily extract all the water humans need from the Martian atmosphere.

Next we have to worry about what we breathe.

To be honest, I was really shocked when NASA solved this problem.

This is an MIT scientist named Michael Hecht.

And he developed this machine, the Moxy.

i love this

This is essentially a reverse fuel cell that sucks in the Martian atmosphere and pumps out oxygen.

And remember that CO2 (the carbon dioxide that makes up 96% of Mars' atmosphere) is basically 78% oxygen.

Now, the next large rover that NASA will send to Mars in 2020 will be equipped with these devices, which will be able to produce enough oxygen to keep one person alive indefinitely.

But the secret to this, just for testing purposes, is that it was designed from the start to scale 100x.

What should we eat next?

Well, we're going to grow food using hydroponics, but we won't be able to grow more than 15-20 percent of our food there, at least until we have running water on the surface of Mars and the probability and ability to actually plant crops.

In the meantime, most of our food will arrive from the earth and dry out.

And you need shelter.

Initially, you can use not only the lander itself, but also an inflatable building under pressure.

However, this only really works during the day.

Too much solar radiation and cosmic rays.

So you really have to go underground.

Well, it turns out that Martian soil is generally perfect for making bricks.

And NASA understood this too.

They throw polymer plastic into bricks, push them into microwave ovens, and they'll be able to build buildings with very thick walls.

Alternatively, you may choose to live inside an underground cavern or lava tube. There are many of them.

And finally, clothing.

On Earth, miles of air fall on us, putting 15 pounds of pressure on us all the time, and we're constantly pushing against it.

Mars has very little atmospheric pressure.

So MIT scientist Dava Newman created this sophisticated spacesuit.

It keeps us together, shields us from radiation, and keeps us warm.

So let's think about this for a second.

Food, housing, clothing, water, oxygen...

I can do it.

I really can.

But it's still a little complicated and a little difficult.

So that leads to the next big, really big step towards having a good life on Mars.

That is Earth terraforming. Make the planet more Earth-like and redesign the entire planet.

It sounds very arrogant, but the truth is that the technology already exists that does everything I'm about to tell you.

You have to warm it up first.

Mars has a very thin atmosphere, which makes it incredibly cold.

The answer is here, at the south and north poles of Mars. Both are covered in incredible amounts of frozen carbon dioxide, or dry ice.

When you heat it up, it sublimates directly into the atmosphere, just like it does on Earth, making it thicker.

And as you know, CO2 is an incredibly powerful greenhouse gas.

Now, my favorite way to do this is to put up a very large solar sail and focus it. This essentially acts as a mirror. And the first will focus on the South Pole of Mars.

As the planet rotates, all of the dry ice heats up and sublimates, rushing into the atmosphere.

In fact, it won't take long for Mars to start warming, perhaps less than 20 years.

Now, temperatures can actually reach 70 degrees Celsius on Mars' equatorial perfect days in midsummer, but can drop to -100 degrees Celsius at night.

(Laughter) What we're looking for is a runaway greenhouse effect. It's warm enough to melt much of the ice on Mars, especially underground.

Then let's get to the real magic.

Everything gets better as the atmosphere thickens.

We will have more protection from radiation, and an increase in the atmosphere will warm us and warm the earth, which in turn will give us water, which will allow crops to grow.

More water vapor is then released into the air, forming yet another powerful greenhouse gas.

It rains and snows on Mars.

And as the atmosphere thickens, pressure will build up enough to throw off the spacesuit.

All we need to survive is about 5 pounds of pressure.

Eventually, Mars will feel a lot like British Columbia.

We still have the complex problem of making our atmosphere more breathable, and frankly, it could take 1,000 years to get there.

But humans are amazingly smart and incredibly adaptable.

We do not know what our future technologies will be able to achieve, nor do we know what our own bodies can do.

In current biology, we are on the brink of being able to control our own genetics, what our own body's genes do, and ultimately our own evolution.

A slightly different species of humans could emerge on Earth than those on Mars.

But what do you do there? how would you live?

It will be the same as on Earth.

Someone is starting a restaurant, someone is building an iron foundry.

Someone will make a documentary film of Mars and sell it on Earth.

An idiot will start a reality show.

(Laughter) There will be software companies, there will be hotels, there will be bars.

This much is certain. I think it will be the most devastating and most moving event in our lives.

Ask a 10-year-old girl if she wants to go to Mars.

Children who are now in elementary school will choose to live there.

Remember when humans landed on the moon?

At that time, people looked at each other and said, "If you can do this, you can do anything."

What would they think if we actually colonized Mars?

Most importantly, it makes us a space-traveling species.

It means that no matter what happens on Earth, humanity will survive.

We will never be the last.

thank you.

(applause)

I would like to introduce you to a wonderful woman.

Her name is Davinia.

Born in Jamaica, Davinia immigrated to the United States at the age of 18 and now lives in the Washington DC suburbs.

She is neither a powerful political staffer nor a lobbyist.

Perhaps she would say that she is quite unremarkable, but she has the most noticeable influence.

What's great about Davinia is that she's willing to spend time each week focusing on people other than herself. People who are not in her neighborhood, her state, or even her country, people she probably will never meet.

Davinia's influence began a few years ago when she reached out to all her friends on Facebook and asked them to donate a penny to help fund girls' education.

She didn't expect a huge response, but after 700,000 pennies, she now has over 120 girls in school.

When we spoke last week, she said she grew a little notorious at her local bank every time she left with a shopping cart full of pennies.

Now -- Davinia is not alone.

Far from it.

She is part of a growing movement.

And people like Davinia have a name: "Global Citizens."

A global citizen is, first and foremost, a person who sees himself as part of humanity, not part of a nation, tribe or nation, and who acts on that conviction and is ready to take on the world's greatest challenges.

Our work is focused on discovering, supporting and activating global citizens.

They exist in every country and every demographic.

What I want to make to you today is that the future of the world depends on its citizens.

I am convinced that with more global citizens active in our world, all of the major challenges we face – poverty, climate change and gender inequality – can be solved.

These are ultimately global problems that can ultimately only be resolved by global citizens demanding global solutions from their leaders.

Now, some people's immediate reaction to this idea is that it's either a little utopian or threatening.

So today I want to tell you a little bit about my story, how I got here, and how it connects with Davinia and hopefully with you.

Growing up in Melbourne, Australia, I was one of those terribly irritating kids who never stopped asking "why?"

You yourself may have been one of them.

I used to ask my mother the most annoying question.

I asked questions like, "Mom, why can't I dress up and play with dolls all day?"

"Why do you want fries with it?"

"What are shrimp and why do I keep throwing shrimp at my Barbie doll?"

(laughter) "And mom, this hairstyle.

why? "

(laughs) I think it's the worst hairstyle.

still terrible.

"Why?" As a child I thought I could change the world, but it was impossible to convince me otherwise.

When I was 12 years old and a freshman in high school, I started fundraising for communities in the developing world.

We are a group of really enthusiastic kids who have raised more money than any other school in Australia.

And I was given the opportunity to go to the Philippines to learn more.

It was 1998.

We were taken to a slum on the outskirts of Manila.

There I became friends with Sonny Boy. Sonny Boy literally lived in a steamy pile of garbage.

They called it "Smoky Mountain".

But don't let the romance of the name fool you. Because it was just a stinking landfill that kids like Sonnyboy spent hours every day scavenging to find something of value.

That night with Sonny Boy and his family changed my life forever. Because when it was time to go to bed, Sonny Boy, myself, and the other seven members of his family were lying on a concrete slab about halfway up the bedroom. The long line was because the smell of garbage was everywhere and there were cockroaches crawling around.

And I hadn't slept at all, but as I woke up I thought to myself, "Why should everyone live like this when I have so much?"

Why is Sonny Boy's ability to realize his dreams determined by where he was born, or what Warren Buffett called the "ovarian lottery"? ” I had no idea and had to figure out why.

Now, it was only later that I came to understand that the poverty I saw in the Philippines was the result of artificial decisions by a series of colonial powers and corrupt governments who genuinely thought of nothing but the interests of the Sonny Boys.

Granted, they didn't build Smokey Mountain, but they might as well.

And if you're trying to help kids like Sonny Boy, just trying to send him a few bucks or clean up the dump he lived in won't work. Because the crux of the problem lies elsewhere.

And as I spent the next few years building schools, training teachers, and working on community development projects to help tackle HIV and AIDS, I realized that community development should be driven by the communities themselves, and that philanthropy is necessary but not enough.

We need to meet these challenges globally and systematically.

And the best I can do is mobilize a large group of citizens in my country to insist that our leaders undertake that systemic change.

That's why, a few years later, with a group of college friends, I brought the Make Poverty History campaign to Australia.

We had this dream of doing this little concert with local Australian artists around the time of the G20 and it suddenly exploded one day when we got a call from Bono, Edge and Pearl Jam and they all agreed to headline our concert.

As you can see, the day was a little exciting.

(Laughter.) But to our surprise, the Australian government has listened to us and agreed to double its investment in global health and development (another $6.2 billion).

It felt like -- (Applause) It felt like an incredible validation.

By uniting citizens, we have helped persuade governments to do the unthinkable and act to solve problems beyond their borders.

But the problem is that it didn't last long.

The government changed and after 6 years all the new money was gone.

what have we learned?

I learned that a one-off spike is not enough.

We needed a sustainable movement, not one susceptible to political mood swings and signs of economic downturn.

And it needed to happen everywhere. Otherwise, every government would have built-in excuse mechanisms that they cannot carry the burden of global action on their own.

So we set out to do this.

And when we set out on this challenge, we asked ourselves, how can we gain enough pressure and build an army large enough to win these battles over the long term?

I could only think of one way.

We needed to somehow transform the short-term excitement of those involved in the Making History of Poverty campaign into a long-term passion.

It had to be part of their identity.

So in 2012, I co-founded an organization with exactly that goal.

And there was only one name: Global Citizen.

But this is not about any particular organization.

This is for citizens to take action.

And according to research data, only 18% of the total population that cares even about global issues are doing something about them.

It's not that people don't want to act.

We often don't know how to act or believe that our actions have no effect.

So we had to somehow recruit and activate millions of people in dozens of countries to pressure their leaders to act altruistically.

In doing so, we discovered something truly thrilling. When you make global citizenship your mission, you suddenly find yourself with a wonderful ally.

Extreme poverty is not the only fundamental global problem.

So are climate change, human rights, gender equality, and even conflict.

We find ourselves standing shoulder to shoulder with people who are passionate about tackling all these interrelated issues.

But how did they actually recruit and engage global citizens?

Yes, we used the universal language of music.

We launched the Global Citizen Festival in Central Park, New York City, and persuaded some of the world's leading artists to participate.

We have ensured that these festivals coincide with the meetings of the United Nations General Assembly so that leaders who need our voices to be heard cannot ignore them.

However, there were twists and turns that tickets could not be bought.

had to earn it.

You need to take action for a global cause, and only if you do it will you earn enough points to qualify.

Activism is currency.

I was not interested in citizenship purely as some sort of feel-good thing.

To me, citizenship meant that we had to act, and that's what we wanted.

And surprisingly it worked.

Last year, more than 155,000 citizens in the New York area alone earned enough points to qualify.

Currently, citizens are registered in more than 150 countries around the world.

And last year, we signed up over 100,000 new members each week throughout the year.

You see, we don't have to create global citizens out of thin air.

we are already everywhere.

All you need is the preparation and motivation to take action.

Here, I believe, we can learn a lot from Davinia, who began her global citizenship journey in 2012.

Here's what she did:

It wasn't rocket science.

She started writing letters and emailing politicians' offices.

She did volunteer work in her local community.

That's when she began to be active on social media and collect hefty pennies.

Now, that may not sound like a big deal to you.

How does it accomplish anything?

Well, she wasn't alone, so it accomplished a lot.

Her actions, like those of 142,000 other global citizens, have led to a doubling of the US government's investment in the Global Partnership for Education.

And Dr. Raj Shah, Director of USAID, is making the announcement.

When thousands of global citizens draw inspiration from each other, the combined power is amazing.

Global citizens like Davinia helped persuade the World Bank to increase investment in water and sanitation.

This is World Bank President Jim Kim, who announced a $15 billion grant on stage at Global Citizen, while Indian Prime Minister Modi announced his commitment to have toilets in every home and school across India by 2019.

Encouraged by late-night TV host Stephen Colbert, people around the world launched a Twitter invasion of Norway.

The country's prime minister, Erna Solberg, received this message and promised to double invest in girls' education.

Citizens of the world joined Rotarians in calling on the governments of Canada, the United Kingdom, and Australia to increase their investment in polio eradication.

Together they donated $665 million.

Despite this momentum, however, we face some major challenges.

You may be wondering how to convince world leaders to keep the focus on global issues.

In fact, American politician Tip O'Neill once said, "All politics is local."

That is why we always elect politicians. That is, to seek, acquire, and hold power through the pursuit of local interests or the best national interest.

The first time I experienced this was when I was 21 years old.

I met with the then-Australian Foreign Affairs Minister, who remained anonymous -- [Alexander Downer] (laughter) and behind closed doors shared with him my passion for ending extreme poverty.

I said, 'Sir, Australia has a once-in-a-lifetime opportunity to help achieve the Millennium Development Goals.

I can do it. "

And then he stopped, looked down at me with cold, negative eyes, and said, "Huh, nobody cares about foreign aid."

But he didn't use the word "funk".

he continued.

He said we need to take care of our backyard first.

I think this is an outdated and even dangerous way of thinking.

As my late grandfather would say, complete BS.

Parochialism brings about this false dichotomy because it pits the poor in one country against the poor in another.

It pretends that we can isolate ourselves and our nations from each other.

The whole world is our backyard and we ignore it at our peril.

Look, look what happened when we ignored Rwanda, when we ignored Syria, when we ignored climate change.

With the effects of climate change and extreme poverty on our doorstep, political leaders should "funk."

Well, citizens of Earth, they understand this.

We live in an era that favors global citizens, an era in which all voices are heard.

Remember when the Millennium Development Goals were signed in 2000?

At the time, all we could do was fire the letter and wait for the next election.

There was no social media;

Today, billions of people have more tools, access to more information, and more influence than ever before.

Both the problem and the tools to solve it are in front of us.

The world has changed and we are on the right side of history as we look beyond borders.

So where are we?

So we run this great festival and we have some big policy wins and national signatures all over the world.

But have we done our job?

no.

We still have a long way to go.

But I see this as an opportunity for me.

The concept of global citizenship, logically self-evident but hitherto impractical in many respects, coincided with this special moment in which we are privileged to live.

As global citizens, we have a unique opportunity to accelerate large-scale positive change around the world.

In the coming months and years, therefore, global citizens will hold world leaders accountable for ensuring that new global goals for sustainable development are tracked and implemented.

Global citizens partner with the world's leading NGOs to eradicate diseases such as polio and malaria.

Global citizens sign up anywhere on the planet, increasing the frequency, quality and impact of action.

These dreams are within reach.

Imagine an army of millions growing into tens of millions, connected, informed, actively engaged, unwilling to accept the answer of no.

Over the years, I have tried to reconnect with Sonny Boy.

Unfortunately I couldn't do that.

We met long before social media and, as is often the case in the slums, his address has now been moved by the authorities.

I want to sit with him wherever he is and share how much his time in Smoky Mountain inspired me.

Thanks to him and many others, I have come to understand the importance of being involved in people's movements. Children are happily trying to look at the world, global citizens, through screens.

A global citizen who unites, asks "why?", rejects the naysayers and embraces the amazing possibilities of the world we share.

I am a global citizen.

you?

thank you.

(applause)

[On April 3, 2016, we witnessed the largest data breach in history. ] [The Panama Papers exposed the rich and powerful] [Hiding large sums of money in offshore accounts. ] [What does this mean?] [I called Robert Palmer of Global Witness to explain] A lot of news came out this week from the leak of 11 million documents from a Panama-based law firm called Mossack Fonseca.

The release of these documents from Panama reveals just a veil of the secretive offshore world.

We can gain insight into how customers, banks, and lawyers come to companies like Mossack Fonseca and say, "Okay, I want an anonymous company, can you give it to me?"

So you can actually check your email, see the exchange of messages, see how this all works, how it works.

Well, this is already starting to have an immediate impact.

The prime minister of Iceland has resigned.

There was also news that allies of the brutal Syrian dictator Bashar al-Assad had also acquired offshore companies.

Allegations have surfaced that a $2 billion fund trail traced to Russian President Vladimir Putin, his childhood friend and top cellist.

And there are probably a lot of wealthy people in the world, and there will be others who are uneasy about the next set of stories, the next set of leaked documents.

Now, this sounds like the plot of a spy thriller or a John Grisham novel.

It seems very far from you and me and the general public.

Why should I care?

But the truth is that when wealthy and powerful individuals keep their money abroad and don't pay the taxes they're supposed to pay, they spend less money on critical public services like health care, education and roads.

And it affects us all.

Well, for my organization, Global Witness, this revelation was astonishing.

Media and political leaders around the world are talking about how individuals can use offshore secrets to hide or disguise their assets. This is what we have been talking about and exposing for 10 years.

Now, I think a lot of people find this whole world mysterious and confusing and hard to understand how this kind of offshore world works.

I like to think of it like a Russian doll.

Thus, one company may be stacked within another, or within another, making it almost impossible to really understand who is behind these structures.

It can be very difficult for law enforcement, tax authorities, journalists and civil society to really understand what is going on.

I also find it interesting that there is less coverage on this issue in the United States.

Perhaps it's because some prominent figures in the United States are completely unaware of this revelation and scandal.

Now, it's not because there are no wealthy Americans hiding assets overseas.

It's just that Mossack Fonseca's American customers are declining because of the offshore system.

If you look at leaks from the Cayman Islands, or Delaware, Wyoming, Nevada, I'm sure you'll find many more incidents and cases going back to the Americans.

In fact, many US states require less information to get a job at a company than to get a library card.

Such secrecy in America has allowed school district officials to steal money from schoolchildren.

This has made it possible for scammers to defraud vulnerable investors.

This is the kind of behavior that affects us all.

Now, Global Witness wanted to see what this would look like in action.

How does this work in practice?

So what we did was send undercover agents to 13 law firms in Manhattan.

Our investigators posed as African ministers seeking to transfer the suspect's funds to the United States in order to purchase homes, yachts and jets.

Now, what really struck me was that all but one of the lawyers offered investigators suggestions on how to move the suspected funds.

These were all pre-meetings, and none of the lawyers accepted us as clients, and of course no money moved, which clearly shows the problem with this system.

It is also important not to consider this as an isolated case only.

This isn't just about the individual lawyers who have spoken with our undercover investigators and made suggestions.

It's not just about certain senior politicians embroiled in scandals.

This is a question of how the system that perpetuates corruption, tax evasion, poverty and insecurity.

The game needs to change to deal with this.

The rules of the game need to be changed to make this kind of behavior difficult.

This may seem like fate or depression, as if there is nothing we can do, as if nothing has changed, as if there will always be wealthy and powerful individuals.

But as natural optimists, I think we are starting to feel some change.

Over the last few years, there has been a real push to improve transparency regarding corporate ownership.

The issue was put on the political agenda by British Prime Minister David Cameron at the massive G8 summit in Northern Ireland in 2013.

And from then on, the European Union would create a central register at the national level of who actually owns and controls companies across Europe.

One sad thing is that the US is actually lagging behind.

Bipartisan bills have been introduced in the House and Senate, but have not made the progress we hoped.

Therefore, we really hope that the Panama leak, this huge information peek into the offshore world, will be used as a vehicle to be opened up in the United States and around the world.

For us at Global Witness, it's time for change.

We need to make the public angry at the way people hide their identities behind secret companies.

We need business leaders to stand up and say, "secrets like this are bad for business."

We need our political leaders to be made aware of this issue and commit to changing the law to expose this type of secret.

Together, we can end the secrecy that currently allows tax evasion, corruption and money laundering to flourish.

I have spent the last 38 years trying to keep a low profile.

I'm a copyeditor.

I work for the New Yorker, and copyediting for The New Yorker is like playing shortstop for a Major League Baseball team. Every little move is picked up by critics. Make no mistake.

To be clear, copyeditors don't choose what they put in the magazine.

We work at the level of sentences, perhaps paragraphs, words and punctuation marks.

Our business is in the details.

Place the diaeresis, or double dot, above the ``i'' in ``naïve''.

We impose our home style.

All publications have a house style.

The New Yorkers are particularly distinctive.

We are sometimes teased for our style.

Please try to imagine. We still spell the word "teen-ager" with hyphens as if it had just been coined.

But the hyphen in "teenage" and the diaeresis in "cooperation" tell you you're reading The New Yorker.

Copy editing at The New Yorker is a mechanical process.

A related role is called query proofing or page OK.

Copy-editing is mechanical, but query proofing is interpretive.

Through our editors, we make suggestions to authors to improve the emphasis of their writing, point out unintended repetition, and offer compelling alternatives.

Our aim is to make the author look good.

Note that we do not provide proofs directly to authors, but to editors.

This often creates a good cop/bad cop relationship where the copyeditor (I use it as an umbrella term) is always the bad cop.

When we do our job well, we stand out, but when we make a mistake, the copy editor stands out quickly.

Here is the latest mistake put on my front door.

[Last Tuesday, Sarah Palin, the epitome of pre-Trump Republican populist nihilism, endorsed Trump. ] "Where Was The New Yorker's Legendary Copy Editor?" wrote a reader.

"Isn't what the writer meant to say 'ignorance'?"

ah.

There is no excuse for this mistake.

But I like the principle of doing nothing.

It may mean "nihilism" in American terms.

(Laughter) Here another reader quotes a passage from a magazine. [Ruby was 76, but she maintained an authoritative demeanor. Her unsteady gait alone made her age unbelievable] He added: "Certainly someone at The New Yorker knows the meaning of 'believed' and knows that it is the opposite of the meaning used in this sentence.

come! please do it together ”

Billy: Giving the wrong impression.

It should have been "betrayed".

E.B. White once wrote of the comma in The New Yorker, "The comma falls with the precision of a knife outlining a corpse."

(Laughter) It's true - there are a lot of complaints about commas.

"Does 'Martin Luther King, Jr., Boulevard' really have two commas?"

It may not be written on the sign, but yes, that's New Yorker-style "Junior".

One old lady wrote: [“Please, can you ban this comma maniac from the editorial staff, or at least detain it?”] (Laughter) Oh yeah.

The commas are well placed, except that in this case there should be no comma between "maniac" and "on".

(Laughter) Also, if you need to put commas around "at least", you can also use dashes around that phrase to change it: "... -- or at least suppress --" Perfect.

(Applause.) Then he said, "I love you, I love your magazine, but could you please stop writing lots of numbers as text?"

[2.5 million…] No.

(Laughter) A final note from the spelling obsessed: ["Those long strings are vocal cords, not cords."] An outraged reader said, "I'm sure I wasn't the first to write about this terrible proofreading mistake, but I'm equally sure I wasn't the last.

Be! "

(laughs) I used to like receiving emails.

There is an agreement between writers and editors.

Editors never sell writers, never publish bad jokes or overlong stories that had to be cut.

A good editor saves a writer from going too far.

I also have the code in the copy editor. We do not advertise our oversights.

I think it would be disingenuous to reveal it here, so let's see what is right for us to do.

Somehow, I have a reputation for being tough.

But I work with writers who know how to get their way.

I've known Ian Frazier aka "Sandy" since the early 80's.

And sometimes he writes things that give copy editors pause, but he's one of my favorites.

This is one of the stories about Staten Island after Hurricane Sandy. [The wharf, broken in the middle and missing the other half, slanted towards the water, its supporting pipes and wires leaning forward as if you had opened a box of linguine and slid down. ] (Laughter) This would never have gone through the minds of the old grammarians.

But what can you do?

Technically, "like" should be "as", but it sounds silly, as if the author were trying to embark on Homer's extended metaphor "like when you open a box of linguine."

(Laughter) I decided the hurricane did poetic justice for Sandy and decided to reserve judgment.

(Laughter) Usually when I think something is wrong, I call three times.

Just recently, when I thoughtlessly mentioned it to Sandy, he said, "Only three?"

So he learned to endure.

Recently, he wrote short articles for the first section of the magazine Talk of the Town on subjects ranging from the Ricky Jay exhibition at the Metropolitan Museum of Art to the introduction of the doggy bag in France.

Sandy's talk was about Supreme Court Justice Sonia Sotomayor's return to the Bronx.

There were three things I had to challenge in that.

First, a grammatical query.

The judge was dressed in black, and Sandy writes [her face and hands stood out like an old, almost dark painting] Now, unlike in the case of a hurricane, in this "like" case the author had no excuse to describe the damage of the hurricane.

"Like" in this sense is a preposition, and a preposition receives an object, a noun.

This "like" must be "as".

"Like an old, almost dark painting."

Second, there is the issue of spelling.

The author was quoting a judge's aide: ["It will be over in a minute.

We're on the mic for justice. ”] On the mic?

The music industry spells it "mic" because it's spelled that way on the device.

I had never seen it used as a verb in this spelling before, so the thought of "mic'ed" appearing in a watch magazine freaked me out.

(Laughter) The New Yorker abbreviation for "Mike" is "Mike."

Finally, there was the annoying grammatical and usage problem that pronouns must have the same grammatical number as their antecedents.

[everyone nearby holds their breath] "They" is plural and its antecedent "everyone" is singular.

I would never say "everyone was there".

everyone was there. everybody's here

But people often say things like, "Everyone was holding their breath."

To give it some legitimacy, copy editors call it "the singular 'they'". It's as if calling it singular makes it no longer plural.

(Laughter) When I see it in print, it's my job to do my best to eliminate it.

"Everyone held their breath" or "Everyone held their breath" or "Everyone held their breath" was impossible for me.

I had to blend in with whatever I suggested.

I asked through my editor if they would consider changing it to "everyone around me held their breath" since "everyone" is plural.

no.

I asked again, "Was everyone there holding their breath?"

I thought this sounded vaguely judicial.

However, the editor pointed out that ``now'' and ``now'' cannot be in the same sentence.

When the final evidence came back, the author had accepted "as" for "like" and "miced" for "mic'ed."

However, in the scene where "everybody held their breath" he stood his ground.

2 out of 3 are not bad.

In the same issue, there was an article about doggy bags in France, where the French used the F word unfairly.

Readers will be even more offended when the mail arrives.

(laughs) Thank you.

(applause)

How does news shape the way we see the world?

Here we show the world based on appearance, based on land.

And here's how news shapes how Americans look.

This map -- (Applause) -- This map shows the number of seconds that American network and cable news organizations provided news stories by country exactly one year ago, in February 2007.

Well, this month was the month when North Korea agreed to dismantle its nuclear facilities.

Massive floods have occurred in Indonesia.

And in Paris, the IPCC presented findings confirming the human impact on global warming.

The United States accounted for 79 percent of all news coverage.

And if you look at the remaining 21 percent, excluding the United States, you see a lot of Iraq. It's the big green one there and very little else.

For example, the combined coverage of Russia, China and India reached just 1%.

After analyzing all news articles and removing just one article, the world looked like this:

what was the story? Death of Anna Nicole Smith.

The story overshadowed every country except Iraq and received ten times more coverage than the IPCC report.

And the cycle continues. As we all know, Britney is getting pretty big these days.

So why not ask more about the world?

One reason for this is that news networks have halved the number of overseas bureaus.

With the exception of one ABC mini station in Nairobi, New Delhi and Mumbai, there are no network news stations across Africa, India or South America, home to over two billion people.

The reality is, it's cheaper to cover Britney.

And seeing where people go for news makes this lack of global coverage all the more disturbing.

Local TV news is very influential, but unfortunately only 12 percent of its coverage is devoted to international news.

But what about the web?

The most popular news sites don't perform as well.

Last year, Pew and the Columbia J School analyzed 14,000 articles on the Google News front page.

And in fact they covered the same 24 news events.

Similarly, a study of electronic content found that much of the global news by U.S. news producers repurposed stories from the Associated Press and Reuters and did not put things in context that people could relate to.

So, all this together might help explain why today's college graduates and less-educated Americans know less about the world than they did 20 years ago.

And if you think it's just because we're not interested, you're wrong.

In recent years, more than 50% of Americans say they follow world news closely most of the time.

The real question is, is this warped worldview what Americans want in an increasingly interconnected world?

we know we can do better.

And can you afford not to? thank you.

Another reason for my optimism is climate change.

Believe it or not, this is a fact.

On December 12, 2015, 195 governments met in Paris under the umbrella of the United Nations to unanimously decide to deliberately change the course of the global economy to protect the most vulnerable and improve the lives of all of us – anyone who has ever worked with governments knows how difficult that is.

This is an amazing achievement.

(Applause.) But it's even more remarkable given the circumstances we were in just a few years ago.

2009, Copenhagen.

Anyone remember Copenhagen?

Now, after years of striving for a climate change deal, the same government convened in Copenhagen and failed miserably.

Why did it fail miserably?

The reasons vary, but the main reason is the deep-seated chasm between the Global North and the Global South.

So now, six months after this failure, I have been called to take charge of the global climate change negotiations.

You can imagine the perfect moment to start this new job.

The global mood on climate change has been trashed.

No one believed that a global agreement could be achieved.

In fact, so did I.

If you promise not to tell anyone but this amazing TED audience, I'll reveal a secret that has been thankfully buried in history.

At my first press conference, a journalist asked, "Well, Mr. Figueres, do you think a global agreement is possible?"

And without thinking, I heard me say, "Never in my life."

Now, you can imagine my team of reporters horrified by this crazy Costa Rican woman as their new boss.

And I was terrified too.

Now that I am a little more comfortable with myself, I am not afraid of myself.

I was genuinely horrified by the consequences of what I just said, and the consequences for the world all our children will have to live in.

Frankly, it was a terrible moment for me, and I was like, well, no, wait, wait.

Impossible is an attitude, not a fact.

it's just an attitude.

And I decided to change my attitude on the spot and help change the world's attitude to climate change.

So I don't know -- no, that's all? thank you.

I don't know -- what would you do if you were told your job was to save the planet?

Please include it in your job description.

And while you have full responsibility, you have no authority at all, as you are sovereign over every decision the government makes.

Well, I would love to know what you do on the first Monday morning, here's what I did. I panicked.

(Laughter) Then I panicked again, realizing that I had absolutely no idea how to solve this problem.

And then I realized that I have absolutely no idea how to solve this problem. But one thing I do know is that the tone of this conversation has to change.

Because you can't bring victory without being optimistic.

I'm using optimism here as a very simple term, but let's understand it in a broader sense.

Let us understand it as courage, hope, trust, solidarity, and the fundamental belief that we humans can come together and help each other to better the destiny of humanity.

Well, you can imagine how I thought I wouldn't be able to get out of Copenhagen's paralysis without it.

And for six years I've been stubbornly, relentlessly injecting optimism into the system no matter what questions the press ask me, and I've gotten better at those questions, and whatever the evidence to the contrary.

Believe me, there is plenty of evidence to the contrary.

But the system is permeated with relentless optimism.

And soon, changes began to take place in many areas, caused by thousands of people, including many of you here today, and thank you.

And I wouldn't be surprised to say that this TED community is the first area where we've seen noticeable change...

technology.

We are beginning to see that clean technologies, especially renewable energy technologies, are starting to lower prices and increase capacity, and we are now already to the point of building centralized solar power plants with the capacity to power entire cities, not to mention what we are doing in mobility and intelligent buildings.

And with this technological change, we began to understand that the economic equation was changing. This is because we were able to recognize that climate change is costly and that the risks are compounded.

But there are also economic and intrinsic advantages. Because the spread of clean technologies will bring cleaner air, better health, better transport, more livable cities, more energy security and greater energy access to developing countries.

In short, a better world than the one we have now.

And with that understanding, indeed, some of you must have witnessed the ingenuity and excitement first spreading through non-state governments, the private sector, industry leaders, insurance companies, investors, city leaders, and faith communities. Because they all started to realize that this could actually be to their advantage.

This can actually improve your bottom line.

And it wasn't just the usual suspects.

Earlier last year, the CEO of a major oil and gas company had to come up to me and say, Personally, of course, he wasn't sure how he was going to change his company, but he was interested in its long-term viability, so he said he would.

Now, we are now changing the economic equation, and with it, with widespread support from all of you, it didn't take long for governments to realize the fact that this was in their national interest.

And when we asked countries to start identifying how they could contribute to the global effort based on their national interests, 189 out of 195 countries submitted comprehensive climate change plans based on their national interests and aligned with their priorities as well as their national sustainable development plans.

If we could protect our core national interests, we would understand that the nation was ready to begin converging on a common path, a common direction. It will probably take decades, but those decades will bring us to a new economy, a decarbonized and highly resilient economy. And while the national contributions currently on the table on behalf of governments are insufficient to get us to a stable climate, they are only the first steps and will improve over time.

And the measurement, reporting and verification of all these efforts is legally binding.

And the checkpoints we carry out every five years to assess collective progress towards our goals are legally binding, as is the path to a decarbonized and more resilient economy itself.

And here is the more important part. What did you have before?

A very small number of countries made very reduced short-term emission reduction commitments, which were perceived to be wholly inadequate and largely burdensome.

Well, what do we have?

All the countries of the world are now contributing in different areas and with different intensities from different approaches, all of which contribute along the path of environmental conservation towards a common goal.

Now, putting all this in place and changing this understanding, we see that the government was able to go to Paris and adopt the Paris Agreement.

(Applause) So, when I look back over the past six years, I first recall the day the Paris Agreement was adopted.

The euphoria throughout the room cannot be described in words.

5,000 people jumped out of their seats, crying, clapping, screaming, screaming, torn between euphoria and still disbelief at what they had just seen. Because so many people have been working towards this for years and this has finally become their reality.

And it wasn't just the direct participants.

A few weeks ago I was with a colleague trying to decide which Tahitian pearls he wanted to gift his wonderful wife Natasha.

And when he finally decided what to buy, the jeweler told him, “You are very lucky that you can buy this now because these pearls could soon become extinct due to climate change.”

"But," said the jeweler, "you hear, the government has just made a decision, and Tahiti may have a chance."

Well, perhaps it's a great confirmation that there is hope and opportunity here.

I was the first to realize that I still have a lot of work to do.

We are just beginning to tackle climate change.

And indeed, we need to double down on our efforts over the next five years—the five years of urgency.

But we believe we have gone from impossible to now unstoppable in the last six years.

So how did they do it? By infusing transformative optimism, we were able to move from conflict to cooperation, to understand that national and local interests are not necessarily in conflict with global needs, and that if we understand that, they can be brought together and blended harmoniously.

And when we look to other global issues that need our attention in this century — food security, water security, home security, forced migration, etc. — we find that we certainly still don't know how to solve those problems.

But one page of what we've done on climate change shows that we need to reinterpret the zero-sum way of thinking.

Because we have been trained to believe that there will always be winners and losers and that your loss is my gain.

Well, now that we have reached the planetary boundaries and in a world where we are not only interconnected but increasingly interdependent, what you lost is no longer my gain.

Either we are all losers or we are all winners.

But you have to decide between zero and sum.

We have to choose between giving everyone zero profit or living life as the sum of everyone.

We have done it once. I can do it again.

thank you.

(applause)

(music) Amanda Palmer (singing): Ground control to Major Tom, Ground control to Major Tom, take a protein pill and put on your helmet.

Al Gore: 10, 9, 8, 7, 6...

AP: Ground control to Major Tom, AG: 5, 4, 3, 2, 1... AP: Start countdown, engines on.

Check ignition. May God's love be with you.

AG: Please take off.

AP: This is Ground Control for Major Tom. you really did well. And the newspapers want to know whose shirt you're wearing.

Come out of the capsule if you dare.

"This is Ground Control Major Tom, I'm walking through the door and I'm floating in the strangest way, and the stars look quite different today.

Because here I am, hovering around a tin can.

High above the world, the earth is blue, and there is nothing I can do. ”

(music) "After 100,000 miles, I feel very calm and I think my spaceship knows where to go.

Tell my wife I love her so much, she knows too. ”

Tell ground control to Major Tom. Circuit is down. Something is wrong.

Can you hear me, Major Tom?

Can you hear me, Major Tom?

Can you hear me, Major Tom?

you can ...

"Here I am, far above the moon, floating around a tin can.

The earth is blue, so there is nothing I can do.

(music) ["I am not a prophet or stone age man. I am a potential Superman...

...I stay alive. David Bowie, 1947-2016] (Applause)

I will be 44 years old next month, and I have a feeling that 2044 will be a very good year, a year of fulfillment and realization.

I felt that way not because of anything special, but because I read in Norman Mailer's 1968 book, "This year will be a good year."

"He felt his age, 44..."

In The Army of the Night, Mailer writes, "It was as if he had arrived, as if he had embodied his bones, muscles, heart, mind, and feelings as a man."

Yes, I know Mailer didn't write about me.

But I also know he was. For all of us, you and I, the subjects of his books age more or less in step, progressing from birth along the same grand order. Adolescent liberation and frustration. Authority and stele to adulthood. Recognition and resignation of old age.

Life has patterns and they are shared.

Thomas Mann wrote: "The same thing that happened to them will happen to me."

We are not simply living these patterns.

We record them too.

We write them down in books, where they become stories that we can read and recognize.

Books tell us who we were, who we are, and who we will be.

They have been doing so for thousands of years.

As James Salter wrote, "Life is a few pages when you move on."

So six years ago, an idea came to my mind. If life spans the page, then somewhere there must be an article written about every era.

If you can find them, you can put them together to make a story.

I was able to assemble them into a whole life, a long life, a hundred years of life, and the same big chain that the luckiest among us go through.

I was 37 years old at the time, William Trevor writes, and I was "of a sensible age."

I tended to meditate on time and age.

It was clear long ago that due to family illnesses, and my subsequent injuries, I could not expect to grow old.

On top of that, getting older only procrastinates the inevitable, and over time I've realized that the situation is otherwise.

I was a little disappointed.

However, the list is long-lasting.

Chronicling life by fragile years is about embracing the fleeting and grounding, and will give myself and others a glimpse into the future, whether we get there or not.

And when I started making the list, I was immediately hooked and searched page after page.

We spent every stage of our first 100 years here.

"Age 27...A time of sudden revelation", "Age 62...A time of subtle decline".

Of course, I had in mind that such insights are relative.

First of all, we now live longer and age slower.

Christopher Isherwood used the term "yellow leaf" to describe a 53-year-old man, just a century after Lord Byron used it to describe himself at 36.

(Laughter) I was also aware that life can change wildly and unpredictably from year to year, and that people of the same age can have different experiences.

But still, as the list consolidated, the page also reflected, in mirror-clear clarity, the life I had lived. At 30, he emerged from the "wasteland of preparation for an active life." At age 40, I learned, "...to gently close the door of a room you'll never return to."

I was there

Of course we are all there.

The great graphic designer Milton Glaser, who created beautiful visualizations like the one you see here, is now 85 years old, and Nabokov describes these years as “maturity and apotheosis,” pointing out that literature, like art and color, helps us remember what we have experienced.

In fact, when I shared the list with my grandfather, he nodded in approval.

At the time he was 95 years old and soon died, Roberto Bolaño wrote, "It's the same as not dying."

And in retrospect, he told me, Proust was right, in the same way that we are sure that we will not die at 22, in the same way that a thanatologist named Edwin Schneidmann claimed that we will certainly not die at 90.

It happened to him as it did to them.

The list is now complete. 100 years.

And looking back, I see that it's not over yet.

I still have life and still many pages to go through.

Wait for 44, with mailers in mind.

thank you.

(applause)

period.

Blood.

Menstruation.

gross.

secret.

hidden.

why?

A natural biological process that all girls and women experience each month for about half of their lives.

A phenomenon so important that the survival and reproduction of our species depend on it.

But we consider it taboo.

We feel awkward and ashamed to talk about it.

When I got my first period, I was told to keep it a secret from everyone else, even my father and brother.

Later, when this chapter appeared in textbooks, biology teachers skipped the subject.

(laughter) You know what I learned from that?

I've learned that it's really embarrassing to talk about it.

I have learned to be ashamed of my body.

I've learned to ignore my periods in order to stay sane.

Studies across India show that 3 out of 10 girls are unaware of their menstruation when they have their first period.

And in some parts of Rajasthan, the figure is so high that 9 out of 10 girls are unaware of it.

Most of the girls I've talked to, who didn't know about periods when they had their first period, would be surprised to learn that they had blood cancer and thought they were going to die soon.

Menstrual hygiene is a very important risk factor for genital tract infections.

But in India, only 12 per cent of girls and women have access to hygienic ways to manage their periods.

If you do the math, 88% of girls and women manage their periods in unhygienic ways.

I was one of them.

I grew up in the small town of Galwa in Jharkhand, where even buying sanitary pads was considered shameful.

So when my period started to set, I started by using a rag.

Always wash and reuse after use.

But when I stored it, I hid it in a dark, damp place so no one could find out I was on my period.

Repeated washing made the rag rougher, and I often got rashes and infections when using it.

I wore this for 5 years already until I left that town.

Another problem menstruation has brought into my life is the social restrictions imposed on menstruating girls and women.

I'm sure you all know this, but for those who don't know, I'll list it here.

We were not allowed to touch or eat the pickles.

I was not allowed to sit on the sofa or other family members' beds.

I had to wash my bed sheets after every period, even if they weren't dirty.

I was considered unclean and forbidden to worship or touch anything of religious significance.

Signs outside the temple prohibit menstruating girls and women from entering.

Ironically, most often in the family it is the older women who impose such restrictions on young girls.

After all, they grew up accepting such restrictions as the norm.

And without intervention, myths and misconceptions are passed on from generation to generation.

Over the years I have worked in this field, I have also come across stories about girls having to eat and wash dishes separately.

In some families, women are not allowed to take a bath during their period and are isolated from other family members.

About 85 percent of Indian girls and women follow one or more restrictive habits regarding their monthly periods.

Can you imagine what effect this would have on a girl's self-esteem and self-confidence?

What psychological trauma is this affecting every aspect of her character, academic performance, and early formative development?

I have adhered to all of these restrictive practices for 13 years until a discussion with my partner Tuhin changed my perception of menstruation forever.

In 2009 Tuhin and I were pursuing a graduate degree in design.

We fell in love with each other and felt comfortable discussing periods with him.

Tuhin knew very little about menstruation.

(Laughter) He was surprised to learn that the girl had painful cramps and bled every month.

(Laughter) Right.

He was completely shocked to learn about the restrictions imposed by family and society on menstruating girls and women.

To cure my cramps, he did some research on the internet about menstruation.

When he shared his findings with me, I realized how ignorant I was about menstruation.

And it turns out that many of my beliefs are actually myths.

We wondered then. If we are well educated and yet so ignorant about menstruation, millions of girls out there will remain ignorant.

To research and better understand this issue, I conducted a year-long study to study the lack of awareness about menstruation and the root causes behind it.

Ignorance and misconceptions about menstruation are commonly believed to be a rural phenomenon, but as research progressed, it turned out to be an urban phenomenon as well.

And it exists in the educated urban class as well.

After talking to many parents and teachers, I found that many of them actually want to educate premenstrual girls about periods.

And—but they themselves had no suitable means.

And because it is taboo, they feel restrained and ashamed to talk about it.

Currently, girls get their periods in classes 6 and 7, but our educational curriculum only teaches menstruation in standard classes 8 and 9.

And teachers still ignore this subject altogether because it is taboo.

That's why schools don't teach girls about periods, and parents don't talk about them.

where are the girls going

20 years ago and now nothing has changed.

I shared these findings with Tuhin and wondered what it would be like to create something that would help girls understand their own periods, something that parents and teachers could feel comfortable talking about with young girls.

During my research, I was collecting a lot of stories.

These are the experiences of menstruating girls.

These stories will make girls curious and interested in talking about menstruation in their close circle.

that's what we wanted.

We wanted something that would interest the girls and make them want to learn about it.

We wanted to use these stories to teach girls about periods.

So we decided to create a comic book where cartoon characters act out these stories and educate girls about menstruation in a fun and engaging way.

We have three characters to represent the girls in different stages of puberty.

Pinky, who hasn't gotten her period yet, Jiya, who has her period in the story of the book, and Mila, who has already started her period.

There is a fourth character, Priya Didi.

Through her, girls get to know different aspects of growth and menstrual hygiene.

In creating this book, we have taken great care to ensure that none of the illustrations are offensive or culturally sensitive.

During the prototype testing, we found that the girls loved the book.

They read the book with enthusiasm and wanted to learn more about periods for themselves.

Parents and teachers used the book to inform young girls about menstruation, and sometimes boys read it with interest.

(Laughter) (Applause) This cartoon helped create an environment where menstruation is no longer taboo.

Many volunteers have personally used the prototype to educate girls and conduct awareness workshops on menstruation in five different states of India.

One of the volunteers then brought this prototype to this monastery in Ladakh to educate young monks.

We created the final version of the book, Menstrupedia Comic, and launched it last September.

And so far, more than 4,000 girls in India have been educated using the book. And -- (applause) Thank you.

(Applause.) And ten countries.

We are constantly translating this book into different languages ​​and working with local organizations to make this book available in different countries.

Fifteen schools in different parts of India are teaching girls about menstruation with this book as part of their school curriculum.

(Applause.) It's amazing to see how volunteers, individuals, parents, teachers, and school principals have come together to bring this menstrual awareness campaign into their communities, to ensure girls are learning about menstruation at the right age, and to help break this taboo.

I dream of a future where menstruation is neither a curse nor a disease, but a welcome change in a girl's life.

And I will -- (applause) And I'd like to end this with a small request to all the parents here.

Dear Parents, if you are embarrassed about your period, your daughters should be embarrassed as well.

So keep your period positive.

(laughs) Thank you.

(applause)

How do you find dinosaurs?

Think it's impossible?

it's not.

And the answer depends on the formula that all paleontologists use.

And I will tell you the secret.

First, find a stone of the right age.

Second, those rocks must be sedimentary rocks.

And third, those rock layers must be naturally exposed.

that's it.

If you find these three and land on the ground, you'll have a better chance of finding a fossil.

Let's break down this formula.

Organisms exist only during certain geological periods.

Therefore, you need to find the right age stones according to your interests.

If you want to find trilobites, you have to find really, really old rocks from the Paleozoic, rocks that are 500 to 500 million years old.

Now, if you want to find dinosaurs, don't look for the Paleozoic. No dinosaur found.

They hadn't evolved yet.

We have to find young Mesozoic rocks, 235 to 66 million years old in the case of dinosaurs.

Well, the earth is loosely geologically mapped, so it's fairly easy to find rocks of the right age at this point.

This is hard-earned information.

The chronicles of Earth's history are written in rock chapter by chapter, with the oldest pages on the bottom and the youngest on the top.

Well, geologists would be delighted if it were that easy.

it's not.

Earth's library is old.

There is no librarian to give order.

A myriad of geological processes operating over vast amounts of time give ancient rocks all kinds of possibilities.

Most pages are discarded immediately after being written.

Some pages are overwritten, creating a hard-to-decipher palimpsest of a long-gone landscape.

A page that finds sanctuary under the sands of time progression is never truly safe.

Unlike our dead, rocky companion, the Moon, the Earth is alive, pulsing with creative and destructive forces that fuel geological metabolism.

All the moon rocks brought back by the Apollo astronauts date back to the time of the solar system.

Moon stones are eternal.

Earth's rocks, on the other hand, face the danger of a living lithosphere.

A combination of cutting, compressing, bending, tearing, scorching, and baking will destroy all things.

Thus, the volumes of Earth's history are incomplete and disordered.

The library is vast and nice, but dilapidated.

And it's this ragged complexity of rock records that obscured its meaning until relatively recently.

Nature did not provide geologists with card catalogs. This needs to be invented.

Five thousand years after the Sumerians learned to record their thoughts on clay tablets, the volume of the Earth remained a mystery to mankind.

We were geologically illiterate, ignorant of the antiquity of our planet, and ignorant of our deep connection with time.

First, it wasn't until the early 19th century that James Hutton's The Earth Theory was published and our blinders were removed. In it, he said, the Earth shows no trace of a beginning or prospect of an end. And the printing of William Smith's map of England provided the first national geological map and the first predictive insight into where particular types of rocks were located.

Then you can say things like, "If you go over there, you should be in the Jurassic period," or, "If you go over that hill, you should be in the Cretaceous period."

So if you want to find trilobites, get a good geological map and go to Paleozoic rocks.

If you want to find dinosaurs like I do, find Mesozoic rocks and go there.

Of course, fossils can only be formed in sedimentary rocks, rocks made of sand and mud.

Fossils do not exist in igneous rocks formed by magma, such as granite, or in metamorphic rocks that have been heated and compressed.

And I have to go to the desert.

Dinosaurs did not live specifically in deserts. They lived on every land and in every conceivable environment.

That means going to places that today are deserts, where there isn't much vegetation covering the rocks, and where erosion is constantly exposing new bone to the surface.

So find these three things. Rocks of the appropriate age in the desert, i.e. sedimentary rocks. Get down to the ground and literally walk until you see bones sticking out of the rock.

This photo was taken in southern Patagonia.

All pebbles on the ground are part of dinosaur bones.

So when you're in that situation, it doesn't matter if you find fossils. You will find fossils.

The question is whether we can find anything scientifically significant.

To help with that, we add a fourth part to our formula. It's about staying away from other paleontologists as much as possible.

(Laughter) It's not that I don't like other paleontologists.

When you go to relatively unexplored places, you are much more likely to find something new to science than just finding fossils.

This is my formula for finding dinosaurs and I have applied it all over the world.

In the Southern Hemisphere summer of 2004, I went to the depths of South America, to the depths of Patagonia, Argentina, to observe dinosaurs. It was in the desert, a place with age-appropriate terrestrial sedimentary rocks rarely visited by paleontologists.

And we found this.

This is the femur of a giant plant-eating dinosaur.

Its bone is 2.2 meters in diameter.

It is over 7 feet long.

Now, unfortunately, the bone has separated.

I dug and dug and dug and there was no more bones.

But it made us want to go back the next year and eat more.

And on the first day of the next field season, I found this. Another two-meter femur, only this time unseparated, this time associated with 145 other bones of a giant plant-eating animal.

And this is what the quarry looks like after three more grueling, really grueling field seasons.

And there I see the tail of that great beast wrapped around me.

The giant sleeping in this tomb, a new kind of dinosaur, we will finally call it "Dreadnoughtus Shurani".

The Dreadnoughtus was 85 feet from nose to tail.

It stood two and a half stories high on the curb, was all animated and fleshed out, and weighed 65 tons.

People sometimes ask, "Was Dreadnoughtus bigger than Tyrannosaurus?"

This is equivalent to the mass of 8 or 9 Tyrannosaurs.

Now, one of the really cool things about being a paleontologist is when you find a new species, you can name it.

And I've always regretted that these giant plant-eating dinosaurs were too often portrayed as passive, rumbling platters of meat on the landscape.

(Laughter.) It's not.

Large herbivores can be surly or territorial. You don't want to mess with hippos, rhinos or water buffaloes.

Yellowstone bison hurt far more people than grizzly bears.

So can you imagine a big breeding bull, a 65-ton Dreadnoughtus, defending his territory?

The animal would have been incredibly dangerous, a menace to its surroundings, and terrifying in and of itself.

Hence the name "Dreadnoughtus", which means "fear nothing".

Now, to get this big, an animal like Dreadnought would have had to be a paragon of efficiency.

Its long neck and long tail help it radiate heat into the environment and passively control temperature.

And its long neck also serves as a super-efficient feeding mechanism.

A dreadnoughtus could stand in one place and sweep a huge plant cover with its neck, taking in tens of thousands of calories while burning very little.

And these animals evolved a bulldog-like spread-leg posture, which gave them immense stability. Because when you weigh 65 tons, literally the size of a house, you fall and die.

Well, these animals are big and tough, but they can't withstand such blows.

Dreadnoughtus falls, breaking a rib and puncturing a lung.

The organ ruptured.

Weighing in at 65 tons, the big Dreadnoughtus will never fall in your life.

Now, after this particular dreadnought carcass was buried and de-fleshed by a multitude of bacteria, worms, and insects, its bones underwent a short period of metamorphosis, exchanging molecules with ground water, becoming more and more like buried rock.

Layers of sediment piled up, the pressure from all sides weighed down like a glove of stone, its firm and enduring grip holding each bone steady.

And it's been a long time...

none.

Age after age of sameness, there is no event without a number.

All the while, the skeleton lay in perfect equilibrium in its rocky tomb, eternally unchanged.

Meanwhile, Earth's history unfolded in the skies.

The dinosaurs will reign for another 12 million years before their hegemony is wiped out by a violent apocalypse.

The continent drifted. Mammals got up.

The ice age has arrived.

And in East Africa, hopeless apes have evolved a strange trick of sentient thought.

These bright primates were neither particularly fast nor strong.

But they excelled at covering the ground, and in an astonishing breakaway that surpassed even the record of dinosaur land conquest, they dispersed across the globe, destroying every ecosystem they encountered along the way, inventing culture, metalworking, painting, dancing, music, science, and a rocket ship that would eventually take twelve exceptional apes to the moon's surface.

With seven billion Homo sapiens circling the planet, it is perhaps inevitable that one of them will end up treading the majestic tombs of giants buried beneath the wilderness of southern Patagonia.

I was that monkey

And as I stood alone in the desert, I could understand that the odds of any one person going into the fossil record were infinitesimal.

But the earth is very old.

And after a long time, the impossible becomes possible.

That's the magic of the geological record.

In this way, the myriad creatures that lived and died on the old planet left behind a huge number of fossils. Each is a small miracle, but the whole is inevitable.

66 million years ago, an asteroid collided with Earth, wiping out the dinosaurs.

This could have easily not been the case.

But we can only get one history, and that's the history we have.

However, this peculiar reality was not inevitable.

A tiny perturbation of that asteroid far from Earth would have knocked it off our planet by a large margin.

A pivotal and tragic day when the dinosaurs became extinct and set the stage for the modern world.

It may have been just another day, perhaps Thursday, in the 63 billion days already enjoyed by dinosaurs.

But as geological time progresses, improbable and near-impossible events do occur.

From our Cambrian worm-eating ancestors to suit-wearing primates, a myriad of junctures have led us to this particular reality.

Dreadnoughtus bones lay underground for 77 million years.

Who could have imagined that a single species of shrew-like mammal living in the crevices of the dinosaur world would evolve into intelligent beings that could characterize and understand the very dinosaurs they feared?

I once stood at the headwaters of the Missouri and crossed it.

There, it's nothing but the gurgling of water coming from under the rocky boulders in the meadows high in the Bitterroot Mountains.

A neighboring stream flows for several hundred meters and ends in a small pond.

These two streams look identical.

But one is an anonymous drop of water and the other is the Missouri River.

Now, when we go down to the mouth of the Missouri River near St. Louis, it is clear that it is a big river.

But when you go to Bitterroots and look at the Missouri River, the human perspective can't see it as anything special.

Now, let's go back to the Cretaceous and look at our little downy ancestors.

You can never imagine them being anything special, and if it weren't for that pesky asteroid, they probably wouldn't be.

Now create and run 1000 more worlds and 1000 solar systems.

You will never get the same results.

No doubt those worlds are astonishing and astonishingly implausible, but they are not our worlds and they are not our histories.

There are an infinite number of histories we could have had.

I only got one, but wow I never got a good one.

Dinosaurs like the Dreadnoughtus did exist.

Sea monsters like Mosasaurus were real.

Dragonflies with the spread wings of eagles and pill bugs as long as cars did exist.

Why study antiquity?

Because it gives us perspective and humility.

Dinosaurs perished in the world's fifth mass extinction, annihilated in a space accident through no fault of their own.

They didn't expect it to happen and they had no choice.

We, on the other hand, have a choice.

And the nature of the fossil record indicates that our place on this planet is precarious and potentially fleeting.

Our species is currently unleashing an environmental disaster on a geological scale, so widespread and severe that it deserves to be called the 6th extinction.

We just see it coming, unlike dinosaurs.

And unlike dinosaurs, we can do something about it.

We have that choice.

thank you.

(applause)

Some people believe that TED talks are supposed to be "on a round red rug."

"Please share your childhood story."

"Exposing personal secrets."

“End with an inspiring call to action.”

no.

That's not how I think about TED talks.

In fact, overuse of these devices will only leave you feeling clichéd and manipulative.

But all great TED talks have one thing in common. I would like to share it with you. Because over the past 12 years, I've heard hundreds of these amazing TED speakers from my ringside seat.

I helped them prepare their talks for primetime and learned firsthand the secrets of delivering great talks.

While all these speakers and their topics may seem very different, they actually have one important common denominator.

And it is: Your primary task as a speaker is to convey to your listeners' minds extraordinary gifts, strange and beautiful objects we call ideas.

Tell me what you mean

Here is Haley.

She's about to give a TED Talk, and frankly, she's terrified.

(Video) Presenter: Haley Van Dyke!

(Applause.) Over the course of 18 minutes, 1,200 people, many of whom they had never met before, found their brains beginning to synchronize with Hailey's brain and with each other's brains.

They are literally starting to show the same EEG patterns.

It's not just that they feel the same emotions.

Something even more amazing is happening.

Let's take a peek inside Haley's brain.

Billions of interconnected neurons are intertwined in an impossibly complex way.

But look here. Millions of them are linked together in ways that represent a single idea.

And incredibly, this exact pattern is being reproduced in real time in everyone's minds listening.

That's right; in just a few minutes, when people hear voices and see faces, patterns involving millions of neurons are teleported into 1,200 minds.

But wait -- what is an idea anyway?

It can be thought of as patterns of information that help us understand and navigate the world.

Ideas come in all shapes and sizes, from complex and analytical to simple and beautiful.

Here are just a few examples shared from the TED stage.

Sir Ken Robinson -- Creativity is the key to our children's future.

(Video) Sir Ken Robinson: My argument is that creativity is now as important in education as literacy and should be treated in the same place.

Chris Anderson: Elora Hardy -- The bamboo building is beautiful.

(Video) Elora Hardy: It grows all around us, it's strong, it's elegant, it's shockproof.

CA: Chimamanda Adichie -- People are not single identities.

(Video) Chimamanda Adichie: Single stories create stereotypes, but the problem with stereotypes is not that they are untrue, but that they are incomplete.

CA: Your mind is full of ideas, not just randomly.

They are carefully linked.

Collectively they form a stunningly complex structure that is your personal worldview.

It's your brain's operating system.

That's how you navigate the world.

And it is built from millions of individual ideas.

For example, if one small element of your worldview is the idea that kittens are adorable, when you see this you might react:

But if another component of your worldview is the idea that leopards are dangerous, your reaction will be a little different when you see this.

It is therefore clear why the ideas that make up the worldview are important.

It needs to be as reliable a guide to the frightening yet wonderful real world as possible.

Well, different people have different worldviews.

For example, how does your worldview react when you see this image: (Video) Daria Mogahed: What do you think of me?

"Woman of Faith", "Expert", maybe "Sister"?

Or "repressed", "brainwashed", "terrorist"?

CA: There are millions of people who will react very differently to whatever your answer is.

That's why ideas are so important.

When properly communicated, it can forever change someone's way of thinking about the world and shape their behavior not only now, but in the future.

Ideas are the most powerful force shaping human culture.

So if you accept that your biggest job as a speaker is to build ideas in your audience's heads, here are four guidelines for how you should approach that job. One is to limit the talk to just one main idea.

Ideas are complicated things. You need less content to focus on the one idea you're most passionate about and give yourself a chance to adequately explain that one.

You need to give context, share examples, and clarify.

So pick one idea, make it the thread that runs through the talk, and make sure everything you say links to that idea in some way.

Second, give your listeners a reason to care.

Before you can start building anything in your audience's minds, you need to get permission to welcome them.

And what are the main tools to achieve it?

curiosity.

arouse the viewer's curiosity.

Use intriguing and provocative questions to identify why something doesn't make sense and needs an explanation.

If you can uncover a gap in someone's worldview, they will feel the need to fill that knowledge gap.

And once you awaken that desire, it becomes much easier to start building ideas.

Third, build your ideas step by step from concepts your audience already understands.

You harness the power of language to interweave concepts that already exist in the minds of your listeners, but in your language, not theirs.

You start where they are.

Speakers often forget that many of the terms and concepts they are familiar with are completely unfamiliar to their audience.

Now, metaphors can play an important role in showing how pieces fit together because they reveal the desired shape of the pattern, based on ideas the listener already understands.

For example, when Jennifer Kahn tried to describe an amazing new biotechnology called CRISPR, she said, "It's like getting your first word processor to edit DNA.

CRISPR makes it very easy to cut and paste genetic information. ”

Now, vivid descriptions like this fit right in our minds and bring us satisfying “aha” moments.

Therefore, it's important to test your story with a trusted friend to find out where they are confused.

Fourth and final tip. Make your ideas worth sharing.

In other words, ask yourself the question, "Who will benefit from this idea?"

And I want you to answer honestly.

Unfortunately, if the idea only works for you or your organization, it probably isn't worth sharing.

The audience sees you.

But if you believe that the idea has the potential to brighten someone's day, change someone's perspective for the better, or inspire someone to do something different, then you've got the core ingredients of a really great talk that can be a gift to them and all of us.

How much do you need to know about a person before you can safely take out a loan?

Suppose you want to lend $1,000 to the person sitting two rows behind you.

What do you need to know about a person to feel comfortable?

My mother came to the US from India in her late 30's.

She is a doctor in Brooklyn who often asks friends and neighbors to come to her for medical services, whether she can pay for it right away or not.

I remember meeting patients with her in grocery stores and on the sidewalks. Sometimes they came and paid her on the spot for previous bookings.

She thanked them and asked them about their family and health.

She trusted them, so she trusted them.

Most of us look like my mother.

We trust our acquaintances and neighbors.

But most of us wouldn't lend money to a stranger unless we knew even a little bit about that person.

Banks, credit card companies, and other financial institutions don't know us personally, but they have a way of trusting us through our credit score.

Our credit scores are created through the aggregation and analysis of public consumer credit data.

And because of them, we now have fairly easy access to all the goods and services we need, from getting electricity to buying a home or even taking a risk and starting a business.

but ...

There are 2.5 billion people in the world who do not have a credit score.

This corresponds to one-third of the world's population.

they don't have a score. Because they don't have formal public records: bank accounts, credit history, social security numbers.

And because they don't have a score, they don't have access to credit or financial products that can improve their lives.

they are not trusted.

So we wanted to find a way to build trust and open financial access to these 2.5 billion people.

So we created a mobile application that uses mobile data to build their credit score.

There are now over 1 billion smartphones in emerging markets.

And people use them just like we do.

They text friends, get directions, browse the internet, and even make financial transactions.

Over time, this data will find its way into our mobile phones and provide a truly rich picture of our personal lives.

Our customers have given us access to this data and we obtain it through our mobile applications.

This helps us understand the creditworthiness of people like Jennifer, a small business owner from Nairobi, Kenya.

Jennifer is 65 and has been running stalls in the Central Business District for decades.

She has three sons in vocational school and is the leader of a local chama, or savings group.

Jennifer's stall is thriving.

Every day she earns enough to cover her living expenses.

However, she is not financially secure.

In the event of an emergency, she could be left in debt.

And she doesn't have the discretionary income to improve her family's lifestyle, prepare for emergencies, or invest in growing her business.

If Jennifer wants to get credit, her options are limited.

She can get a small loan, but she needs to form a group that can guarantee her credibility.

Still, the loan amounts are too small to really impact her business, averaging around $150.

Loans are always an option, but they are financially dangerous with interest rates well over 300%.

And since Jennifer has no collateral or credit history, she can't go to the bank and ask for a business loan.

But one day, Jennifer's son convinced her to download our application and apply for a loan.

Jennifer answered some questions on my phone and gave me access to some key data points on the device.

And here is what we saw.

So first, the bad news.

Jennifer had low savings and no history of taking out loans.

These are factors that would have set red flags for traditional banks.

But there were other points in her history that showed more of her potential.

As an example, I found her calling her family in Uganda regularly.

The data showed a 4 percent increase in reimbursement for those who remained in constant contact with a small number of close contacts.

We also learned that although she was moving around frequently throughout the day, she actually had a fairly regular movement pattern, either at home or at a stall.

Data also shows a 6% increase in repayments among customers who match where they spend most of their time.

I also learned that she communicates a lot with different people throughout the day and has a strong support network.

According to our data, people who communicate with more than 58 different contacts tend to be good borrowers.

For Jennifer, she communicated with 89 different individuals and found a 9% increase in repayments.

These are just a few of the thousands of different data points we look at to understand an individual's creditworthiness.

And after analyzing all these different data points, we took the first risk and gave Jennifer the loan.

This is data not found in paper records or formal financial records.

But it's a sign of trust.

Looking beyond income reveals that people in emerging markets who appear risky and unpredictable on the surface are actually willing and able to repay.

Our credit score has helped provide over 200,000 loans in Kenya last year alone.

Also, our repayment rate is over 90 percent. By the way, this is in line with traditional bank repayment rates.

With something as simple as a credit score, we empower people to build their own futures.

Our customers have used loans to invest in family living expenses, emergencies, travel, and business growth.

They are now building better economies and communities where more people can thrive.

Jennifer's savings have increased by 60% in the past two years since using our product.

She has also started two more stalls and is currently planning her own restaurant.

She is applying for a small business loan from a commercial bank. Because she has a credit history that proves she is eligible for the loan.

I met Jennifer in Nairobi just last week and she told me that she is very excited to start working with her.

“My son was the only one who believed I could do this,” she said.

She has lived believing that there is a part of the world that is closed to her.

Our job now is to open up the world to Jennifer and the billions of people like her who deserve our trust.

thank you.

(applause)

(cello music) (music ends) On the plane here, I thought of my mother.

I am a self-taught cellist, but have never taken lessons.

I was studying the double bass, but I liked the cello, so I picked it up and started playing.

But my mother inspired me.

I didn't know she was a source of inspiration because she got her degree in music from a correspondence course, the American School of Music.

While raising two children, she received lessons in the mail once a week and practiced.

And at the end of a few years she gave a recital.

And I turn 50 this month, and it took me so long to realize that she was such a huge inspiration.

I'm just going to go on -- yes, thank you mom.

(Applause.) She's not only a great musician, she's also one of the most extraordinary people I know.

Actually, I want to play a little bit for my mom and your mom too.

(cello music) (music ends) See, this is what usually comes to mind when you hear the cello.

(plays Bach's Cello Suite No. 1) I won't do that today.

(laughter and applause) (drums) (cello) Hi!

(loop sample of sound on stage) (cello music and loop sample) (end of music) (applause and cheers)

I'm an artist, but I'm a slightly different artist.

I don't draw.

I can't draw.

When I was in high school, the store teacher wrote me a threat on the report card.

You probably don't want to see my photos too much.

But there is one thing I know how to do. It just means that you know how to program a computer.

You can code.

And people will say that 100 years ago people like me didn't exist, that's impossible, art made with data is new, it's a product of our time, and it's very important to think of it as very 'now'.

That's true.

But there is an art form that has existed for a very long time that aims to use information, abstract information, to create works that resonate emotionally.

And it's called music.

We've been making music for tens of thousands of years, right?

And if you think about what music is, what are notes, chords, keys, harmonies, melodies, these are algorithms.

These are systems designed to unfold over time and bring us emotions.

I entered the world of art through music.

I trained as a composer and about 15 years ago I began to focus on the intersection of sound and image, creating works that aim to use imagery to reveal the structure of music, or to use sound to show something interesting about what is usually pictorial.

So what you see on the screen is literally painted by the musical structure of the musicians on stage, and it's no coincidence that it looks like a plant. Because the underlying algorithmic biology of plants influences musical structure in the first place.

So once you understand how to do this and how to code with media, you can do some really cool things.

This is a project I did for the Sundance Film Festival.

It's a very simple idea. We've taken all the Best Picture Academy Awards, sped each one up to a minute, and spliced ​​them all together.

75 minutes of Hollywood movie history.

And what this work actually shows us is the history of editing in Hollywood movies.

Casablanca is on the left. Chicago is on the right.

And you can see that Casablanca is a little easier to read.

This is because in the 1940s the average length of a shot in a movie was 26 seconds, now it is about 6 seconds.

This is a project funded by the US federal government in the early 2000s and inspired by several tasks of looking at video footage and finding specific actors in the video.

So I reused this code to train the system for one person in our culture who doesn't need to be monitored in that way: Britney Spears.

I downloaded 2,000 paparazzi photos of Britney Spears and trained a computer to find just her face.

I can stream any footage of her and put her eyes in the center of the frame. This sort of thing is a bit of a double commentary on surveillance in our society.

We are full of attention anxiety, but we also become obsessed with celebrities.

What you see on the screen here is a collaboration between me and an artist called Lián Amaris.

What she did is very easy to describe and explain, but very difficult to do.

She did a 72-minute activity to prepare for a night out on the town, which she extended to three days and performed in slow motion on New York City's traffic islands.

I was also there with the film crew.

We shot the whole thing, then reversed the process and sped it up again to 72 minutes. So she moves normally and the whole world seems to fly.

At some point I realized that what I was doing was making portraits.

When I think of portraits, I tend to think of things like this.

The man on the left is named Gilbert Stuart.

He is sort of America's first serious portrait painter.

And on the right is a 1796 portrait of George Washington.

This is the so-called Lansdowne portrait.

And when you look at this painting, there's a lot of symbolism, right?

A rainbow is appearing outside the window. we have swords

There is a quill pen on our desk.

All of this is meant to remind us of George Washington as the father of our nation.

This is my portrait of George Washington.

This is an eye chart, but with words instead of letters.

And what are those words? The 66 words George Washington uses more than any other president in his State of the Union address.

Therefore, "gentleman" has its own symbolism and its own rhetoric.

And it's very important that it's the word he used the most.

This is George W. Bush's eye chart, who was president when I made this piece.

And how you get there from 'Gentleman' to 'Terror' in 43 easy steps tells a lot about American history and gives you a different insight than looking at a series of paintings.

These works offer lessons in U.S. history through the political rhetoric of their leaders.

Ronald Reagan spent a lot of time talking about deficits.

Bill Clinton spent a lot of time talking about the century when he won't be president, but maybe his wife will.

Lyndon Johnson was the first president to give a State of the Union address on primetime television. He started every paragraph with the word "tonight".

And Richard Nixon, or more precisely his speechwriter William Sapphire, spent a lot of time thinking about language and making sure his bosses expressed the rhetoric that expressed their sincerity.

This project appears as a series of monolithic sculptures.

Light box series for outdoor use.

And it's important to note that they are to scale. So if you can stand 6 feet apart and read between two black lines, you have 20/20 vision.

(laughs) This is a portrait. And there are many of these.

There are many ways to do this with data.

I started looking for ways to think about how I could paint a more democratic form of portraiture, something more about my country and how it works.

The United States has a census every ten years.

We literally count people, find out who lives where, what job they have, and what language they speak at home.

And this is important, really important.

But it doesn't really tell us who we are.

We are not told about our dreams and aspirations.

So in 2010, I decided to do my own census.

And I started looking for a corpus of data that contained many descriptions written by ordinary Americans.

And it turns out there's a corpus of data that's just there to collect.

It's called online dating.

So in 2010, as a gay man, straight man, gay woman, and straight woman, I joined 21 different online dating services in every US zip code and downloaded nearly 19 million dating profiles. This represents approximately 20 percent of the adult population in the United States.

i have obsessive compulsive disorder.

This will really become clear. Please go with me.

(Laughter) So what I did was sort all of this by zip code.

and examined word analysis.

These are some dating profiles from 2010 with the word "lonely" highlighted.

If you look at these topographically and imagine that the words dark to light are often used, you can see that Appalachia is a pretty lonely place.

You can also see that Nebraska isn't all that interesting.

This is a strange map. So what this shows is that Alaskan women need to hang out with men in southern New Mexico and have a good time.

And I have this on a fairly detailed level, so I can say that men in the eastern half of Long Island are far more interested in getting their butt spanked than men in the western half of Long Island.

That's one takeaway from this whole conference.

That fact will be remembered for about 30 years.

(Laughter) If you take this down to the cartographic level, you can create maps and do the same tricks I was doing with eye charts.

You can replace the name of any city in the United States with a word that people use in that city more than anywhere else.

If you've ever dated someone from Seattle, this makes perfect sense.

you have "cute" You are "broken".

There is a "gig". you have a "cigarette"

They play in bands and smoke.

And right above that you will see "Email".

Redmond, Washington, where Microsoft is headquartered.

Some of these you can probably guess - i.e. Los Angeles is 'acting' and San Francisco is 'gay'.

Some are a little more heartbreaking.

At Baton Rouge, they talk about curvaceous. Downstream New Orleans still talks about flooding.

People in America's capital would say it's funny.

People in Baltimore, Maryland would say it's scary.

This is New Jersey.

I grew up somewhere between "annoying" and "cynic."

(Laughter) (Applause) And the number one word in New York City is "now." "Now I work as a waiter, but I'm actually an actor."

(Laughter) Or, "I'm an engineering professor at New York University, but I'm actually an artist."

If you go to the north, you can see "dinosaurs".

That's Syracuse.

The best place to eat in Syracuse, New York is a barbecue joint in Hell's Angels called Dinosaur Barbecue.

Take someone on a date there.

I live in Midtown Manhattan somewhere between 'Unconditional' and 'Midsummer'.

This is gentrified North Brooklyn, so 'DJ', 'glamorous', 'hipster' and 'urban' come together.

So it's probably a more democratic portrait.

And the idea was, what if I made a map of red states and blue states based on what I wanted to do on Friday night?

This is a self-portrait.

This is based on my emails, about 500,000 emails sent over 20 years.

You can think of this as a digitized selfie.

So what I'm doing is running a physical equation based on my personal data.

Imagine everyone I've ever corresponded with.

It started in the middle and exploded with a loud bang.

And everyone has a gravitational pull on each other. Gravity is based on email volume and who you email with.

It also does sentiment analysis, so saying "I love you" makes you weigh more to me.

And you're drawn to my email address in the middle, acting like a mainline star.

And all the names are handwritten.

In some cases, this data may be combined with real-time data to reveal specific issues in specific cities.

This is a Walther PPK 9mm semi-automatic pistol that was shot during a parking lot altercation in New Orleans' French Quarter on Valentine's Day about two years ago.

Those are my cigarettes.

This is the house where the shooting took place.

There was a little engineering involved in this project.

Equipped with a bicycle chain as a camshaft, it is driven by a computer.

Its computer and mechanics are buried inside the box.

The top of the gun is welded to an iron plate.

A wire runs through the trigger and the computer inside the box is online.

I listen to the New Orleans Police Department 911 feed, so every time a shooting is reported in New Orleans, a gunshot is fired.

Well, there are no bullets because there are blanks.

Big light, big noise, and most importantly the housing.

With about five mass shootings a day in New Orleans, the case was filled with bullets in the four months it was installed.

You all know what this is. We call this "data visualization".

If you do it right, it will lighten up.

If you do it the wrong way, you will get anesthesia.

It reduces people to numbers.

So be careful.

One last thing.

I spent the last summer as an artist-in-residence in Times Square.

And Times Square in New York is literally the crossroads of the world.

One thing people don't realize is that this is the most Instagrammed place on earth.

About every five seconds someone takes a selfie in Times Square.

That's 17,000 per day, but I have them all.

(Laughter) These are the eye-centered ones.

Every civilization uses the best available technology to create art.

And it's up to the artist to question what that technology means and how it reflects our culture.

Therefore, I would like to say this. We are more than numbers.

We are humans and we have dreams and ideas.

And reducing us to statistics is at our peril.

thank you very much.

(applause)

Hello.

This is my first trip and the first time in my life to go outside the walls of Gaza.

I am very happy to be here.

(Applause.) My ambition has always been to be a pilot, to fly an airplane, to fly freely, to touch the sky.

But that didn't happen.

Simply, I live in Gaza, but there is no airport.

All borders are closed on all fronts.

We live in one of the world's largest prisons.

All I can do is look up at the sky.

Some days we are lucky if we have electricity for 4-5 hours.

When it's cold, we make a fire in the porch or roof of our house.

I also make food sometimes.

My job in Gaza is to make all arrangements for journalists who come to my country to report what is happening in Gaza.

Many times in the morning I had to go to the border to pick up journalists.

Bad things can happen if something happens to a journalist, or if a journalist decides to cover a story that the government doesn't want them to cover.

My work life includes traveling around the country helping journalists, filmmakers and news crews.

I believe my success will come from building relationships with the Gaza community, not just with journalists and news crews.

I never saw them as stories or numbers to these communities that didn't want their stories told.

But they are human, just like I am.

I have built many relationships over the last 10 years.

And what do you think?

This gives you the opportunity to access people and stories that are inaccessible to others.

In certain situations, as a woman, I feel like I have more power.

Many male journalists in my society want to cover articles about drug addiction in my country.

The problem started when the Gaza tunnels were being built.

In the Gaza Siege, tunnels brought people all their basic necessities such as food, building materials, and other necessities.

But it no longer works because the Egyptian side flooded it with water and it no longer works.

Drugs were smuggled and many young people became drug addicts.

Tradition in Palestinian society forbids men from entering the home.

So none of the male journalists will understand this story.

But I did.

I have a wonderful husband, a wonderful husband who supports me in spite of society's criticism.

He is now home with my two children and I have another growing child here.

(Applause.) When I'm at work, I call him every two hours. He knows that if he doesn't hear from me, he should call my contact number. The person who makes this story accessible and who I trust.

When British journalist Alan Johnston was kidnapped in Gaza, I was asked by an American magazine to set up a meeting with the kidnappers in Gaza, which I did.

The journalist covering this article and I were asked to meet outside his hotel.

They came over and picked us up in a black van with black windows. I was wearing a mask that day.

And they drove us out into the middle of a distant field.

They took our phones and we interviewed the kidnappers in the open field.

That day was very scary, a day I will never forget.

So why am I doing what I do?

Because I believe that otherwise a large part of the story about Gaza will be lost.

I have a few other stories I can tell you about my country.

And not all of them are bad.

we love our country Despite the terrible conditions we live in: siege, poverty and unemployment, there is still life.

There are dreamers and wonderful people full of energy.

We have great music and a great music school.

There are parkour dancers dancing inside the rubble house.

And Gaza is the only place in the Arab world where Muslims and Christians live in strong fraternity.

(Applause.) During the war, the hardest thing for me was leaving my children early in the morning.

I take pictures of them every day because I don't know if they will come back.

Being a fixer and journalist in Gaza is difficult and dangerous.

But when I hear artillery fire or bombing, I just head straight there. Because I want to go there first, because these stories should be told.

When my children were little, when they heard the sounds of war, I used to tell them, "This is fireworks."

Now they are grown up and understand.

Everything I witnessed during the war, especially the lifeless bodies of young children, gives me terrible nightmares.

I still remember a little girl, her name is Hara.

She was the only survivor of her family.

Her photo will stay with me forever.

i will never forget her.

I am proud to be standing here today with all of you.

I am proud to tell you stories, both sad and happy, about my little corner of the world, Gaza.

I am proud to be the first female fixer working in Gaza.

And the funny thing is that in Gaza they call me Mr. Rambo.

(Laughter) I hope one day I'll have the chance to tell the stories of other women in my country, all the amazing women I know.

I hope one day I can help other women in my country to become fixers like me.

And of course sometimes I feel like I can't do this job anymore, it's too much for me.

But I remember these words: "Don't limit your challenges, challenge your limits.

Don't let others stand in front of your dreams. ”

thank you.

(applause)

Are we going to do whatever it takes to tackle climate change?

I am not asking this question as an environmentalist. In fact, I confess I'm pretty hopeless about recycling.

I approach this question as a professional observer of monetary policy decisions and one who wonders how history judges us.

One day, this ring that had belonged to his grandfather passed to his son Charlie.

And I wonder what his generation, and perhaps generations to come, would do with the two lives that this ring brought.

My grandfather was a coal miner.

In his time it was accepted to burn fossil fuels for energy and to develop the economy.

We now know otherwise because of the greenhouse gases that coal produces.

But today, I fear that the industry I work in will come under even tougher scrutiny because of its impact on the climate. It's even tougher than my grandfather's industry.

Of course, I work in the banking industry, but this crisis will be remembered for the 2008 crisis. The crisis has diverted government attention and finances from really, really important commitments, such as the 2009 Copenhagen Climate Summit commitment to mobilize $100 billion a year to help developing countries move away from burning fossil fuels and toward using cleaner energy.

That promise is already at stake.

And this really matters. Because the transition to cleaner energy has to happen sooner or later.

First, once released, greenhouse gases remain in the atmosphere for decades.

And second, if developing countries currently build their grids around fossil fuels, it will be much more costly to change later.

So when it comes to climate, history may judge that the banking crisis happened just at the wrong time.

However, the story doesn't have to be this dark.

Three years ago, I argued that governments could use the tools put in place to save the financial system to meet other global challenges.

And rather than weakening over time, these arguments grow stronger.

Let's briefly recall what these tools look like.

When the financial crisis hit in 2008, the US and UK central banks began buying bonds issued by their own governments in a policy known as "quantitative easing."

Depending on what happens when these bonds mature, this could be another name for the printing of banknotes.

And did they print.

The United States alone created its own currency worth $4 trillion.

This was not done in isolation.

In a notable act of cooperation, the 188 countries that make up the International Monetary Fund (IMF) have agreed to issue $250 billion worth of their own currencies (Special Drawing Rights) to boost foreign exchange reserves around the world.

When the financial crisis hit Europe, European Central Bank President Mario Draghi promised to “do whatever it takes”.

And they did.

The Bank of Japan has repeated the very same promise to "do whatever it takes" to revitalize the economy.

In both cases, “do whatever” meant trillions more dollars for money-printing policies that continue today.

What this shows is that when faced with some global challenges, policymakers can act collectively with urgency and risk unconventional policies such as money printing.

So let's go back to the first question: Can we print money for climate finance?

Three years ago, the idea of ​​spending money this way was something of a taboo.

Breaking down and dismantling the idea that money is a finite resource, governments can quickly become overwhelmed by public demand to print more and more money for other purposes, such as education, health care, welfare, or even defense.

And there are some truly horrific historical examples of money printing, or uncontrolled money printing, leading to hyperinflation.

Consider the Weimar Republic in 1930. In Zimbabwe, the price of basic commodities such as bread doubled every day in 2008.

But all of this has pushed the public debate forward, making money printing for the people openly discussed in the financial media and even in some political manifestos.

However, it is important that the discussion about printing national currencies does not end here.

Since climate change is a global issue, there are some very compelling reasons why the international currency issued by the IMF should be printed to fund climate change.

The Special Drawing Right (SDR) is the IMF's electronic unit of account used by governments to transfer funds to each other.

Think of it as a peer-to-peer payment network for governments like Bitcoin.

And it's truly global.

Each of the 188 IMF member countries holds an SDR quota as part of their foreign exchange reserves.

These are national reservoirs of wealth that countries keep to protect themselves from currency crises.

And its global nature is precisely why the IMF issued an additional $250 billion in the midst of the 2009 financial crisis. Because it worked as a collective global action defending nations big and small at once.

But here is the interesting part.

More than half of the 2009 SDR reprints (worth $150 billion) went to advanced market countries, which in most cases had less need for reserves due to their flexible exchange rates.

So the additional reserves increased in 2009 turned out not to be really necessary, at least for advanced market countries.

And they remain unused today.

Here are some ideas.

As a first step, why not start spending your unused extra SDRs printed in 2009 to fight climate change?

For example, it could be used to buy bonds issued by the United Nations Green Climate Fund.

This is a fund established in 2009 following the climate change agreement in Copenhagen.

And it was intended to direct funds to developing countries to accomplish their climate change projects.

It is one of the most successful funds of its kind, having raised about $10 billion.

But the additional SDRs issued will help get the government back on track to meet the $100 billion annual pledge derailed by the financial crisis.

It could also serve as a test case.

If the inflationary impact of using SDRs in this way is modest, it could be used to justify issuing additional SDRs every five years, for example, under the promise that advanced market countries will channel their share of new reserves into the Green Climate Fund.

Printing international currency in this manner has several advantages over printing domestic currency.

First, it is very easy to argue that spending money to mitigate climate change benefits everyone.

No part of society benefits more from the printing press than others.

Conflicting claims issues are mitigated.

Also, since so many countries would need to agree to issue these additional SDRs, it is very unlikely that the printing of banknotes would get out of control.

The end result is collective global action for the global good, and that is controlled global action.

And, as we learned with the money printing program, any concerns we have can be mitigated by regulation.

So, for example, we can cap the issuance of additional SDRs every five years so that this international currency does not exceed 5 percent of the world's foreign exchange reserves.

This is important. Because it would allay the absurd US concerns that the SDR could challenge the dollar's dominant role in international finance.

And really, I think the only thing the SDR is likely to steal from the dollar under this plan is its nickname, the “greenback.”

Because even if that cap had been set, the IMF could have issued another $200 billion in SDRs in 2014, following its massive SDR issuance in 2009.

So, hypothetically, developed countries could contribute up to $300 billion worth of SDRs to the Green Climate Fund.

That's 30 times what it is today.

And you know, that might sound grand, but it's just starting to look like 'what it takes'.

And think about what great things you could do with that money. In 2009, Norway pledged $1 billion in reserves to Brazil if it met its deforestation goals.

The program has reduced deforestation by 70% over the past decade.

This would save 3.2 billion tons of carbon dioxide emissions, equivalent to keeping all US cars off the road for three full years.

So what can we do with 300 such pay-for-performance climate change projects organized globally?

We could take cars off the road for a generation.

So let's not quibble about whether we can afford to fund climate change.

The real question is, do we care enough about future generations to take the exact same policy risks we took to save the financial system?

After all, we could do it, we did it, and we are doing it today.

We must, must do "whatever it takes".

thank you.

(applause)

Interestingly, in the United States, the most significant portion of the private and public health care budget is spent on treating cardiovascular disease.

Not comparable at all.

In Africa it is a major killer, yet it is completely ignored.

And that situation can't be right. Something has to be done about it.

The state of health of a country parallels its development.

Seventeen million people die each year from heart disease.

32 million heart attacks and strokes have occurred.

Most of them are in developing countries, most of them in Africa.

Eighty-five percent of the global burden of cardiovascular disease is in the developing world, not in the West, but 90 percent of the resources are in the West.

Who is at risk? There are people like you.

Africans are not the only ones to worry about this.

All my African friends who have a reason to stay in Africa at some point must be very concerned about this dire situation.

Have any of you here ever wondered what would happen if you returned to your room at night with chest pains, shortness of breath and sweating?

I am having a heart attack. what are you going to do

Will you go back to America, Germany or Europe?

no, you will die Without treatment, 50% die within 24 hours.

This is what is happening.

If you look at the map of the United States, on the graph here, there are 10 million people here and 10 million people here.

By the time I turn 50, there are almost no people left in Nigeria. Life expectancy is 47 years.

It's not because some people don't survive childhood illnesses, but they do survive, but they don't survive when they're 45 or 50 years old.

And that time is when you are most productive.

Now is the time to contribute to Africa's development. But they are not there.

The best way to fall into the cycle of poverty is to kill your parents.

If we cannot secure parents, we cannot guarantee the safety of African children.

What are the risk factors?

It's very well known. I'm not going to spend much time on them.

These are just information: high blood pressure, diabetes, obesity, lack of exercise. Usual suspects.

Here in Tanzania, 30% of the population has hypertension.

20% receive treatment.

Less than 1% receive adequate treatment.

If hypertension alone could be treated in Africa, 250,000 lives could be saved each year. That is very important!

Easy to treat. Let's look at the situation in Mauritius.

In eight short years, we're talking about HIV and malaria here, and that's all good.

We cannot repeat the mistakes we made with malaria and HIV.

Within eight years, non-communicable diseases will be the leading cause of death in Africa.

That's something to keep in mind. You can't deal with situations like this.

This is a typical African hospital. We cannot rely on the elite. They go to America, Germany and England for treatment. can't believe it.

We cannot rely solely on foreign aid.

Here's the situation: Countries are turning inward.

Since 9/11, the United States has had many difficulties dealing with its own domestic problems.

So they spend money to solve those problems.

That is, of course, my responsibility, not theirs. You have to solve your own problems.

If they can help, so be it! But that's not my expectation.

Deteriorating indicators of medical and health research in Africa call for a new perspective. You can't keep doing things the way they used to be.

If they didn't work, you'll have to look for another solution.

I'm here to talk to you about a solution.

This was a difficult sign for some of us.

A few years ago we started thinking about it.

Everyone knows the problem. No one knows what the solution is.

We decided we needed to get our money out there.

In terms of grant aid to developing countries, everyone is ready to put money into it.

No one cares when you talk about sustainable investing.

can't collect money.

I have done medical related business in the United States. I live in Nashville, Tennessee, the medical capital of the United States.

Raising money for a healthcare venture is very easy.

But start telling them they are going to do it in Nigeria and everyone runs away.

That's totally wrong. Everyone here, if you want to help Africa, invest your money in sustainable development.

I'll walk you through a day at the Heart Institute to give you a glimpse of what we do and I'll tell you a little more about it.

What we have done is to show that quality health care that rivals the best in the world is possible in developing settings.

We currently have 25 positions, all trained and certified in the US, Canada or the UK.

Vanderbilt's clinics in Cleveland have all of the treatments available nationwide and perform them for about 10 percent of the cost of performing these treatments in the United States.

(Applause.) In addition, we have a policy that no one is ever denied because of their ability to pay.

we take care of everyone.

(Applause.) It doesn't matter if you have $1 or $2.

And we'll talk about how we can do that.

We care about choosing the right equipment.

Adopt a modular unit. Units with multimodality capabilities have modular components. Since it is easy to repair, we do not accept items that are not durable or do not last long.

We value training and make sure this process is regenerative.

Soon we will all die and disappear, but the problem will persist unless there is someone to take over where we left off.

We made sure we produced some things ourselves.

We do not purchase radiopharmaceuticals in unit doses.

Generators are procured from various companies.

We manufacture our own. This keeps costs down.

So for radiopharmaceuticals in the US, a single dose is $250, but once manufactured in-house, the price is about $2.

(Applause.) We recognize that the only way to bridge the gap between rich and poor countries is through education and technology.

All these issues we are talking about all go away if we bring in development.

Technology is a great equalizer. How do we make it work?

Self-care has been proven to be cost-effective.

This will open up opportunities in rural centers and allow them to leverage their expertise in very smart ways.

This is how our center was established.

We currently have three locations in the Caribbean with plans for a fourth.

And we have now decided to go to Africa.

We will be hosting the West African Heart Institute in Port Harcourt, Nigeria. That project is due to start in the next few months. We hope to open in 2008-2009.

And so do other centers.

This model can be adapted to any disease process.

All units, all centers are linked through a switched hub to a central server and all images are captured for station review.

And we designed this telemedicine solution. This is our property and we are happy to share what we have learned with anyone interested in it. You can still make a profit.

Our telemedicine platform gives you access to specialized medical experts anywhere in the world at the click of a button.

Let's see how this happens.

This is the Heart Institute. Doctors can log in from anywhere.

I called you in Switzerland and said, 'Listen, get into our system.

Look at Mrs. Jones. Take a look at the research and let us know what you think. ”

They will provide me with that information and we will better care for our patients.

Patients do not have to travel.

You don't have to experience the anxiety of not knowing because of your limited expertise.

We also use an electronic medical record system.

What we have deployed is not deployed in 80% of US healthcare settings, but the technology still exists.

But you know, they have that luxury.

Because if you can't get it in Nashville, you can get it in Birmingham, two hours away. If you can't get it in Cleveland, go to Cincinnati. We can't afford that, so we have to make it happen.

Doing so can reduce treatment costs.

And extend it to rural centers and make it affordable.

And everyone gets the care they deserve.

We recognize that it cannot be just technology.

Prevention must be part of the solution. we emphasize it.

But we have to tell people what they can do.

Even if you tell them to do something that costs money, it will be impossible, and they will not be able to do it when they go home.

They need to be alive, they need to be fed.

Exercise is recommended as the most effective, simple and easy method.

We have been taking walks in March and April every year.

We organize people into groups and challenge them.

Give a prize to which group loses the most weight.

Prizes will be awarded to the group that records the most walking distance on their pedometer. we do this all the time.

We recommend bringing children.

In doing so, we begin to make clear to our children what these issues are from very early on. Because once they learn it, they keep using it. This has created at least 100 skilled jobs in Jamaica alone. These are doctors with expertise and special training.

To date, we have cared for over 1,000 needy patients who could die, including four patients who had complete heart block and had free pacemakers. For those who understand cardiology, a complete heart block means certain death.

I would die without this pacemaker.

So we are happy with that.

Indirectly, we saved the Jamaican government $5 million from people who would have gone to Miami or Atlanta for treatment.

And we hope we have saved many lives.

By the end of this year, we will have contributed more than $1 million to care for the poor. $340,000 in the first four months, averaging $85,000 per month. Governments don't do that. Because governments have competing needs.

Resources must be placed elsewhere. But we can still do it.

People say, "How can you do that?" Here's how to make it happen.

At least 4,000 wealthy Jamaicans heading to Miami for treatment have confessed that the Caribbean Heart Institute didn't do it for them.

And if you go to Miami, your spending will increase significantly, 8 to 10 times. And they are happy to receive the same quality of care at home.

And with that money, you get the chance to treat at least four patients who can't afford it for every patient who can afford it.

(Applause.) For this to work, this progress must be sustainable.

That's why we put a lot of emphasis on training. Training is very important.

We have gone further and have established a relationship with the Jamaica Institute of Technology, to which we are now making a commitment.

And we're starting a biomedical engineering program to train people locally to repair the equipment.

That way you don't have to deal with issues like obsolescence.

We have also launched a supplemental health care skills training program, offering training such as echocardiography and echocardiography. Well, such training motivates people.

Because they're going to get bachelor's degrees in medical imaging and things like that. In the process, I would like to hear from the trainees themselves what it means for them.

(Video) Dr. Jason Topping: My name is Jason Topping.

I am a Senior Resident in the Department of Anesthesiology in the Intensive Care Unit at the University Hospital of the West Indies.

I came to the Heart Institute in 2006 as part of an elective course in the Anesthesia and Intensive Care Program.

I spent three months at the Heart Institute.

There is no doubt among my colleagues about the usefulness of the training I received here. I think there is currently a growing interest in echocardiography in particular and its use in our environment.

Sharon Lazarus: I have been an echocardiologist at the Caribbean Heart Institute for the past two years. I was trained at this facility.

I think this aspect of cardiology training that the Caribbean Heart Institute has introduced to Jamaica is very important in terms of diagnosing heart disease.

Ernest Madou: The lesson to be learned from this is that it can be done, it can be sustained, it can be made possible by anyone.

Who are we to decide that poor people don't get the best care?

When were you appointed to play God?

It's not my decision. My job is to ensure that everyone, regardless of what destiny they are assigned, has the opportunity to receive the best quality health care of their lives.

Our next stop is the West African Heart Institute. As I said before, we will be in Port Harcourt, Nigeria. Other centers are planned to open throughout West Africa.

We will expand the same system to other fields such as dialysis treatment.

For anyone interested in doing this in any medical setting, we are happy to assist you and tell you how we did it and how you can do it. If we can achieve this, we can change the face of healthcare in Africa.

Africa has been good to us. It's time for us to give back to Africa.

i am going. If you want to come, please come with me.

thank you.

(applause)

In the next 16 minutes, I will guide you on perhaps mankind's greatest dream, a journey of understanding the rules of life.

So it all started for me many years ago when I encountered my first 3D printer.

The concept was appealing.

A 3D printer requires three things: a little information, raw materials and energy, and can create any object that has never existed before.

I was doing physics and came home to realize I had actually known about 3D printers all along.

And everyone does.

it was my mother

(Laughter) My mother receives three elements. A little bit of information (in this case between father and mother), raw elements and energy contained in the same medium, namely food, and a few months later produce me.

And I didn't exist before.

So, aside from my mom's shock when she found out I was a 3D printer, I was immediately fascinated by the piece, the first piece, the information.

How much information do you need to build and assemble a human being?

is there a lot? less?

How many thumb drives can I put in?

Well, when I first studied physics, I saw this human approximation as a giant piece of Lego.

So imagine that the building blocks are small atoms, hydrogen here, carbon here, nitrogen here.

So if, in a first approximation, we can list the number of atoms that make up a human being, then we can construct a human being.

Well, let's do some math and it turns out to be a pretty amazing number.

So the number of atoms, the files you store on your thumb drive to assemble your little baby, actually fills the entire Titanic thumb drive, multiplied by 2,000.

This is a miracle of life.

Every time you see a pregnant woman from now on, she's collecting more information than you've ever encountered.

Forget big data. Forget everything you heard.

This is the largest amount of information that exists.

(Applause.) Fortunately, however, nature is much smarter than the young physicist and has spent four billion years packing this information into tiny crystals called DNA.

We first encountered the star in 1950 when Rosalind Franklin, a woman and brilliant scientist, took a picture of it.

But it took us over 40 years before we finally got inside a human cell, took this crystal, unfolded it, and read it for the first time.

You can see that the code is a very simple alphabet, four letters A, T, C, G.

It takes 3 billion humans to make humans.

3 billion.

What is 3 billion?

Numbers don't mean much, do they?

So I was wondering how I could better explain how big and huge this code is.

But there, I mean, I need a little help. The best person to help introduce the code is Dr. Craig Venter, who actually deciphered the array of codes first.

So welcome to the stage, Dr. Craig Venter.

(Applause.) Not a living human being, but for the first time in history, this is a specific human genome, printed page by page, letter by letter. 262,000 pages and 450 kilograms of information were transported from the United States to Canada thanks to Bruno Boden. Startup Lulu.com did it all.

It was a great feat.

But this is a visual recognition of what the norms of life are.

And now, for the first time, I can have fun.

You can actually go inside and read.

So let me introduce you to an interesting book...a book like this.

There are annotations. It's a pretty big book.

So I want you to see what the norms of life are.

Thousands, thousands, thousands, millions of letters.

And they clearly make sense.

Let's move on to the specifics.

Let me read: (laughter) "AAG, AAT, ATA."

To you it sounds like a mute letter, but this sequence gives Craig's eye color.

I will introduce another part of this book.

This is actually a little more complicated.

Chromosome 14, Book 132: (Laughter) You guessed it.

(Laughs) "Atta, cut, gutta."

This human is lucky. Because if you miss just two letters in this position, two out of three billion, you're sentenced to contract the dreaded disease of cystic fibrosis.

We have no cure and no solution. And that's just two letters away from where we are now.

A great book, a powerful book, a powerful book that helps you understand and show you something very amazing.

Each of you, what makes me, me, and you, is only about five million copies, half a book.

Otherwise we are all exactly the same.

500 pages is the miracle of your life.

We will share the rest.

So if you think you're different, think again.

This is the amount we share.

Now that we've got your attention, the next question is how do you read it?

How should I make sense of it?

Well, no matter how good you are at building Swedish furniture, this instruction manual isn't something you'll be able to decipher for the life of you.

(Laughter) So in 2014, two famous TEDsters, Peter Diamandis and Craig Venter themselves decided to start a new company.

"Human Longevity" was born with one mission. Try everything you can and learn everything you can from these books. Its goal is one. It's about realizing the dream of personalized medicine, understanding what you need to do to improve your health, and what the secrets are in these books.

Great team, 40 data scientists and more people, fun to work with.

The concept is actually very simple.

It uses a technology called machine learning.

On the one hand, we have thousands of genomes.

Meanwhile, we have collected the largest possible database of all humans, including phenotypes, 3D scans, and NMR.

Among these two opposing aspects lies the secret of translation.

And along the way, build a machine.

We build machines and train them to try to understand and translate the phenotypic genome. In other words, train many machines, not exactly one.

What are those letters and what do they do?

This is an approach that can be used for everything, but its use in genomics is particularly complex.

We wanted to grow little by little and accumulate various challenges.

We started from the beginning with common traits.

Common characteristics are comfortable because they are common and everyone has them.

So we started asking, "Can you predict height?"

Can you predict your height by reading a book?

Well, it's actually possible with an accuracy of 5 centimeters.

BMI has a lot to do with your lifestyle, but it's still possible and you can achieve an accuracy of roughly 8 kilograms.

Can you predict eye color?

Yes, I can.

80 percent accuracy.

Can you predict skin color?

Yes you can with 80% accuracy.

Is it possible to predict age?

Obviously, it's possible because the code will change while it's alive.

It gets shorter, pieces are lost, and insertions occur.

Read the signal and build a model.

Well, it's an interesting challenge. Can you predict a human face?

It's a bit complicated, with human faces scattered among millions of characters.

And the human face is not a very well defined object.

So we had to build an entire hierarchy to learn and teach the machine what a face is, embed it and compress it.

Anyone familiar with machine learning knows what the challenge here is.

Fifteen years later, this October, fifteen years after reading the first sequence, I started to see some signs.

And it was such an emotional moment.

Shown here is a subject coming into our lab.

This is our face.

So we capture the real face of the subject and reduce the complexity. Because not everything is in your face. Many traits, flaws and asymmetries come from your life.

Symmetrize the face and run the algorithm.

The results I'm going to show you now are the predictions from the blood.

(Applause.) Just a minute.

During these few seconds your eyes are staring left, right, left and right, and your brain wants those pictures to be identical.

So, to be honest, I want you to do another exercise.

There are many differences, so look for them.

The most common signal comes from gender, followed by factors such as age, BMI, and human ethnicity.

And scaling up that signal is much more complicated.

But what you see here will help you understand that we are in the right ballpark and close, even if there are differences.

And it's already giving you some emotion.

This is also a new theme, a prediction.

The face is a little smaller and we didn't get the full cranial structure, but it's still good enough.

This is the subject and prediction of our lab.

So these people have never attended machine training.

These are the so-called "holdout" sets.

But these are people you probably will never believe.

We publish everything as a scientific publication, so you can read it.

But we're on stage, so Chris challenged me.

I probably bared myself and tried to predict someone you might recognize.

So this vial of blood, believe me, I don't know what we had to do to get this blood now, but this vial of blood contains the amount of biological information needed to do a complete genome sequence.

Only this amount is required.

We ran this sequence. I will run with you too.

And we start building up all the understanding we have.

From the vial of blood we predicted he was male.

And the target is male.

His height is expected to be 1 meter 76 centimeters.

The subject is 1 meter 77 centimeters.

Therefore, we predicted that he would be 76 years old. The subject is 82.

His age is expected to be 38.

Subject is 35 years old.

Predict his eye color.

It's too dark.

Predict his skin color.

we are almost there.

that's his face

Now is the moment of revelation. This person is the subject.

(laughs) And I did it on purpose.

I am of a very particular and particular ethnicity.

Southern Europeans, Italians – they never fit the model.

And what's special is that ethnicity is a complicated corner case for our model.

But there is another point.

So one of the things we frequently use to recognize a person is never written into the genome.

It's our free will and it's how I look.

In this case it's not my haircut, it's my beard cut.

So, in this case, we transfer the subject's whiskers. This is just Photoshop, no modeling.

And soon, we feel much, much better.

So why do we do this?

Of course, we're not doing it to predict height or take beautiful pictures out of blood.

We do this because the same technology and the same approach, machine learning in this code, is helping us understand how we work, how the body works, how the body ages, how disease develops in the body, how cancer grows and develops, how drugs work and whether they work on the body.

This is a big challenge.

This is a challenge we share with thousands of researchers around the world.

This is called personalized medicine.

It is the ability to move from a statistical approach where you are a dot in the ocean to a personalized approach where you read all these books and understand exactly how you are.

But this is a particularly complex challenge. With all these books, we probably know about 2 percent as of today, or only 4 out of over 175 books.

And this is not the subject of my talk. Because we will learn more.

We have the best minds in the world on this subject.

Predictions are more accurate, models are more accurate.

And the more you learn, the more you'll be forced to make decisions about life, death, and parenting that you never had to face before.

So we're touching a very deep part of how life works.

And it is a revolution that cannot be confined to the realm of science and technology.

This should be a global conversation.

We must start thinking about the future we are building as a human race.

We need to interact with creators, artists, philosophers and politicians.

Everyone is involved because it is the future of our species.

Fear not, but with the understanding that the decisions we make next year will change the course of history forever.

thank you.

(applause)

I have a pretty old one.

It is older than any human artifact, older than life on Earth, older than continents and intercontinental oceans.

It formed over 4 billion years ago, in the early days of the solar system, when planets were still forming.

This rusty hunk of nickel and iron may not look anything special, but when you cut it open...

You can see that it is different from the metal on the ground.

This pattern reveals metallic crystals that can only form in space, where molten metal cools very slowly, a few degrees every million years.

It was once part of a much larger body and was one of the millions left over after the planet formed.

We call these objects asteroids.

Asteroids are our oldest and most abundant cosmic neighbors.

This image shows a near-Earth asteroid orbiting the Sun in yellow and swinging near the Earth's orbit in blue.

The sizes of the Earth, Sun, and asteroids are greatly exaggerated for clarity.

Teams of scientists around the world are searching for these objects, discovering new ones every day and steadily mapping near-Earth space.

Much of this research is funded by NASA.

I think of the search for these asteroids as a huge public undertaking, but instead of building highways, we're mapping outer space and building archives that will last for generations.

These are 1,556 near-Earth asteroids discovered just last year.

These are all known near-Earth asteroids, with a final count of 13,733.

Each has been imaged, cataloged, and its orbit around the Sun determined.

The paths of most asteroids can be predicted for decades, depending on the asteroid.

And the paths of some asteroids can be predicted with incredible accuracy.

For example, scientists at the Jet Propulsion Laboratory predicted four years ago where the asteroid Tutatis would go within 30 kilometers.

Over the past four years, Toutatis has traveled 8.5 billion kilometers.

This has a decimal precision of 0.000000004.

(Laughter) Now, the reason I have this beautiful asteroid fragment is because, like in other neighboring countries, asteroids sometimes pop up unexpectedly.

(Laughter) Three years ago today, a small asteroid exploded over the city of Chelyabinsk, Russia.

The object was about 19 meters in diameter, about the size of a convenience store.

An object of this size hits Earth about every 50 years.

Sixty-six million years ago, a much larger object collided with Earth, causing a mass extinction.

Sadly, 75 percent of plant and animal species, including dinosaurs, have been lost.

The object is about 10 kilometers in diameter, roughly equivalent to the cruising altitude of a 747.

Next time you're on a plane, take a window seat, look out, and imagine yourself lying on the ground and a rock so huge that it grazes against the tip of your wing.

It is so wide that it takes a full minute for an airplane to pass through it.

That's the size of an asteroid that hits Earth.

It was only in my lifetime that asteroids came to be considered a credible threat to our planet.

Since then, an intensive effort to find and catalog these objects has been underway.

I was lucky enough to participate in this effort.

I am part of a team of scientists using NASA's NEOWISE telescope.

Now, NEOWISE wasn't designed to find asteroids.

It was designed to orbit the Earth and look far beyond our solar system, searching for the coldest stars and brightest galaxies.

And it has performed very well for its designed 7-month lifespan.

But today, six years later, it still does.

We reused it for asteroid discovery and research.

A nice little space robot, but these days it's more like a used car.

The refrigerant used to cool the sensors has long since run out, so you joke that your air conditioner is broken.

The odometer has 920 million miles on it and it's still working fine, reliably taking pictures of the sky every 11 seconds.

I took 23 photos after I started talking to her.

One of the reasons NEOWISE is so valuable is its ability to see the sky in thermal infrared.

In other words, NEOWISE does not see the sunlight reflected by the asteroid, but rather the heat it emits.

This is a very important feature, as some asteroids are as faint as coal and can be difficult or impossible to spot with other telescopes.

But all asteroids shine brightly in NEOWISE, whether bright or dark.

Astronomers have every technology at their disposal to discover and study asteroids.

A historic milestone was reached in 2010.

Together, the community has discovered more than 90 percent of asteroids larger than one kilometer in diameter – objects with the potential to wreak havoc on Earth.

But the work isn't done yet.

Objects over 140 meters can annihilate a medium-sized country.

So far, only 25% of them have been found.

We must continue to search the skies for near-Earth asteroids.

We are the only species that can understand calculus and build telescopes.

We know how to find these objects.

This is our responsibility.

If you spot a dangerous asteroid with critical early warning, you can push it out of the way.

Unlike earthquakes, hurricanes and volcanic eruptions, asteroid impacts can be accurately predicted and prevented.

What we have to do now is map the near-Earth space.

We must keep searching the sky.

thank you.

(applause)

I was three months pregnant with twins when my husband Ross and I went for our second ultrasound.

I was 35 at the time, and I knew that meant I was at a higher risk of having a child with a birth defect.

So Ross and I researched standard birth defects and felt reasonably prepared.

Well, nothing could have prepared us for the strange diagnosis we were about to face.

Doctors explained that one of our twins, Thomas, had a fatal birth defect called anencephaly.

This means that his brain was not forming properly because part of his skull was missing.

Babies with this diagnosis usually die in utero or within minutes, hours, or days after birth.

But the other twin, Callum, appeared to be in good health as far as doctors could tell, and the twins were genetically identical.

So after many questions about why this could happen, selective abortion was mentioned. This surgery was not impossible, but it poses some unique risks for my healthy twins and myself, so we decided to continue the pregnancy to term.

So, I'm three months pregnant, two trimesters ahead, and had to find a way to manage my blood pressure and stress.

And I felt like my roommate had a loaded gun pointed at me for six months.

But I stared into the barrel of that gun for so long that I saw a light at the end of the tunnel.

There was nothing we could do to prevent the tragedy, but I wanted to find a way to have some positive impact on Thomas' short life.

So I asked the nurse about donating organs, eyes, and tissues.

She connected with the Washington Area Transplant Community, a local organ procurement organization.

The WRTC explained to me that Thomas would probably be too small at birth to donate for a transplant. And I was shocked. I didn't even know I could be rejected for that.

But they said he would be a good candidate to donate for research.

This allowed me to see Thomas in a new light.

More than just a victim of disease, I came to see him as a possible key to solving the mysteries of medicine.

Twins were born on March 23, 2010 and both were born alive.

And as doctors said, Thomas was missing the top of his skull, but he could feed and drink from a bottle like a normal baby, cuddle and hold our fingers, and sleep in our arms.

Six days later, Thomas died in Ross' arms, surrounded by his family.

We called WRTC and WRTC sent a van home to take him to the National Children's Medical Center.

A few hours later, I received a call saying that the collection was successful and that Thomas' donation would go to four locations.

His cord blood will be sent to Duke University.

His liver was sent to Cytonet, a cell therapy company in Durham.

His corneas were to be sent to the Sheppens Eye Institute, part of Harvard Medical School, and his retinas to the University of Pennsylvania.

A few days later, we held a funeral with close family members, including baby Callum, and we were basically done with this chapter of our lives.

But I wondered what was going on now.

What are researchers learning?

And was it worth donating?

The WRTC invited Ross and I to a grief retreat to meet with about 15 other grieving families who had donated their loved ones' organs for transplantation.

Some even received thank you letters from recipients of their loved ones' organs.

I learned that if both parties signed a waiver, it would be possible to meet, just like in an open adoption.

And I was so excited that I thought maybe I could write a letter or receive a letter and find out what happened.

However, I was disappointed to learn that this procedure only exists for those who donate for the transplant.

So I was jealous. I think there was a feeling of envy towards the transplant.

(Laughter) But over the years, I learned more about giving and even got a job in that field.

And then I got an idea.

I wrote a letter beginning with "Dear Researcher".

I explained who I was, asked if I could tell him why I requested infant retinas in March 2010, and asked if my family could visit the lab.

I emailed it to the Old Dominion Eye Foundation, the eye bank that arranged the donation, and asked if it could be sent to the right person.

They said they've never done anything like this before and can't guarantee a response but they wouldn't be an obstacle and would deliver.

Two days later, I got a reply from Dr. Arpa Ganguly of the University of Pennsylvania.

She thanked me for the donation and explained that she was researching retinoblastoma. Retinoblastoma is a deadly cancer of the retina that affects children under the age of five, and yes, we were invited to visit her lab, she said.

So then we spoke on the phone and one of the first words she said to me was that I couldn't even imagine how we felt and that Thomas had made the ultimate sacrifice and she seemed to owe us.

So I said, "I have nothing against your research, but we didn't actually choose it."

We donated to the system and the system chose your research.

I said, "And secondly, bad things happen to our children every day. If we didn't want this retina, it would probably be buried in the ground right now."

So being able to participate in your research gives Thomas a new meaning to his life.

So never feel guilty about using this tissue. ”

She then explained to me how unusual it was.

Six years ago she had requested this organization from the National Agency for Disease Research and Exchange.

She obtained only one tissue sample that met her criteria. It belonged to Thomas.

Next, I arranged a date for my visit to the lab and chose March 23, 2015, the twins' fifth birthday.

After I hung up, I emailed her a picture of Thomas and Callum. A few weeks later this T-shirt arrived in the mail.

A few months later, Ross, Callum, and I got in our car and went on a road trip.

We met with Ms. Alpa and her staff and when I told her not to feel guilty Mr. Alpa said she was relieved and didn't see it from our point of view.

She also explained that Thomas has a secret codename.

Thomas was called the RES 360 in the same way Henrietta Lux was called the HeLa.

RES means research and 360 means he is the 360th specimen in about ten years.

She also shared a unique document with us. It was the shipping label that sent his retinue from Washington DC to Philadelphia.

This shipping label is now like an heirloom to us.

It's the same as a military medal or a marriage certificate.

Arpa also explained that he's using Thomas' retina and its RNA to inactivate genes that cause tumorigenesis, and he also showed us some results based on RES 360.

She then took us to the freezer and showed us two samples she still had, labeled RES 360.

I have two small ones left.

She said she kept it because she didn't know when she would get more.

After this, we went to the conference room to relax and have lunch together, and the lab staff gave Callum a birthday present.

It was a child experiment kit.

And they also offered him an internship.

(Laughter) Finally, I have two quick messages for you today.

One is that probably most of us don't think about donating to research.

I know you didn't. I'm an ordinary person.

But I did.

It was a good experience and would recommend it and it brought great peace to my family.

And second, if you work with human tissue and are concerned about a donor or family member, please write.

Tell them you received it, tell them what you're working on, and invite them to visit your lab. Because the visit may be even more pleasing to you than to them.

And I have a request for you too.

If you have had any success in arranging these visits, please let me know about it.

Another story from my family is that we ended up visiting all four Thomas-donated facilities.

And we met some amazing people doing inspiring work.

The way I look at it now is that Thomas got into Harvard, Duke, and Penn -- (laughter) and he works at Cytonet and has colleagues, some of whom are at the top of their field.

And they need him to do their job.

And life, which once seemed short and insignificant, was revealed to be important, eternal and meaningful.

And I can only hope that my life will be just as meaningful.

thank you.

(applause)

Perhaps unsurprisingly, I don't like being in the hospital, nor do I like going to the hospital.

you?

Isn't there a lot of people who feel the same way?

but why? Why do we hate hospitals so much?

Or is it just a fact of life that we must accept?

Is it crappy food?

Is it because parking is expensive?

Does it have a strong odor?

Or is it fear of the unknown?

It's not just that, but it's more.

Patients often have to travel long distances to get to the nearest hospital, making access to hospital care increasingly a problem not only in the rural United States, but also in sparsely populated countries like Sweden.

And even if hospitals are plentiful, the poor and the elderly typically have difficulty accessing treatment due to the lack of convenient and affordable transportation.

And many avoid hospital care altogether, and the cost prevents them from getting proper treatment.

It shows that 64% of Americans avoid healthcare because of cost.

And even when treated, hospitals often exacerbate the disease.

Medical malpractice is reported to be the third leading cause of death in the United States, behind cancer and heart disease.

I've been in healthcare for over 20 years and I see every day how broken and outdated our hospital system is.

Let me give you two examples.

4 out of 10 Japanese doctors and 5 out of 10 American doctors are burnout.

Only 17 million people live in my native Netherlands.

There will be a shortage of 125,000 nurses in the next few years.

But how did this idea of ​​housing sick people of all kinds together in one big building get here?

Well, we have to go back to ancient Greece.

In 400 BC, a healing temple was built where people could receive diagnosis, treatment and healing.

And indeed, for about 2,000 years, we have seen religious care centers all the way up to the industrial revolution. There we have seen hospitals set up as assembly lines on the principles of the Industrial Revolution to efficiently produce and get products, in this case patients, out of hospitals as quickly as possible.

Over the past century we have seen many interesting innovations.

We have discovered how to make insulin.

We invented pacemakers and X-rays, and entered a wonderful new era of cell and gene therapy.

But the biggest change to fully fix the hospital system is still ahead of us.

And I believe that now is the time to completely transform the system and forget about the current hospital system.

I think the time has come to build a new system centered on home medical care.

Recent studies show that 46 percent of hospital care can be transferred to patients' homes.

It's a lot.

It is primarily intended for patients suffering from chronic diseases.

This allows hospitals to shrink to small, agile, mobile medical centers focused on acute care, and they should.

Therefore, I believe that neonatology, intensive care, surgery, imaging, etc. will remain in hospitals, at least for the time being.

A few weeks ago, I met a colleague whose mother had been diagnosed with incurable cancer, and she said, 'Niels, you're in trouble.

Knowing that she only has a few months left to live is very painful.

Instead of playing with her grandchildren, she has to make a two-hour round trip to Amsterdam three times a week just to get treatment and tests. ”

It's really heartbreaking because we all know professional nurses can draw blood even at home.

And being able to get tested and treated at home will allow her to do what really matters to her in her final months.

My mother is now 82 years old. May God bless her. She avoids going to the hospital because it is difficult to plan and manage her trips.

So my sisters and I help her.

However, many older people avoid care and wait too long before their lives are in danger, leading them straight to costly intensive care.

Dr. Kovinsky, a clinical researcher at the University of California, concludes that one third of patients over the age of 70 and more than half of those over the age of 85 are more disabled than they were at hospital admission.

And the very real question many patients face when they have to go to the hospital is where to go with their main companion in life, where to go with their dog.

By the way, that's my dog. isn't she cute?

(Laughter) But it's not just about convenience.

Unnecessary medical stays and costs are also an issue.

My friend Art recently had to be in the hospital for a minor surgery and had to stay in the hospital for over two weeks simply because he needed a particular type of antibiotic drip.

There he occupied a bed costing more than €1000 a day for two weeks.

It's ridiculous.

And these costs are precisely the heart of the matter.

As such, we have seen healthcare spending increase as a percentage of GDP over the last few years in much of the global economy.

We can see that over the past 50 years, Germany's healthcare costs have increased from around 5% to around 11% today.

In the US, we are currently seeing growth of 6% to over 17%.

And most of these costs are driven by investments in large, shiny hospital buildings.

And these buildings are inflexible, maintaining a system that requires hospital beds to be filled in order for the hospital to operate efficiently.

There is no incentive for hospitals to operate with fewer beds.

Do you feel sick just thinking about it?

And, importantly, the cost of treating a friend's art at home can be up to 10 times cheaper than hospital treatment.

And that's where we're headed.

The hospital beds of the future will be in our own homes.

And it has already started.

Global home health care is up 10% year-over-year.

And my own experience tells me that logistics and technology make these home health solutions work.

Thanks to technology, we are already able to do things that were once only possible in hospitals.

Diagnostic tests such as blood tests, glucose tests, and urine tests are now available in the comfort of your own home.

And more and more connected devices, such as pacemakers and insulin pumps, actively signal when we need immediate help.

And all that technology comes together to give you more insight into patient health, and that insight and all that information translates into better management and less malpractice. Remember the 3rd leading cause of death in the US?

And I see it at work every day.

I work in logistics and home health care is useful for me.

There we witnessed delivery drivers delivering medicines to patients' homes.

A nurse joins in and actually administers the medicine at the patient's home.

It's that simple.

My friend, do you remember art?

He can now get an antibiotic drip in the comfort of his own home. You don't need hospital pajamas or poor food. Also, there is no danger of antibiotic-resistant super-strength bacteria that only sting in hospitals.

And so on.

So older people can now get the care they need in the comfort of their own homes with the best companions of their lives.

No more driving for hours just to get treatment or tests.

In the Netherlands and Denmark, we have seen cancer clinics organize chemotherapy in patients' homes, sometimes with fellow patients, with great success.

The best improvement for these patients is a reduction in stress, anxiety and depression.

Home care also helped them regain a sense of normalcy and freedom in their lives, and actually helped them forget about their illness.

But as for home care, Mr. Niels, what if I don't even have a home, or I'm homeless, or I have a home but no one to look after me or open the door?

Well, here comes our sharing economy, or Airbnb for home care, as I like to call it.

In the Netherlands, we see churches and care organizations matching people who need care and companionship with people who actually have a home and can provide care and companionship.

Home health care is cheap, easy to facilitate, and quick to set up. This is true not only in the rural areas we speak of, but also in humanitarian crises. Providing medical care at home is often safer, faster, and cheaper.

Home health care is highly applicable not only in wealthy areas, but also in underserved areas.

Home health care is practiced not only in developing countries but also in developed countries.

Therefore, I am passionate about helping improve patients' lives through home health care.

I am passionate about helping older people get the care they need in the comfort of their own homes with the best companions of their lives.

I am passionate about making a difference and helping patients, not illnesses, take control of their lives.

For me, it is medical care provided at home.

thank you.

(applause)

Design is a slippery and elusive phenomenon that has taken on different meanings at different times.

But all truly inspiring design projects have one thing in common: they all started with a dream.

And the bolder the dream, the greater the design feat required to achieve it.

And this is why great designers are almost always the biggest dreamers, rebels and rebels.

This was true throughout history, going back to 300 BC, when a 13-year-old boy became king of a remote, very poor, very small Asian nation.

He dreamed of acquiring land, wealth and power through military conquest.

And to make that possible, as unlikely as it may sound, his design skills would be essential.

At that time, all weapons were hand-made to various specifications.

As such, even if an archer runs out of arrows during combat, he or she may not always be able to shoot another archer's arrows from his own bow.

This naturally meant that they were less effective in combat and much more vulnerable.

Ying solved this problem by claiming that all bows and arrows were designed identically and were interchangeable.

And he did the same with daggers, axes, spears, shields, and all other weapons.

His formidably equipped army won battle after battle, and within fifteen years his small kingdom had succeeded in conquering all its larger, richer, and more powerful neighbors, creating the mighty Chinese Empire.

Now, of course, at the time, no one would have thought of describing Ying Zheng as a designer. Why?

Yet he unconsciously and instinctively, but with tremendous ingenuity, used design to achieve his goals.

And equally improbable accidental designers were equally willing to use violence to get what they wanted.

It was an English pirate, Edward Teach, better known as Blackbeard.

This was the golden age of piracy, with pirates like Teach terrorizing the high seas.

Colonial trade was thriving, and piracy was lucrative.

And smart pirates like him realized that in order to maximize their loot, they had to attack with such brutality that they would surrender if they saw an enemy.

This meant that the ship could be captured without wasting ammunition or suffering casualties.

So Edward Teach redesigned himself as Blackbeard by playing the role of the merciless beast.

He wore a heavy jacket and a large hat to emphasize his height.

He had a thick black beard that covered his face.

He slung the pistol brace over either shoulder.

He even lit a match in the brim of his hat so that whenever the ship was ready to attack, the match made an intimidating sizzle.

And, like many pirates of the time, he hoisted a flag depicting the macabre symbol of a human skull and a pair of crossed bones. Because these motifs have meant death in many cultures for centuries, the meaning was instantly recognizable even in the lawless and illiterate world of the high seas. If you don't surrender, you will suffer.

Naturally, therefore, all his decency victims surrendered at sight.

Considered this way, it's easy to see why Edward Teach and his fellow pirates are considered the pioneers of modern communication design, and why their deadly symbols - (laughter) there are more - their deadly symbols of skull and crossbones were the predecessors of today's logo, more like the big red letters standing behind me, but of course with a different message.

(Laughter.) But the design was also used for a nobler purpose by an equally talented and equally unlikely designer, the 19th-century English nurse Florence Nightingale.

Her mission was to provide adequate medical care for all.

Nightingale was born into a fairly wealthy large family in England, but her family was appalled when she volunteered to work in a military hospital during the Crimean War.

Once there, in the filthy and fetid wards, I quickly realized that more patients were dying from infections than from battle wounds.

So she campaigned to design and build a cleaner, lighter and airier clinic.

Back in the UK, she ran another campaign, this time targeting private hospitals, arguing that the same design principles would apply to private hospitals.

The Nightingale Ward, as the so-called Nightingale Ward, dominated hospital design for the following decades, elements of which are still in use today.

But by then, design was seen as a tool of the industrial age.

It was formalized and specialized, but confined to specific roles, and generally applied to pursue commercial goals, rather than being used intuitively as in Florence Nightingale, Blackbeard, and Ying Zheng.

By the 20th century, this commercial spirit had become so powerful that any designer who deviated from it risked being seen as a freak or a disruptor.

Among them is the brilliant Laszlo Moholy-Nagy, one of my great design heroes.

He is a Hungarian artist and designer whose experiments on the impact of technology on everyday life are so powerful that he still influences the design of the digital images displayed on mobile phone and computer screens.

He radicalized the Bauhaus design school in 1920s Germany, but some of his former colleagues shunned him years later as he struggled to found a new Bauhaus in Chicago.

Moholy's ideas were as bold and edgy as ever, but his approach to design was too experimental, as was his obsession with seeing design as an attitude rather than a contemporary profession, in his words.

And sadly, the same was true of design maverick Richard Buckminster Fuller.

Another great design visionary and design activist, he was so committed to designing a sustainable society in such a forward-thinking way that he began talking about the importance of environmental protection in design in the 1920s.

Now, despite his efforts, he is routinely derided as a freak by many in the design world, and it is true that some of his experiments have failed, like the flying car that never got off the ground.

But the Geodesic Dome, his design formula for constructing emergency shelters using almost anything available at the time: wood, metal, plastic, scraps of wood, old blankets, plastic sheets, is one of the greatest feats of humane design and has since provided much-needed shelter to many in desperate situations.

Now, it was the bravery and courage of radical designers like Bucky and Mohorley that drew me to design.

I started my career as a news journalist and foreign correspondent.

I wrote about politics, economics and corporate affairs, but I could have chosen to specialize in any of those areas.

But I chose design because I believe it is one of the most powerful tools at your disposal to improve your quality of life.

Thank you, TED design enthusiasts.

(Applause.) And while I greatly admire the extraordinary and invaluable achievements of professional designers, I also believe that design greatly benefits from the originality, lateral thinking, and resourcefulness of rebels and rebels.

And we live in a remarkable moment in design. Because this is the time when the two factions are getting closer.

Because even the very basic advances in digital technology have allowed us to operate more and more independently, both within and outside the commercial context, and pursue ever more ambitious and eclectic goals.

In theory, therefore, basic platforms such as crowdfunding, cloud computing, and social media should give professional designers more freedom, improvisational designers more resources, and hopefully a more receptive response to their ideas.

Well, some of my favorite examples are in Africa. In Africa, a new generation of designers is developing amazing Internet of Things technologies to fulfill Florence Nightingale's dream of improving healthcare in countries where more people have access to mobile phones than clean water.

Among them is Arthur Zhang.

He is a young Cameroonian design engineer who adapted a tablet computer into the Cardiopad, a mobile heart monitoring device.

It can be used to monitor the heart of patients living in remote locations.

The data is then sent over cellular networks to well-equipped hospitals hundreds of miles away for analysis.

And if a problem is discovered by a specialist there, an appropriate course of treatment is recommended.

And of course this saves many patients from long, laborious, expensive and often pointless trips to the hospital, and makes it much more likely that their hearts will actually be examined.

Arthur Zang started working on Cardiopad eight years ago during his final year of college.

But he was unable to convince traditional stakeholders to invest in getting the project off the ground.

He posted the idea on Facebook, where a Cameroonian government official saw it and managed to secure a government subsidy.

He is currently developing Cardiopad as well as other mobile medical devices to treat various conditions.

And he is not alone. Because there are many other inspiring and enterprising designers pursuing their own extraordinary projects.

Finally, we finish by looking at some of them.

One is peak vision.

This is a group of Kenyan doctors and designers who have developed a unique Internet of Things technology as a portable eye test kit.

Next, Gabriel Maher is developing a new design language that allows us to articulate the nuances of shifting gender identities without resorting to traditional stereotypes.

All of these designers, and many more, are using the discipline of a professional designer and the wit of a rebel and a rebel to make the most of their newfound freedom to pursue their dreams.

And we all stand to benefit from it.

thank you.

(applause)

This is a story about gene drives, but let's start with a quick story.

Twenty years ago, a biologist named Anthony James became obsessed with the idea of ​​creating a malaria-free mosquito.

It was a great idea, but an almost complete failure.

First, it turned out to be very difficult to create malaria-resistant mosquitoes.

Professor James finally did just a few years ago by adding some genes that make it impossible for the malaria parasite to survive inside the mosquito.

But that just created another problem.

Once you have a malaria-resistant mosquito, how do you replace all malaria-carrying mosquitoes?

There were several options, but Plan A basically consisted of mass-breeding new, genetically-engineered mosquitoes and releasing them into the wild, hoping that their genes would be passed on.

The problem was that it literally had to release ten times the number of native mosquitoes to work.

So a village with 10,000 mosquitoes will release 100,000 more.

As you can imagine, this was a strategy that was not very popular with the villagers.

(Laughter.) And last January, Anthony James got an email from a biologist named Ethan Beer.

Bia, along with graduate student Valentino Ganz, said they stumbled across a tool that could not only ensure that a particular genetic trait is passed on, but that it spreads incredibly quickly.

If they're right, the problem he and James have been grappling with for 20 years is basically solved.

As a test, they engineered two mosquitoes to carry the antimalarial gene and this new tool, the gene drive. More on this later.

Finally, mosquitoes that inherited the antimalarial gene were set to have red eyes instead of the usual white eyes.

This is for convenience so that you can tell at a glance which is which.

So they took two antimalarial red-eyed mosquitoes, put them in a box with 30 normal white-eyed mosquitoes, and bred them.

In two generations, 3,800 grandchildren were born.

That's not surprising.

This is the amazing part. Assuming you started with 2 red-eyed mosquitoes and 30 white-eyed mosquitoes, you would expect most of your offspring to be white-eyed mosquitoes.

Instead, when James opened the box, all 3,800 mosquitoes had red eyes.

When I asked Ethan Beer about this moment, he was so excited he was literally screaming into his phone.

That's because catching only red-eyed mosquitoes violates the absolute foundation of biology: the laws of Mendelian genetics.

Briefly, according to Mendelian genetics, when a male and female mate, the baby inherits half of its DNA from both parents.

So if the original mosquito is aa and the new mosquito is aB (where B is the anti-malarial gene), babies should be born with four permutations: aa, aB, aa, Ba.

Instead, a new gene drive made them all AB.

Biologically, it shouldn't be possible.

what happened?

The first came in 2012 with the advent of a gene-editing tool known as CRISPR.

I'm sure many of you have heard of CRISPR, so let me briefly explain how it is a tool that allows researchers to edit genes with great precision, ease and speed.

This is done by taking advantage of mechanisms already present in bacteria.

Basically, there are proteins that act like scissors to cut DNA, and there are RNA molecules that point the scissors at any point on the genome.

The result is basically a word processor for genes.

You can also take out an entire gene, insert one, or edit just a single letter within a gene.

And you can do that with just about any species.

OK, remember when I said that gene drives originally had two problems?

The first was that it was difficult to engineer mosquitoes to be malaria resistant.

Thanks to CRISPR, it's basically gone.

But another problem was logistical.

How do you spread your character?

This is where it gets smart.

A few years ago, Harvard biologist Kevin Esvelt wondered what would happen if CRISPR were to insert not only new genes, but also cut-and-paste machines.

In other words, what if we also copy and paste CRISPR itself?

Eventually we will have a perpetual machine for gene editing.

And that's exactly what happened.

This CRISPR gene drive created by Esvelt not only guarantees inheritance of traits, but when used in germline cells, it automatically copies and pastes new genes onto both chromosomes of all individuals.

This is like a global search and replace, which in scientific terms makes a heterozygous trait homozygous.

So what does this mean?

First, this means we have a new tool that is both very powerful and somewhat alarming.

The fact that gene drives haven't worked so well so far has actually been a saving grace.

Normally, messing with an organism's genes makes it less evolutionarily fit.

So biologists can create all the mutant fruit flies they want without worrying.

Even if some escape, natural selection just takes care of them.

The amazingly powerful and scary thing about gene drives is that it is no longer true.

Assuming your trait doesn't have a major evolutionary handicap like a flightless mosquito, a CRISPR-based gene drive will spread change relentlessly until it reaches every individual in the population.

Now, making a gene drive that works that well isn't easy, but James and Esvelt think it can be done.

The good news is that this opens the door to some notable things.

Researchers estimate that introducing an anti-malarial gene drive into just 1% of malaria-carrying Anopheles mosquitoes could spread to the entire population within a year.

In other words, we will be able to virtually eradicate malaria within a year.

Malaria still kills 1,000 children every day, even though it's still years away.

A year from now, that number may be nearly zero.

So are dengue fever, chikungunya fever, and yellow fever.

And it gets better.

Suppose you want to get rid of invasive species, such as driving Asian carp out of the Great Lakes.

All you have to do is release the gene drive so that the fish produce only male offspring.

In a few generations there will be no females and no carp.

In theory, this means that hundreds of native species that have been pushed to the brink can be restored.

OK, that's good news, but this is bad news.

Gene drives are so effective that even an accidental release can change an entire species, and often very quickly.

Anthony James took good precautions.

Because he raised the mosquitoes in biocontainment laboratories and used species not native to the United States, even if some escaped, they would just die and have nothing to mate with.

However, it is also true that if a dozen or so Asian carp with an all-male gene drive were accidentally brought back to Asia from the Great Lakes, it could wipe out native Asian carp populations.

And given how connected our world is, it's not that improbable.

In fact, that's why we have an alien species problem.

And it's a fish.

Things like mosquitoes and fruit flies literally have no way of being contained.

They always cross borders and oceans.

OK, the other bad news is that gene drives may not be limited to so-called target species.

It's because of gene flow (a fancy way of saying that neighboring species sometimes interbreed).

Gene drives could then cross over, like Asian carp infecting other carp species.

If your urge only promotes a trait such as eye color, that's not so bad.

In fact, it is quite possible that in the near future we will see a wave of very strange fruit flies.

But if the intention is to eliminate the species entirely, it can be a disaster.

A final worrisome thing is that the technology to do this—genetically engineering organisms to incorporate gene drives—can be done in basically any lab around the world.

Even undergraduates can do it.

Any talented high school student with some equipment can do that.

Now, I think this is terrifying.

(Laughter) But interestingly, almost every scientist I spoke to seemed to think that gene drives weren't really that scary or dangerous.

One reason is that we believe that scientists act very carefully and responsibly when using them.

(Laughter) So far, that's true.

However, gene drives also have some limitations in practice.

So, first, they only work in species that reproduce sexually.

Thankfully, it cannot be used to manipulate viruses or bacteria.

Also, this trait only spreads with each generation.

Therefore, changing or eliminating populations is only practical if the species has a fast reproductive cycle, such as insects and small vertebrates such as mice and fish.

In the case of elephants and humans, it would take centuries for a trait to become widespread enough to be significant.

And even with CRISPR, it's not that easy to design truly disruptive properties.

Suppose you wanted to create fruit flies that would eat normal fruit instead of rotten fruit, with the goal of sabotaging American agriculture.

First, we need to figure out the genes that control what the flies want to eat, which is already a very long and complicated project.

These genes would then need to be altered to change the fly's behavior as desired, which would be an even longer and more complicated project.

And the genes that control behavior are so complex that it might even fail to work.

So what if you were a terrorist and had to choose between embarking on a grueling basic research program that required years of meticulous lab work and could still go wrong, or just blowing things up?

I would probably choose the latter.

This is especially true since, at least in theory, it should be very easy to build a so-called reversing drive.

This basically overwrites the changes made by the first gene drive.

So if you don't like the effect of the change, at least in theory, you can just free up a second drive canceling the change.

Now what are we going to do?

We can now change entire species at will.

should we?

Are we gods now?

I don't know if I should say that.

But I want to say First, some very smart people are still debating how to control gene drives.

At the same time, other very smart people are working hard to create safeguards like gene drives that self-regulate or disappear after a few generations.

That is wonderful.

But this technology still requires a conversation.

And given the nature of gene drives, that conversation must be global.

What if Kenya wants to use the drive but Tanzania does not?

Who decides whether to release a flying gene drive?

I have no answer to that question.

I think what we can do in the future is to be honest about the risks and benefits and take responsibility for our choices.

That is, not only the choice to use a gene drive, but also the choice not to use a gene drive.

Humans tend to think that maintaining the status quo is the safest option.

However, this is not always the case.

Gene drives have risks and should be debated, but malaria is present and kills 1,000 people a day.

To combat it, we spray pesticides that seriously damage other species, including amphibians and birds.

So when you hear about gene drives in the coming months, believe me, you will hear about it too, remember that.

Acting can be scary, but inaction can be worse.

(applause)

Imagine that you have invented a device that can record my memories, dreams and ideas and transmit them to your brain.

Will it be a game-changing technology?

But in fact, we already have this device, called the human communication system and effective storytelling.

To understand how this device works, we have to look into our brains.

And you should formulate your question in a slightly different way.

Now I have to ask how the neuronal patterns in my brain associated with my memories and ideas are transmitted to your brain.

And I think there are two elements that make communication possible.

First, your brain is physically coupled with the sound waves I am sending to your brain.

We then developed a common neural protocol to enable communication.

So how do we know that?

In my lab in Princeton, I take people into fMRI scanners and scan their brains while they tell and listen to real stories.

And to give you a sense of the stimulus we use, let me play 20 seconds from the story we used, told by the very talented storyteller Jim O'Grady.

(Audio) Jim O'Grady: So I'm putting out my story in a big way, and I know it's a good one, and then I start making it better -- (laughter) by adding an element of embellishment.

Reporters call this a "hoax."

(Laughter.) And they advise not to cross that line.

But I had just witnessed a line crossed between a powerful dean and a pastry assault.

And I kind of liked it. ”

Uri Hasson: So let's look into your brain and see what happens when you hear this kind of story.

Let's start with the simple things. Let's start with one listener and one brain region: the auditory cortex, which processes sound coming in through the ear.

As you can see, this particular brain area responds up and down as the story unfolds.

Now we can take these responses and compare them with those of other listeners in the same brain region.

Then you can ask, "How similar is the reaction of all listeners?"

Five listeners are shown here.

And we start scanning their brains before the story begins, when they're just lying in the dark waiting for the story to start.

As you can see, each brain region goes up and down, but their responses are very different and out of sync.

But as soon as the story begins, something amazing happens.

(Audio) JO: So I'm putting out my story in a big way, and I know it's a good thing, and then I start making it up -- UH: All of a sudden, you see that every subject's reaction is anchored to the story. And now you can see that the reaction is going up and down in a very similar way among all listeners.

And in fact, this is exactly what is happening in your brain right now as you listen to me speak.

We call this effect “neural entrainment”.

To explain what neural entrainment is, let's first explain what physical entrainment is.

Let's take a look at the five metronomes.

Think of these five metronomes as five brains.

And just like the listener before the story begins, these metronomes click, but they click out of phase.

(click) Now let's see what happens when we place and connect these two cylinders.

(click) Now these two cylinders will start to rotate.

This rotational vibration travels through the wood and binds all the metronomes together.

And hear the click sound.

(synchronized click) This is what we call physical retraction.

Now let's go back to our brains and think about it. What is causing this neural entrainment?

Is it just the sound the speakers are making?

Or maybe words.

Or it could be the meaning the speaker is trying to convey.

So, to test it, I did the following experiment.

First, I tried playing the story backwards.

And it preserved many of the original auditory features, but removed the meaning.

And it sounds like that.

(audio) JO: (incomprehensible) And then flashed colors in the two brains to show the areas of the brain that respond very similarly in different people.

As you can see, this incoming sound triggered entrainment or tuning in all of the brain, in the auditory cortex that processes sound, but it didn't extend deep into the brain.

Now we can take these sounds and build words from them.

So if you scramble the words using Jim O'Grady, you get a list of words.

(Audio) JO: ... animals ... various facts ...

And soon... pieman... potentially... my story UH: And you'll find that these words are starting to induce alignment in the early language domain, but no more.

Now you can take words and build sentences from them.

(Audio) JO: And they advise not to cross that line.

he says: "Dear Jim, that's a good story. You know the details.

Did she only know him through me? ”

UH: Now you can see that the responses for all language domains that handle incoming languages ​​will be consistent or similar across all listeners.

But only with the full use of compelling and coherent stories does the response extend deep into the brain and into higher regions, including the frontal and parietal cortices, where they all respond in very similar ways.

And these responses in the higher realms are thought to be evoked or similar in the listener as a whole by the meaning conveyed by the speaker rather than by words or sounds.

If we're right, there's a strong prediction that the brain will still respond similarly if we convey the exact same idea using two completely different sets of words.

And to test it, my lab did the following experiment.

We translated the English story into Russian.

Now we have two different sounds and linguistic systems that convey exactly the same meaning.

Then, play an English story to the English listeners and a Russian story to the Russian listeners so you can compare their reactions across the group.

And when we did that, we didn't see a similar response in the auditory cortex in language, because language and sounds are so different.

However, we find that the responses in the upper regions are still similar between these two groups.

This is likely because they understood the story in a very similar way, as confirmed by the post-story test.

And we believe that this adjustment is necessary for communication.

For example, as you know, I am not a native English speaker.

I grew up with another language, and many of you in the audience may be the same.

Still, we can communicate.

Why?

We believe that we can communicate because we have this common code of meaning.

So far, I've only talked about what's going on in the listener's brain, your brain, when you're listening.

But when I'm talking to you, what's going on in the speaker's brain, my brain?

To study the speaker's brain, they put the speaker in a scanner, scanned his brain, and compared his brain response to that of the audience listening.

It must be remembered that giving speech and understanding speech are completely different processes.

Now we ask: how similar are they?

Surprisingly, it turns out that all these complex patterns in the listener actually come from the speaker's brain.

Therefore, production and comprehension rely on very similar processes.

We also found that the stronger the similarity between the listener's brain and the speaker's brain, the better the communication.

So if you're totally confused right now, I hope that's not the case, but I know your brain reacts very differently than mine.

But I also know that if you really understand me now, your brain...and your brain...and your brain is really like me.

Now, let's put all this information together. How can I use it to transfer memories from my brain to yours?

Therefore, we conducted the following experiment.

We scanned people's brains while watching a TV episode of the BBC series Sherlock for the first time in their lives.

And we had them go back to the scanner and tell the story to another person who had never seen the movie.

Now let's get specific.

Consider this very scene in London where Sherlock gets into a cab driven by the murderer he's looking for.

For me as a viewer, there are certain brain patterns in my brain when I watch it.

Now, in exactly the same pattern, saying the words “Sherlock, London, Murderer” reactivates my brain.

And as I am sending these words to your brain now, you need to reframe it in your mind.

In fact, you can see the pattern manifesting in your brains right now.

And we were really surprised to find that the patterns you have in your head now as I describe these scenes are very similar to the patterns I had when I saw this movie on my scanner a few months ago.

Now let's talk about the mechanisms by which we tell stories and communicate information.

Because now you are listening hard and trying to understand what I am saying.

And we know it won't be easy.

But I hope that at some point in our conversation we will come to our senses and you will notice me.

And in a few hours, days, months, you will meet someone at a party and tell him about this talk. And suddenly it will feel as if he is standing here with us now.

Now you know how to use this mechanism to try to convey memories and knowledge to people. Isn't this great?

But our ability to communicate depends on our ability to have something in common.

Because I know that if, for example, I try to use the British synonym 'hackney carriage' instead of 'taxi', I will disagree with most of the audience.

This alignment is not just about the ability to understand basic concepts. It also depends on the ability to build common ground, develop understanding, and share belief systems.

That's because we know that people often understand the exact same story in completely different ways.

So, to test it in our lab, we did the following experiment.

We covered the story of J.D. Salinger. In it, a husband lost his wife in the middle of a party and called his best friend and asked, "Have you seen my wife?"

Half of the subjects said their wives were having an affair with their best friend.

As for the other half, he said that the wife was loyal and the husband was very jealous.

This one sentence before the beginning of the story was enough to make it clear that the brain responses of all those who believe their wives are cheating are very similar in these higher areas and different from other groups.

And if one sentence is enough for your brain to be similar to people who think like you and totally different to people who think differently than you, think how this effect is amplified in real life when we are all listening to the exact same news items, exposed daily to different media channels like Fox News and the New York Times that give us a very different perspective on reality.

So let's wrap up.

If everything went according to plan tonight, I used my ability to vocalize sounds and made them into your brain.

And I used this coupling to send my brain patterns related to my memories and ideas to your brain.

In this I begin to uncover the hidden neural mechanisms by which we communicate.

And in the future, we know that it will improve and facilitate communication.

But these studies also reveal that communication relies on common ground.

And we as a society really need to worry about losing this common ground and our ability to speak to people who are slightly different from us because we have a few very powerful media channels holding the microphone and manipulating and controlling the way we all think.

I'm just a scientist so I don't know how to fix it.

But perhaps one way to do it is to return to a more natural way of communicating: dialogue. In dialogue, it's not just me talking to you right now, it's a more natural way of talking, I'm speaking, I'm listening, and together we're trying to reach common ground and new ideas.

Because at the end of the day, it's the people we connect with that define who we are.

And our desire to connect with another brain is a very basic one that starts at a very early age.

I would like to end with an example from my own personal life. I think this is a great example of how our connections with other people really define us.

This is my son Jonathan at an early age.

See how he, along with my wife, developed a voice game out of nothing but the desire and sheer joy of connecting with another human being.

(both vocalize) (laughter) Now imagine that your son's ability to connect with us and others in his life will shape who he will become in the future.

And think about how you change from day to day as you interact and connect with other people in your life.

So keep connecting with other people.

Keep spreading your ideas. Because the sum of all of us is greater than our part.

thank you.

(applause)

As a conceptual artist, I am always looking for creative ways to provoke challenging conversations.

I do this through painting, sculpture, video and performance.

But regardless of format, two of my favorite materials are history and dialogue.

In 2007, I created "Lotus", a glass painting that is 7.5 feet in diameter and weighs 600 pounds.

In Buddhism, the lotus is a symbol of transcendence and purity of mind and spirit.

However, if you look closely at this lotus, you can see that each petal is a cross section of a slave ship.

This symbolic figure was taken from the British Manual of Slavery and was later used by abolitionists to show the atrocities of slavery.

We don't like to talk about slavery in America, and we don't see slavery as a global industry.

However, I hope to use this Buddhist symbol to universalize and transcend the history and trauma of black Americans and facilitate discussion of our common past.

Over 6,000 figures were carved to create "Lotus".

And this later led to the commission of the City of New York to create a 28-foot-tall version in steel as a permanent facility for the Eagle Academy for Young Men, the school for black and Latino students most affected by this history.

The same two groups have been heavily influenced by more recent phenomena, but that's an aside.

I have collected African wooden figurines from tourist shops and flea markets around the world.

Their authenticity and origins are entirely up for debate, but people believe they contain power or magic.

I recently figured out how to use this in my work.

(Gunshot) Since 2012, the world has witnessed the murder of Trayvon Martin, Michael Brown, Eric Garner, Sandra Bland, Tamir Rice and literally countless unarmed black citizens at the hands of police who often walk away with impunity.

Considering these victims, and even I, a law-abiding Ivy League professor, have been held at gunpoint, targeted, and harassed by the police on several occasions.

I created this series of works simply titled "BAM".

It was important to erase the identity of each of these people so they all looked the same and were easier to ignore.

To do this, dip them in dark brown wax and then bring them to the shooting range where they will be re-sculpted using bullets.

I also enjoyed playing with big guns and high-speed video cameras.

But my reverence for these figures left me unable to really pull the trigger and somehow felt like I was going to shoot myself.

Finally, Raul, the cameraman, captured it.

These pieces were then taken out to make a mold and cast first in wax and finally in bronze as you can see here. It bears the marks of its violent creation, like battle scars and scars.

At a recent screening of the film in Miami, one woman said she felt every gunshot echo through her soul.

But she also felt that these works of art commemorated not only the victims of these killings, but other victims of racial violence throughout U.S. history.

But "Lotus" and "BAM" are more than just US history.

At an exhibition in Berlin last year, a philosophy student asked me what was behind the recent murders.

I showed him a postcard photograph of the Lynch in the early 1900s and reminded him that such murders have been going on for over 500 years.

But only through questions like his and through more thoughtful dialogue about history and race can we evolve as individuals and as a society.

I hope my artwork creates a safe space for this kind of honest interaction and an opportunity for people to engage in real, needed conversations with each other.

thank you.

(applause)

Like many people, I think of this picture when I think of dreams.

I was eight years old when I saw Neil Armstrong step onto the moon from the lunar lander.

I had never seen anything like it before, and I haven't seen anything like it since.

The reason we got to the moon is simple. Because John Kennedy promised us to meet the deadline.

And without that deadline, we would still be dreaming of it.

Leonard Bernstein said it takes two things to achieve great things. It's just not enough planning and time.

(Laughter) Deadlines and promises are the great and fading lessons of Apollo.

And they give meaning to the word "moonshot."

And our world desperately needs political leaders willing to set bold deadlines to achieve bold dreams on the scale of Apollo once again.

When I think of dreams, I think of the drag queens of Los Angeles and Stonewall and the millions who risked everything to come out when it was really dangerous. And this photo of the White House lit up in rainbow colors, yes, (applause) celebrating the right to marry for gay and lesbian Americans.

This was unimaginable when I was 18, when I found out I was gay and felt alienated from my country and my dreams because of it.

I am reminded of family photos I never dreamed I would have. (Applause.) And I think of the kids holding up this headline that I never dreamed would be printed about the Supreme Court's decision.

We need more drag queens and astronaut courage.

(Laughter) (Applause) But I want to talk about the need for us to dream in multiple dimensions. Because there was something I didn't know about Apollo when I was eight years old, and there was something about iridescent organization.

Of the 30 astronauts who participated in the original Mercury, Gemini, and Apollo programs, only seven marriages survived.

The iconic image of an astronaut leaping on the moon obscures alcoholism and depression on Earth.

The Trappist monk Thomas Merton asked in the days of Apollo: "What will we gain by sailing to the moon if we cannot cross the abyss that separates us?"

And what does the right to marry give us if we can't cross the bitter emotional distance that often separates us from love?

Not just marriage.

I have seen the most hurtful, devastating and tragic infighting – LGBT, AIDS, breast cancer, nonprofits – all in the name of love.

Thomas Merton also wrote of the wars among the saints: "Modern violence is rife with the forms to which idealists are most easily succumbed: activism and overwork.

The fervor of our activities paralyzes our efforts for peace.

It destroys our own capacity for inner peace. ”

Often our dreams become a fragmented obsession with a future that destroys our ability to live in the present.

Our dreams of a future human race, or a better life for other human beings in other countries, keep us away from the beautiful human race that sits next to us in this moment.

Well, that's just the price of progress, we say.

You can go to the moon or have stability in your family life.

And dreaming in both dimensions at the same time is unthinkable.

And we don't set much higher hurdles when it comes to our emotional life than stability.

That is why the technology for us to speak to each other has gone so vertical that our ability to hear and understand each other has gone nowhere.

Our access to information is above the roof, our access to pleasure is down to earth.

But the idea that our present and future are mutually exclusive, that we must abandon our profound potentialities of being to realize our potential, that the number of transistors on a circuit can double, but that our capacity for compassion and humanity, tranquility and love is somehow limited is a false and stifling choice.

Now, I'm not just suggesting the silly idea of ​​enhancing work-life balance.

What good does it do if you spend more time at home with your kids, but your mind is always somewhere else while you're doing something?

I'm not even talking about mindfulness.

Mindfulness is suddenly becoming a tool for increasing productivity.

(laughs) Right?

I'm talking about dreaming boldly in the plane of our existence as much as in industry and technology.

I'm talking about the bold honesty that allows us to cry together, the heroic humility that allows us to take off our masks and be who we really are.

Our inability to be with each other, our fear of crying together, is what drives many of the problems we struggle to solve in the first place, from parliamentary deadlocks to economic inhumanity.

(Applause.) I'm talking about what Jonas Salk called "Epoch B," a new era in which we become as excited, curious, and scientific about human progress as we are about technological progress.

Don't let the lack of understanding hold you back from this opportunity.

There was a time when we didn't understand the universe.

Or maybe it's because we're used to technology and activities.

That's exactly the definition of being stuck out of your comfort zone.

We are now very accustomed to imagining unimaginable technological achievements.

In 2016, it's the dimensions of our very existence that demand our fair share of imagination.

Now we are here to dream, but let's be honest, maybe we are each chasing our own dreams.

We look at our nametags to see who can help me achieve my dreams, and sometimes we look straight at each other's humanity.

I don't care about you now. I have an idea to save the world.

right?

(Laughter) Many years ago, once upon a time, I had a wonderful company that organized long journeys for heroic civic action.

And we had this belief: "Be human, be kind, be both."

And we encouraged people to experiment with kindness outrageously.

It's like, "Let's help people put up their tents."

There were also many tents.

(laughs) "Everyone, go buy popsicles."

"Help fix people's punctures, even if you know the line for dinner will be long."

And people took us so well that if we got a flat tire from AIDS, we had a lot of people asking if we needed help, so we had a hard time getting it fixed.

For a few days, for tens of thousands of people, we created a world that everyone said they wanted this world to always be.

What if we spent a few days experimenting with a world like this?

And instead of going up to someone and asking, "What are you doing?"

Ask, "So what are your dreams?"

or "What are your broken dreams?"

You know, TED. Get close to each other's dreams.

(Applause.) Maybe it's "I want to be sober" or "I want to build a treehouse with my kids."

Instead of going to someone everyone wants to meet, go to someone who is alone and ask if they want a cup of coffee.

I think our greatest fear is that we will not be given the opportunity to reach our true potential, that we were born to dream and will die without having the opportunity.

We know that being human means living with that fear, so imagine living in a world where we just recognize the deep existential fears within each other and boldly love each other.

The time has come for us to dream in multiple dimensions simultaneously. Somewhere beyond all the wonderful things we can, will and should do, lies the realm of all the incredible things we can become.

Now is the time for us to step into that dimension and reveal the fact that there are dreams too.

If the moon can dream, I think it will be the moon's dream for us too.

It's an honor to be with you.

thank you very much.

(applause)

The space that once held a single transistor can now hold a billion transistors.

The result is a computer the size of an entire room that fits in your pocket.

The future can be said to be small.

As an engineer, I am inspired by this miniaturization revolution of computers.

As a physician, I wonder if this technology could be used to reduce the number of lives lost to cancer, one of the fastest growing diseases on the planet.

Now, when I say that, most people hear me say that we're working on a cure for cancer.

And so are we.

But it turns out that there is a great opportunity to save lives through early detection and prevention of cancer.

Worldwide, more than two-thirds of cancer deaths are completely preventable using the methods we already have today.

Vaccinations, timely testing and, of course, smoking cessation.

But even with the best tools and techniques we have today, some tumors may not be detected until 10 years after they start growing, when there are 50 million cancer cells.

What if we had better technology to detect some of these deadly cancers earlier, when they are just starting to form, when they can be resected?

Let's talk about how miniaturization gets there.

This is a common laboratory microscope used by pathologists to view tissue specimens such as biopsies and pap smears.

This $7,000 microscope is used by people with years of professional training to find cancer cells.

Here's an image from my colleague at Rice University, Rebecca Richards Coutham.

What she and her team did was miniaturize the entire microscope into this $10 piece and attach it to the end of a fiber optic.

This means that instead of taking a sample from the patient and sending it to the microscope, you can bring the microscope to the patient.

And instead of having an expert look at the images, a computer can be trained to score normal and cancer cells.

This is important. Because what they have found working in rural communities is that even though they have mobile testing vans that can go out into the community to conduct tests, collect samples and send them to the central hospital for analysis, after a few days they get a call that their test results are abnormal and they are asked to come to the hospital.

Half of them don't come because they can't afford to travel.

Integrated microscopy and computer analysis allowed Rebecca and her colleagues to create a van with both diagnostic and therapeutic setups.

This means that diagnosis and treatment can be carried out on the spot, so no one has to worry about follow-up.

This is just one example of how miniaturization can save lives.

As engineers, we really think of this as miniaturization.

You got a big one and made it a little one.

But what I've said before about computers is that they have changed our lives by becoming small enough to be carried everywhere.

What, then, is the equivalent of transformation as in medicine?

So what if tiny detectors could circulate through the body and single-handedly locate tumors and send signals to the outside world?

It sounds a little sci-fi.

But in fact, nanotechnology can do just that.

Nanotechnology can shrink the components that make up a detector from 100 microns, the width of a human hair, to 100 nanometers, a thousand times smaller.

And it has deep meaning.

It turns out that the material actually changes its properties at the nanoscale.

When a common material like gold is pulverized into gold nanoparticles, the appearance changes from gold to red.

With more exotic materials like cadmium selenide, large black crystals form. They make nanocrystals out of this material, put them in a liquid and shine a light on them, and they glow.

And they glow blue, green, yellow, orange or red, depending only on their size.

Wild! Can you imagine such an object in the macro world?

It's like all the denim jeans in your closet are made of cotton, but they come in different colors depending on the size.

(Laughter) As a doctor, it's equally interesting to me that it's not just the color of the material that changes at the nanoscale. It also changes how you move around your body.

This is an observation that we use to create better cancer detectors.

Now let me show you what I mean.

These are blood vessels in the body.

There are tumors around blood vessels.

We inject nanoparticles into blood vessels and observe how they move from the bloodstream to the tumor.

It now turns out that the blood vessels of many tumors are leaky, which allows nanoparticles to leak into the tumor from the bloodstream.

Whether it leaks or not depends on the size.

So, in this image, the smaller 100-nanometer blue nanoparticles are leaking out and the larger 500-nanometer red nanoparticles are lodging in the bloodstream.

So, as an engineer, depending on how big the material I make is, I can change where it goes in the body.

My lab recently created a tiny cancer nanodetector that can penetrate the body and look for tumors.

We designed it to monitor tumor invasion, the orchestra of chemical signals required for tumor spread.

To escape from the tissue in which the tumor originates, it must produce chemicals called enzymes that chew up the tissue scaffolding.

We designed these nanoparticles to be activated by these enzymes.

A single enzyme can activate thousands of chemical reactions in an hour.

Today, engineering calls this 1 to 1,000 ratio a form of amplification that makes something super sensitive.

Therefore, we created an ultra-sensitive cancer detector.

Okay, but how do we send this activated signal to the outside world so that we can act on it?

For this, we use another nanoscale biology. It concerns the kidneys.

Kidneys are filters.

Its job is to filter the blood and excrete waste products into the urine.

It turns out that what the kidneys filter also depends on size.

What you can see in this image is that anything smaller than 5 nanometers passes from the blood through the kidneys into the urine, and everything larger is retained.

Well, if you make a 100-nanometer cancer detector and inject it into the bloodstream, it leaks into the cancer, where it is activated by tumor enzymes, releasing a signal small enough to be filtered out of the kidneys and into the urine. There is a signal in the outside world that can be detected.

Ok, but there's one more problem.

This is a very small signal, how can we detect it?

Well, signals are just molecules.

They are molecules that we designed as engineers.

They are fully synthesized and can be designed to be compatible with your tool of choice.

If you want to use very sensitive and sophisticated instruments called mass spectrometers, you create molecules with unique masses.

Or maybe you want to build something cheaper and more portable.

Then create a molecule that can be trapped on paper, like a pregnancy test.

In fact, paper tests are becoming available worldwide in a field called paper diagnostics.

So where do we go with this?

What I am about to tell you represents my dream as a lifelong researcher.

I can't say it's a promise. It's a dream

But I think we all, and maybe even cancer researchers in particular, need to have dreams to keep moving forward.

Let me tell you what I hope will happen with my technology, and that I and my team will put our hearts and souls into making it happen.

yes, I'll go.

I dream that one day, instead of going to expensive labs for colonoscopies, mammograms, and pap smears, I'll be able to wait an hour to get an injection and have a paper strip urine test.

I think this could happen without the need for steady power or a medical professional to be in the room.

Perhaps even if you are far away, you may be connected only with the image of your smartphone.

I know this sounds like a dream, but the lab has already tested this in mice and it works better than existing methods for detecting lung, colon and ovarian cancer.

And what this means is that we hope that one day, at all levels of the world, we will be able to detect tumors in patients within 10 years of their growth, leading to early treatment and early detection saving more lives than it does today.

thank you.

(applause)

Do I look real to you?

I hope so.

I don't know if you see this, but I just want to look ahead and believe you are there.

Draw a semicircle in the sand in front of you so you don't walk past it, making it appear to be floating in the air.

Now I'm standing outside, on the beach under palm trees, where your stage used to be.

It will take about 12 minutes.

I set a limit.

My wife Navid once said that infinite possibilities are a creator's greatest enemy.

For example, this dress. I asked her to design something like what a priest would wear in 23rd century Cairo.

However, it took only three days to make, and the only fabric was an old duvet cover left by another resident.

But she did it, and it was perfect.

And she looked at it and said, "Proof of concept -- creation needs constraints."

So, in the next 12 minutes, I'll tell you about my biggest discovery.

Throughout my life, as so many of you have, my attachment has been eternal life.

You may be happy to know that your research will pay off.

I am 318 years old.

The average human lifespan is currently 432 years, and my job is to extend human lifespan to infinity.

And I never doubted that one day we would reach a point of satisfaction.

But the opposite continues to happen. The longer you live, the longer you want to live and the less you want to die.

who can blame us?

The universe is so vast.

Look no further.

Just yesterday I was reading about sailing from island to island on Earth on a boat on Europa. Some islands have villages where you can stay, visit, or sleep under the shadow of Jupiter.

And another island has just one songwriter sitting facing the ocean and playing a mandolin.

And there are places where there is no one, and where there was no one until now, seeking only the pleasure of touching sand where no one has ever touched.

You can spend 400 years doing just that.

The moon is now rising in the northeast.

Even the naked eye can see the city above it.

They are connected like nerve masses. Mariapolis on Antarctica and Ramachandran on the equator.

And the new Tehran of the Sea of ​​Silence.

It was there that Navid and I met.

We were both artists downtown.

The day we met, when we passed each other in Azadi Square, I bumped my shoulder.

And when I went to apologize, she said, without saying hello or introducing herself. "So, why do you think they passed each other?"

And first of all, I thought, "Who the hell are you?"

But secondly, the question bothered me, because the answer is so simple.

I said, "Elementary particles have mass, and the space between them is filled with binding energy that also has the properties of mass, so they never passed each other. This was known 800 years ago."

She must have felt like interacting with strangers.

Or she looks at me and says, "I thought you would say that.

Think deeper. ”

Then she took off her belt, this belt I'm wearing now, and said, "Our universe is built in such a way that particles have mass.

Without that basic constraint, we would pass each other at the speed of light and not even be noticed. ”

Thus began our romance.

Navid and I never ran out of things to talk about.

I never have.

It was unbelievable.

It was as if we were both heroes climbing a mountain range together, continuing to reach new landscapes, and these new constellations of perfect words emerged from within us to describe them.

And as soon as we made them, we forgot about them, threw them over our shoulders, and moved on to the next thing.

Or at one point Navid told us that our story was like making bread all the time, always adding flour and water little by little, folding and turning, and never getting to the point of baking.

If my obsession was eternal life, Navid's obsession was tactile.

She was genius in that regard.

All her work revolved around it.

My body was like a canvas to her, and she slowly lowered her fingertips over my face so I couldn't feel it moving.

And she was obsessed with the very moment I couldn't tell the difference between my body and mine.

Or she might lie on top of me, dig into my shoulder, and say, "Pilar, why are you feeling so good?"

I would say "I don't know!"

And although she always gave silly answers to silly questions, the answer I remember today was, "It feels good because the universe has chosen its constraints and we are that art."

It's always interesting to think about what you think the future will be like and what it actually is.

In your time, scientists thought humans could freeze themselves and wake up in the future.

And they did - but then they died.

In your time, scientists thought humans could replace organs and extend their lives by hundreds of years.

And so they did, but in the end they died anyway.

In your time, only Earth is inhabited by humans.

In my time, the earth was a place where people would die.

So when Navid started showing signs, our friends thought I would do the same as everyone else. It is to say goodbye and send her to Earth so that none of us will ever have to see her, be around her, or think of her or her...

Failure to stay alive.

Most of all, they didn't want to be near her actual physical body.

They continued to call it "decay", even though she herself was fascinated by the changes taking place day by day according to the laws of nature, independent of her will.

I sent Navid to Earth.

But I came with her.

I remember a friend of ours saying just before we left. "I think it's arrogant to say that the rules don't apply to you or that you think your love is that special."

But I did.

So, I continued to research how to extend life even here on earth.

I never thought there would be any other reaction.

I kept remembering what Navid had said to me that day in Azadi Square that without that basic constraint, the universe that gives matter its mass, we wouldn't exist.

That's one rule.

Another rule is that all masses are subject to entropy.

And we cannot exist in this universe without mass.

know. i tried everything.

I made a photon box with a modified Higgs field.

I recorded the motion of every subatom in my body and played it back in a closed loop.

nothing worked.

But my final innovation was to create a coil dimension with body boundaries that slows down time infinitely, but whose projection appears to move in normal time.

That body appears in our universe as a hologram, but not here.

When I realized I did it, I ran to her room and was so happy I told her I did it. In everyone's eyes, even my own, I moved through space almost normally, laying next to her, forgetting and passing through her.

I found my way to eternal life at the cost of the only thing Navid loved most, to touch and be touched.

and she kicked me out.

But we still have to see.

Humans live 400 years now and still die.

And when death comes, the dying still tear off their bedsheets, their arms turn blue, and purple flowers bloom inside them, and their breath goes away more and more, as if they were falling asleep.

I have always believed that adventure is what gives life meaning.

And death is just a problem we haven't found a solution to yet.

But maybe life only makes sense because it ends.

Perhaps that's the paradox. Constraints are not constraints, they allow complete freedom.

(sighs) We had a thunderstorm here this morning.

The forecast is out tonight, but so far the sky is clear.

You can't feel the wind here, but when I asked a passing caretaker how it felt, he said it was warm like melted butter.

A fitting answer for my wife.

You must find a way to return to your physical body.

Until then, I will occupy nothing but the space you give me.

My name is Rich Barahniuk. A few things I want to talk about today are some ideas that I think resonate a lot with everything that has been said over the last two days.

There are so many things I can sympathize with, so it's difficult to pick them all up, but I'll do my best.

(Laughs) So this is an LP record and it was replaced?

Over the past two decades, we have been swept away by this kind of world-flattening digitization technology.

And I think the best witness of that was today when Thomas was playing music when we came into the room.

What's going on in the world of music, in Apple's words, to borrow a tagline, is that we've created a culture, or ecosystem, in which we create, rip, mix, and burn.

What I mean is that everyone in the world is free and allowed to create new music and musical ideas.

Anyone in the world can rip or copy musical ideas and use them in innovative ways.

Anyone can mix them in different ways, draw connections between musical ideas, and people can burn them or create the final product to keep the circle going.

And what has happened is, as I said earlier, a very inclusive and vibrant community of people working continuously to connect, innovate and keep up to date with musical ideas.

Today's hit single is not last year's hit single.

But I'm not here today to talk about music.

I am here to talk about books.

In particular, the textbooks and teaching materials that we use every day at school.

Has anyone here ever been to school?

(Laughter) Now, does anyone realize that schools around the world are in danger?

I'm not going to spend too much time on this, but what I want to talk about is some of the discontinuities that appear when authors publish their books.

In fact, the publishing process creates a kind of wall between the author of the book and the final user of the book (teacher, student, or just the general reader) simply because the book is complicated, heavy, and expensive.

And this is even more true if you speak a language other than the major languages ​​of the world, especially English.

I'll call these people under the barrier "shutouts". Because they are really shut out of the process of sharing their knowledge with the world.

So what I want to talk about today is that I'm going to take these ideas that I've seen in musical culture and bring them in the direction of reinventing the way we think about writing books, using them, and teaching from them.

That's what I want to talk about, and really, how we get from where we are to where we need to go.

First, try a little thought experiment.

Imagine taking all the books in the world with you.

OK, everyone imagines a book and imagines just tearing out the pages.

So imagine liberating these pages, digitizing them, and storing them in a vast interconnected global repository.

Think of it as a giant iTunes for book-type content.

And imagine putting all that material in the open so people can modify it, play with it, improve it.

Imagine making it free and making all this knowledge accessible to everyone in the world. Also, imagine using information technology to allow this content to be updated, improved, and replayed in seconds instead of years.

Imagine that an edition of a book is published every 25 seconds instead of every 2 years.

So imagine you can do that, imagine you can put people into this.

So that we can truly build an ecosystem not only with authors, but with all those who can or want to be authors in different languages ​​around the world. If it can do this, I think it will be called. I would call it the knowledge ecosystem.

Really, this is a dream, and in a way you can think of us as trying to enable everyone in the world, everyone in the world, to be their own educational DJ, create material, share it with the world, and innovate all the time.

In fact, this dream is becoming a reality.

Over the past six and a half years, we have been working hard at Rice University on a project called Connexions. So what I want to do in the rest of my talk is to talk a little bit about what people are doing with Connexions. You can think of this as the opposite of yesterday's speech by Nicolas Negroponte. They work on hardware to bring education to the world.

We are committed to developing open source tools and content.

So that means putting it in perspective here.

So create.

First of all, there is a community of engineering professors from Cambridge to Kyoto who are developing engineering content for electrical engineering into what could be described as a giant super-textbook covering all areas of electrical engineering.

Not only that, but it can also be customized for use by each individual institution.

If you liked Kitty Jones, a reclusive tutor and mother from Champagne, Illinois, and wanted to share her amazing musical content with the world on how to teach kids how to play music, her materials are now used over 600,000 times a month.

Great usage.

In fact, much of this use is from K-12 schools in the United States. Because everyone involved in the school scales down and the first to be cut is the music curriculum.

So this just shows a huge hunger for this kind of open and free content.

Many teachers use this.

What about ripping? What about copying and reusing?

Volunteer team at the University of Texas at El Paso. A graduate student translates ideas from this engineering super textbook.

And within about a week, it becomes one of our most popular materials, used extensively throughout Latin America, especially Mexico, due to its open and extensible nature.

People, volunteers and even companies who are translating materials into Asian languages ​​such as Chinese, Japanese and Thai will participate to further disseminate knowledge.

OK, what about those who are mixing?

What does "mix" mean?

"Mixed" means building a customized course, which means building a customized book.

Companies like National Instruments have incorporated very powerful interactive simulations into their materials, going far beyond the typical textbook to ensure that all materials provide an experience where you can actually interact, play, and learn while actually learning.

We have worked with Teachers Without Borders who are very interested in mixing our materials.

They plan to use Connexions as a platform to develop and deliver teaching materials to teach teachers in 84 countries around the world.

TWB is currently training 20,000 teachers in Iraq with support from USAID.

And for them, this idea of ​​being able to remix and customize for their local context is very important. Because just giving people free content is actually comparing people in developing countries to a kind of cultural imperialism. If you don't give people the ability to recontextualize the material, translate it into their own language, and take ownership of it, it's no good.

OK, so is another organization we work with, UC Merced. People know about UC Merced.

This is a new university in California's Central Valley that works very closely with community colleges.

In fact, they have developed many of the science and engineering curricula and disseminated them throughout the world in our system.

We also aim to develop all software tools completely open source.

We have worked with AMD. AMD has a project called 50x15 that will bring Internet connectivity to 50% of the world's population by 2015.

We plan to provide content in various languages.

We have also worked with many other organizations.

In particular, many Hewlett Foundation-funded projects have taken true leadership roles in this area of ​​open content.

OK Byrne -- I think this is very interesting in some ways.

"Burn" is the idea of ​​trying to physically instantiate one of these courses.

And I think many of you received these music books in gift packs.

A little present for you.

Simply put, this is an engineering textbook.

There are about 300 pages in hardcover.

This comes at a cost -- can anyone guess?

How much will it cost if I buy it at a bookstore?

(audience) $65.

Richard Barahniuk: Okay. It costs $22 for students.

Why $22?

Because it is published on demand and developed from this repository of open materials.

If this book were published by a regular publisher, it would cost at least $122.

So what we are seeing is a shift in this process of writing or publishing from the usual kind of single-authored book to community-written material that is modular, customized for individual classes, published on-demand very cheaply, pushed out through Amazon or published directly through on-demand printers like QOOP.

And I think it's a very interesting area because there's a huge area under this long tail in publishing.

We're not talking about the left-hand side of Harry Potter.

It is a book about hypergeometric partial differential equations.

A book with the potential to sell 100 copies a year, 1,000 copies a year.

Beneath this long tail, huge revenues are maintained not only to sustain open projects like ours, but also to sustain the rise of new on-demand publishers like QOOP, who published these two books.

And I think one of the takeaways from this talk is the imminent elimination of the middleman in the publishing industry.

And it's going to culminate in the next few years, and I think it's really in our interest, and in the world's interest.

So what are the enablers?

What is really causing this?

There are tons of technologies out there, but the only one I really want to talk about is XML.

How many people know about XML?

that's good

It is a semantic representation of content.

What you really think about the XML in this case is the packaging you're putting around these pages.

Remember when we picked up the book and ripped the pages out?

Now, what XML does is turn these pages into Lego blocks.

XML is Lego's lynchpin that allows content to be combined in many ways and provides a framework for sharing content.

In other words, we will be able to turn this ecosystem into a pristine state of all content, every page ripped from a book, and create very sophisticated learning machines (books, courses, course packs).

The learning experience can be personalized to each individual student, so every student has access to books and courses customized to their learning style, situation, language and excitement.

The same materials can be reused in multiple different ways and in surprising new ways.

This allows you to connect ideas together and show how fields are related to each other.

And let me tell you my personal story.

I came up with this six and a half years ago because I'm teaching you what's inside the red box.

And as Chris said, my day job is an electrical engineering professor.

I teach signal processing and my challenge was to prove this math. Surprisingly, about half of you have already fallen asleep just looking at the equation.

(Laughter) But this seemingly dry mathematics is actually central to this very powerful web of connecting technology. Not only does this web connect really great applications like music synthesizers with huge economic opportunities, but it's also governed by intellectual property.

And I realized that as an engineer, I couldn't write this book to tell you all about it.

We needed a community to make it happen, and we needed new tools that could interconnect these ideas.

And in a way, I think what we're trying to do is make Minsky's dream a reality. There, you can imagine all the books in the library actually starting to talk to each other.

And those of you who are teachers here, whoever taught you, you know this, but the essence of teaching is the interconnection between ideas.

Now let's get back to math.

Imagine -- this is possible. It means that every equation you click in one of the new etexts becomes available for exploration and experimentation.

Now imagine your child's 7th grade algebra textbook.

Clicking on any equation reveals a small tool that you can experiment with, play with, and understand.

Because you don't know until you actually understand it.

The same type of markup, such as MathML for chemistry.

Imagine a chemistry textbook that actually understands the structure of how molecules are formed.

Imagine a Music XML that actually lets you explore, play with, and understand the semantics of music.

No wonder everyone is obsessed with it, right?

Also the three wise men.

(Laughter) Now for the second big success factor, I lied big here.

The second big enabler is intellectual property.

Because, really, I stood here talking about how great music culture is.

We can share it, rip it, mix it, burn it, but really, it's all illegal.

And because this music is proprietary, we would be accused of [copyright infringement] if we did that.

Many are now owned by large industries.

So the point here is that you can't prevent this from happening.

We can't let the Napster incident happen here.

So what we have to do is get it right the first time.

And what we have to do is find an intellectual property framework that makes sharing safe and easy to understand.

And the inspiration here comes from open source software.

It's like Linux or the GPL.

Creative Commons License.

How many of you have heard of Creative Commons?

If you don't have it yet, you should learn about it.

The logo appears at the bottom of all materials for Connexions and many other projects.

Clicking on that logo will take you to a complete no-nonsense, human-readable document – ​​a deed – that tells you exactly what you can do with this content.

In fact, you are free to share, copy, modify, and use it commercially as long as you give credit to the author.

Because in scholarly publishing, and in many educational publications, the idea of ​​sharing knowledge and making an impact is real.

That's why people write, but they don't necessarily make money.

We're not talking about Harry Potter, are we?

We are in the long tail here.

Behind it lies a very carefully constructed code of laws.

And Creative Commons is becoming popular. Over 43 million things out there are licensed under a Creative Commons license.

Not just text, but music, images, videos, etc.

And in fact, there are so many people actually licensing music to make it free for those who do the whole idea of ​​resampling, ripping, mixing, burning and sharing.

Now, I would like to finish by stating only a few final points.

So we built the Commons idea.

Our particular site alone receives over 500,000 unique visitors each month.

MIT OpenCourseWare, another large open content site, has a similar number of hits.

How do we protect it in the future?

And maybe the first thing people think of is quality control?

Because I'm saying that anyone can contribute something to this commons.

Anyone can contribute anything.

that could be a problem.

It didn't take long for people to start posting materials such as lingerie, for example, but this is actually a very nice module.

The only problem is that it was plagiarized from a major French feminist magazine, and when you visit the supposed course website, it points to a website that sells lingerie.

So this is a bit of a problem.

So some sort of quality control idea is clearly needed and this is where the idea of ​​review and peer review really comes into play.

You are at TED. Why are you coming to TED?

Because Chris and his team ensure things are of a very high quality, right?

So we should be able to do the same.

And we need to be able to design structures. What we do is design social software that allows anyone to build their own peer review process. We call these things "lenses".

And basically what they're allowing is for anyone to develop their own peer review process so they can focus on the content they think is really important in the repository.

And you can think of TED as a potential lens.

So I would like to end by saying this. You can really think of this as a call to action.

Connections and open content are all about sharing knowledge.

All of you here are filled with an enormous amount of knowledge. And what I would like to do is encourage each and every one of you to contribute to this project and others like it. Because we believe that together we can truly change the landscape of education and educational publishing.

Thank you very much.

The Value of Nothing: Something comes out of nothing.

It's an essay I wrote when I was 11 and got a B+. (Laughter) What I'm talking about is nothing out of nothing and how we create.

And I will try to stay within that bounds and do it within the 18 minutes I was told to follow the TED precepts. So it actually creates a near-death experience, but near-death is good for creativity.

(laughter) Okay.

So I would like to explain too. Dave Eggers said he would jerk if I lied or said anything against universal creativity.

And I did this with half the audience, the scientists.

When I say "we", I don't necessarily mean you. I mean, me and my right brain, my left brain, and the censors in between tell me what I'm saying is wrong.

And I do that by also looking at what I consider part of my creative process. It includes many things that actually happened. Nothing started earlier than the moment I was creating something new.

That includes nature, upbringing, and what I call nightmares.

Now, we look to see if nature is probably born with abnormal chromosomes in the brain that cause muse-like effects.

And some say we were born with it in a different way.

Others say that, like my mother, I draw material from past lives.

Others have suggested that creativity may be influenced by other neurological disorders such as psychosis and depression, namely Van Gogh syndrome.

I have to tell someone, I read recently that Van Gogh wasn't necessarily psychotic, he might have had a temporal lobe seizure, and I don't think that might have caused his creative outburst, but I think it's doing something in your brain somewhere.

And I should mention that I actually had a temporal lobe seizure many years ago, but that was around the time I was writing my last book, and some people say that book is something completely different.

I think part of it also starts with a sense of identity crisis. I mean, who am I, why am I this particular person, why am I not black like everyone else?

And even if you have a skill, it may not be the kind of skill that allows creativity.

I was painting. I thought I could become an artist.

And I have a miniature poodle.

It wasn't bad, but it wasn't very creative.

Because all I could really do was express myself in a very one-on-one way.

And I feel like this probably copied from a book.

And I didn't really shine in certain areas that I wanted to be. Look at these scores, it wasn't bad, but it wasn't always predictable that one day I would make a living from the artful placement of words.

Also, one of the principles of creativity is to have a minor childhood trauma.

And I had the usual type of things that I think a lot of people have, which is I was expected of me.

By the way, the figure there is a toy that was given to me when I was only 9 years old, and it was meant to help me become a doctor from an early age.

Some have lasted longer. From age 5 to 15, this was supposed to be my side job, but it led to frustration.

But actually, when I was 14 years old, something very real happened in my life.

In 1967, I found out that my brother had a brain tumor, and half a year later my father also had a brain tumor.

And my mother believed that something was wrong and that she would find out what it was and fix it.

My father was a Baptist minister who believed in miracles and believed that God's will would work them out.

But, unsurprisingly, they died half a year apart.

And then my mother believed that this was fate or a curse and looked into all the reasons in the universe why this happened.

Anything but random. She didn't believe in randomness.

There was a reason for everything.

And one of the reasons, she thought, was that her mother, who died when she was very young, was angry with her.

So the concept of death was all around me. Because my mother also believed that I would be next, and then myself.

And when faced with the prospect of imminent death, you start thinking very much about everything.

You can be very creative in terms of survival.

And this led me to my big question.

And they are the same ones I have today.

And that is why things happen and how things happen.

And my mother asked, "How can we make things happen?"

It's a great way to turn to these questions when writing your story.

Ultimately, that framework must answer the questions of why things happen, how things happen, and in what order, between pages 1 and 300. What is the impact?

As a storyteller, as a writer, how do I influence it?

And I think that's what many scientists are wondering.

It is a kind of cosmology and I, as the creator of the universe, have to develop my own cosmology of the universe.

And it often takes many years and many back and forth to try to make it happen or to try to understand it.

So I also think that when I look at creativity, it's this feeling, or this helplessness of repression, that I see relevance to practically everything in life.

And I've been able to get a lot of that through what's happening through this conference, pretty much everything that's happened so far.

So I'm going to use this association of quantum mechanics as a metaphor, which I don't really understand, but still I'm going to use it as a process to explain how it's a metaphor.

In other words, in quantum mechanics, of course, there is dark energy and dark matter.

And it's the same when looking at these questions about how things happen.

There are so many unknowns that we often don't know what they are unless they exist.

But when we make those associations, we want them to have a kind of synergy in the story, and it's a matter of what we find. meaning.

That's what I look for in my work, and that's what it means to me personally.

My understanding is that there is also the uncertainty principle that is part of quantum mechanics. (Laughter) And this happens all the time in writing.

And then there's the terrifyingly terrifying observer effect. I mean, you're looking for something, but things are happening at the same time, and you're looking at it in a different way, really trying to find its content, what this story is about. If you try too hard, you will only be able to write content.

you won't find anything.

And what you were supposed to find, what you hoped to find by chance, is no longer there.

Now, like many scientists, I don't want to ignore the flip side of what's going on in the universe.

So I'm going to introduce string theory here and just say that creative people are multidimensional and that there are 11 levels of anxiety.

(Laughter) And they all work at the same time.

There is also the big problem of ambiguity.

And I connect it to something called the cosmological constant.

And I don't know what is at work, but something is at work there.

For me, ambiguity is a very unpleasant thing in life, and I have it myself. moral ambiguity.

it is always there. And just as an example, this is what came to my mind recently.

I read it in an editorial by a woman who spoke about the Iraq war. And she said, "Save the drowning man, you are responsible for him for the rest of your life."

A very famous Chinese proverb, she said.

It means that we went to Iraq and should stay there until things are resolved. It may take 100 years.

So, another theme that I came across was "saving drowning fish."

That's what Buddhist fishermen say, because they shouldn't kill anything.

And they too have to make a living and people have to eat food.

So the way they justify it is that they are saving fish from drowning, but unfortunately they die in the process.

Now, what is implied in both of these drowning metaphors is, in fact, one of them is my mother's interpretation, which is a famous Chinese proverb. Because my mother told me “If you save someone from drowning, you are responsible for that person for the rest of your life.”

And it was a warning - don't get caught up in someone else's work or you'll get stuck.

OK. I think if someone was really drowning, she would save them.

But both of these sayings, saving the drowning fish and saving the drowning man, had an intention for me.

And in life we ​​all have some reaction when we encounter situations.

And we have intentions.

You do something without knowing what to do.

And the results may not match our intentions.

Maybe things go wrong. What are our responsibilities then?

what should we do

Are we going to stay here for the rest of our lives, or do we do something else to justify ourselves and say, 'My intentions were good, so I can't be held responsible for all of that'?

That's the ambiguity in my life that really haunts me and inspired me to write the book Save the Drowning Fish.

I saw that example. Once I identified this question, it was all over the place.

I got some hints here and there.

And in a way it turns out they were always there.

And when you write, that's what happens. I get these hints, these clues, and realize they were obvious, yet they weren't.

And what you really need is focus.

And when you have questions, focus on them.

And all these things that seem like drifters and jetsams in life actually go through that question and what happens is those specific things become relevant.

And it seems to happen all the time.

You think there is some kind of coincidence, coincidence happening that you are getting all the help from the Universe.

And it might also be explained that I am more focused now.

And you are becoming more and more aware of it.

But you apply this.

Start looking at things that have something to do with your tension.

Your little brother is in trouble, will you take care of him?

Why or why not?

It could be something even more serious – as I said earlier, human rights in Burma.

Someone told me that if I went there, I would endorse the military government, so I thought I shouldn't go.

And after a while, I was forced to ask myself, "Why do we accept knowledge, why do we accept assumptions made by others?"

And that's what I felt when I was a kid hearing the rules of moral conduct from my father, a Baptist pastor.

So I decided to go to Burma for my own purposes, but if I go there what the consequences will be, if I write a book it will only be faced later when the time comes.

We are all interested in what we see in the world we know.

Come here, what should I do as an individual?

Not all of us can go to Africa or work in hospitals. So what should you do when you have these moral reactions and feelings?

I also think that one of the biggest things we've all focused on and talked about today is genocide.

Which leads me to this question.

When I look at all this morally ambiguous and offensive stuff, and think about what my intentions should be, I realize it goes back to the identity questions I had as a child. And why am I here, what is the meaning of my life, and what is my place in the universe?

It seems so obvious, but it really isn't.

We all hate moral ambiguity in some way, but it's also absolutely necessary.

That's where I start when I write stories.

It seems that sometimes you can get help from the universe.

From the first book my mother often said it was my grandmother's ghost because she seemed to know something I shouldn't have.

Instead of writing that the old woman had too much fun and accidentally died of an opium overdose, I wrote in the story that the woman actually committed suicide, and that actually happened.

And my mother decided that the information must have come from my grandmother.

Others, in a very strange way, provide useful information for writing books.

In this case, I was writing a story that included certain details, historical periods, and specific locations.

And I had to find a historical match for it.

And I picked up this book, and I—the first page I flipped through it was exactly the setting, time period, and type of characters I needed—it was the Taiping Rebellion in an area near Guilin, outside of it, and someone who believed himself to be a child of God.

Are these things a coincidence?

So what is random? What is Chance? what is luck?

What can we get from the universe that can't really be explained?

And that also applies to stories.

These are the things I think about on a daily basis.

Especially when good things happen, and especially when bad things happen.

But I think there are some kind of coincidences, and I want to know what those elements are. Then I can appreciate them and try to find them in my life.

Because, again, I think more things happen when I'm aware of them.

Another chance encounter was when I went to a certain place. I was with a few friends and drove randomly to another location and ended up in this non-touristy, pristine and beautiful village.

And we walked over three valleys, and in the third valley we felt something very mysterious, eerie, uncomfortable. And I thought that must be the setting for my book.

And when writing one scene, it happened in that third valley.

For some reason, I wrote about the cairns that men were building - stacks of rocks.

I didn't know exactly why I had it, but it was so vivid.

I got stuck and when a friend asked if I wanted to go for a walk with my dog, I said, "Of course." And about 45 minutes later, while walking along the coast, I found this.

It was a man, a Chinese, piling up these things without glue or anything.

And I asked him, "How can you do that?"

And he said, "Well, I think there's a balance in everything in life."

And this was exactly what my story meant at that point.

There are many examples. There are many examples like this when writing stories, but I can't explain them.

Was it because I had a filter that made me write this kind of thing by accident?

Or is it some kind of random event that we can't explain, like the cosmological constant?

My biggest concern is the accident.

And like I said, my mom didn't believe in coincidence.

What is the nature of the accident?

And how do we assign liability and cause outside the court?

I got to see it first hand when I went to the beautiful Dong Village in Guizhou, China's poorest province.

And then I saw this beautiful place. I wanted to come back.

And when National Geographic asked me if I wanted to write something about China, I had the chance to write it.

And I replied, yes, about this village of singing people, singing minorities.

And they agreed too, and between the time I saw this place and my next visit, a terrible accident happened. An old man fell asleep and his quilt fell into the pot of fire that was warming him.

60 houses were destroyed and 40 were damaged.

Responsibilities were assigned to families.

The man's sons were banished to live in a cowshed three kilometers away.

And of course, as Westerners, we say, "Well, it was an accident. That's unfair.

It's the son, not the father. ”

As you progress through the story, you have to let go of such beliefs.

It takes time, but you have to let them go and just go and be there.

So I went there three times in different seasons.

And I began to feel something different about the history, what had happened, the nature of life in a destitute village, the joys, the rituals, the traditions, the connections with other families. And I saw how this has some kind of justice in its responsibility.

I was also able to learn about rituals that I had not used for about 29 years. And it was to send some men. A feng shui master sent a man into the underworld on a ghostly horse.

Now, you as a Westerner and I as a Westerner would say it's superstition. But being there for a while and seeing the amazing events that happened there makes me wonder whose beliefs are determining how things happen in the world.

So I stayed with them, and the more I wrote that story, the more I fell into those beliefs, and I think that's important to me -- embracing the beliefs, because that's where the story is real, and that's where I'm going to find the answers to how I feel about certain questions I have in life.

It's been years, of course, but what I'm trying to tell you at TED is that it won't happen anytime soon.

Books come and go. When it arrives, it's not my book anymore.

It's in the hands of the reader, and they interpret it differently.

But I come back to this question, how do you create something out of nothing?

And how do you create your life?

And I think it comes from asking yourself and telling yourself that there is no such thing as absolute truth.

I believe in the concreteness of the story, and the past, the concreteness of that past, and what is happening in the story at that point.

I also believe that through thinking about things—thinking about luck and destiny, chance and accident, the will of God and the resonance of mystical forces—we arrive at some conception of what it is and how we create it.

I have to think about my role. Where in the universe am I, did someone intend me to be, or is it just something I came up with?

And I can also find it by imagining enough and becoming what I imagine. And it's in the real world, in the fictional world.

And that's how I find particles of truth, not absolute truth or total truth.

And they have to be in all kinds of possibilities, including possibilities I never thought of.

So there is never a perfect answer.

Rather, if there is an answer, it is to remind yourself that there is uncertainty in everything, and that is a good thing, because then you discover something new.

And if there's a partial answer, a more complete answer, it's just to imagine.

And to imagine is to put myself in the story until there is transparency between me and the story I am creating.

And I discovered that feeling what is in the story - in a story - is the closest you can come to knowing what sympathy is and feeling that sympathy.

Because all questions about how things happen are related to emotions.

To understand much of it, I have to be the story.

Now that we've reached the end of our story, we'll reveal what's in the bag. It is a muse, something that changes in our lives, something that is wonderful, something that stays with us.

she is there

thank you very much!

(applause)

Today I'm going to show you how this tablet and this virtual reality headset I'm wearing will completely revolutionize science education.

It also explains how science teachers can be more than twice as effective.

But before I explain how all this is possible, let me briefly explain why improving the quality of science education is so important.

If you think about it, the world is growing at an incredible speed.

And with that growth comes a growing list of challenges, including tackling global warming, solving hunger and water scarcity, and treating disease.

And who will help us solve all these big challenges?

Well, it's just these young students.

This is the next generation of young, bright scientists.

And in many ways, we all rely on them to come up with new and great innovations to solve all the challenges at hand.

A few years ago my co-founder and I were teaching college students just like these, only the students we were teaching were a little more like this.

(Laughter) And yes, this is the reality of too many universities around the world. Students can become bored, unmotivated, and not even sure why they are studying the subject in the first place.

So we started looking for new and innovative teaching methods, but what we found was very disappointing.

We've seen books transformed into e-books, chalkboards into YouTube videos, and lecture room monologues into MOOCs (Massive Online Open Courses).

Come to think of it, all we're really doing here is taking the same content and the same format and making it available to more students. This is great, but don't get me wrong. That's really great. But the teaching method is still more or less the same, no real innovation.

So we started looking elsewhere.

What we discovered was that flight simulators have proven, time and time again, to be far more effective when used in conjunction with real-world flight training to train pilots.

So we thought, "Why don't we apply it to science?"

Want to build a virtual laboratory simulator?

Well done.

We basically set out to create a fully simulated 1:1 virtual reality lab simulator. There, students can conduct experiments using mathematical formulas that simulate what would happen in a real-world laboratory.

But it goes beyond simple simulations, working with top universities like MIT to create advanced simulations to bring these students to the cutting edge of cancer research.

And suddenly, universities can save millions of dollars by allowing students to conduct virtual experiments before they enter a physical lab.

That's not all. We can now understand what is going on with our machines, even at the molecular level inside them.

And suddenly you can conduct dangerous experiments in the lab.

For example, we again learn about Salmonella, an important subject that many schools cannot teach for safety reasons.

And of course, we quiz students and provide teachers with a complete dashboard so teachers have a complete understanding of where their students are.

But we didn't stop there. Because I realized how important it is for students to participate in class.

So we brought in a game designer to create a fun and engaging story.

For example, in this case students must use their basic science skills to solve a mysterious CSI murder case.

And the feedback we got when we launched all of this was overwhelmingly positive.

There are 300 students here, all enthusiastic about solving CSI murders while learning basic science skills.

And what I love most about this is when students sometimes come up to me afterwards and they're all surprised and a little confused and say, "I just spent two hours in this virtual lab...and I didn't check Facebook."

(Laughter) This is really engaging and immersive for students.

So, to find out if this really works, learning psychologists conducted a study of 160 students at Stanford University and the Technical University of Denmark.

And what they did was divide the students into two groups.

One group used only virtual laboratory simulations and the other group used only traditional teaching methods and were given the same amount of time.

Second, interestingly, we tested the students before and after the experiment, so we could clearly measure the learning effect of the students.

And they surprisingly found that using virtual labs made learning 76% more efficient than traditional teaching methods.

But even more interesting is that the second part of this study explored how teachers influence learning.

They found that combining virtual labs with teacher-led coaching and mentoring increased learning effectiveness by a total of 101%, effectively doubling the impact of science teachers over the same amount of time.

So a few months ago we started asking ourselves. Today we have an amazing team of learning psychologists, teachers, scientists and game developers. And I began to ask myself how I could keep my promise to constantly rethink education.

And today, we're really excited to announce what we've come up with and worked incredibly hard on.

Let me briefly explain what this is all about.

Basically, I take my cell phone (most students already have smart phones) and connect it to this virtual reality headset, a low-cost headset.

And now what I can effectively do is be able to literally step into this virtual world.

Let some of the audience experience this as well. You have to fully feel how immersive this really is.

I literally feel like I've stepped into this virtual lab.

Can you see me on the screen?

Audience: Yes.

Michael Bodeker: Great! wonderful.

So basically, I turned my phone into a fully simulated million dollar Ivy League lab with all the fancy gadgets you can interact with.

For example, you can pick up a pipette and conduct an experiment with it.

I have an E-Ggel, a PCR, and, you know, a next-generation sequencing machine, and there's also an electron microscope.

Does anyone carry an electron microscope in their pocket?

Here is my machine on which I can do various experiments.

And here we have a door so we can join other experiments and do them in the lab.

And here is my study tablet.

This is an intelligent tablet that can read related theories.

As you can see, we can interact.

You can watch videos and review content related to experiments you are currently running.

Then there is Marie here.

She is my teacher, my lab assistant, and she guides me through this lab.

And very soon my teachers will be literally teleporting me into this virtual world I am in to help and guide me through this entire experiment.

And before I finish this, I want to show you something even more amazing. That's something you can't even do in a real lab.

This is a PCR machine.

I'm about to start this experiment.

And what I've just done is literally shrunk myself to a millionth of the size of a molecule. I really feel that way. Please try this.

So now I feel like I'm standing in a machine looking at all the DNA and molecules.

You can see polymerases and enzymes.

And in this case, you'll find that DNA has been replicated millions of times, exactly like what's happening in your body right now.

And you can really feel and understand how all this works.

We hope that you will feel even a little bit of the possibilities of these new educational methods.

And I'd also like to stress that everything I've just seen works on iPads and laptops without headsets.

I say so for a very important reason.

If we are to empower and inspire the next generation of scientists, teachers must drive the adoption of new technologies in the classroom.

So, in many ways, I believe the next big leap in science education will no longer lie in technology, but rather in teachers' determination to promote and introduce these technologies within their classrooms.

We therefore hope that more universities, schools and teachers will work with technology companies to realize this full potential.

So in closing I would like to leave you with a little story that really inspired me.

That's the story of Jack Andraka.

Some of you may already know him.

At the age of 15, Jack invented a new and groundbreaking low-cost pancreatic cancer test.

And when Jack talks about how he made this big breakthrough, he also explains that something was holding him back.

And that means he was too inexperienced to get in, so he didn't have access to a real lab.

Now imagine giving students like Jack the world over an Ivy League multi-million dollar virtual lab with the latest, greatest, and most fancy machines imaginable that would make any scientist here literally jump in sheer excitement.

And imagine how it will empower and inspire a whole new generation of young, bright scientists ready to innovate and change the world.

thank you very much.

(applause)

Hi.

Let the audience ask the question: Did you ever lie as a child?

If so, would you please raise your hand?

oh! This is the most honest group of people I have ever met.

(Laughter) So, for the last 20 years, I've been researching how children learn to lie.

And today we want to share with you some of the things we discovered.

First, let me tell you about a friend of mine, Richard Messina, an elementary school principal.

One day I got a call from him.

The person on the phone said, "Miss Messina, my son Johnny is sick and will not be coming to school today."

Mr. Messina asks, "Who am I talking to?"

Then the person on the phone said, "I am my father."

(Laughter) This story pretty much sums up three common beliefs we have about children and lies.

One is that children do not start telling lies until they enter elementary school.

Second, children are bad liars.

We adults can easily spot their lies.

And third, if children lie at an early age, they must have some character defect and they will be pathological liars for the rest of their lives.

Now, it turns out that all three of these beliefs are false.

We have played guessing games with children all over the world.

Here is an example.

So in this game, we asked the children to guess the numbers on the cards.

Then tell them that if they win the game, they will get a big prize.

However, in the middle of the match, he makes an excuse and leaves the room.

And before leaving the room, tell them not to look at the card.

Of course, the room is equipped with hidden cameras that monitor their every move.

The desire to win the game is strong, so more than 90% of children will immediately look into it when they leave the room.

(Laughter.) The key question is, when we go back and ask the children if they peeped, do they confess to their transgression or lie?

At age 2, 30 percent lied and 70 percent told the truth about their transgressions, regardless of gender, country, or religion.

By age 3, 50% lie and 50% tell the truth.

Over 80% of children lie by age 4.

After the age of four, most children begin to lie.

As you can see, lying is a typical part of development.

And some children learn to lie as young as two years old.

Now let's take a closer look at the younger children.

Why do some but not all toddlers lie?

In cooking, you need good ingredients to make delicious food.

And good lying requires two key ingredients.

The first important factor is theory of mind, or the ability to read minds.

Mind-reading is the ability to know that different people know differently about a situation, and the ability to distinguish between what I know and what you know.

Mind reading is key to lying. Because the basis of lying is knowing you don't know what I know.

Therefore, I can lie to you.

The second key ingredient to being a good liar is self-control.

It is the ability to control speech, facial expressions and body language so that you can tell a convincing lie.

They found that young children with better mind-reading and self-control abilities lie faster and lie more sophisticatedly.

Ultimately, it turns out that these two abilities are also essential for us all to function well in society.

In fact, deficits in reading and autistic abilities are associated with serious developmental problems such as ADHD and autism.

So when you realize your 2-year-old has told a lie for the first time, you shouldn't be alarmed, you should celebrate (laughs). Because it indicates that your child has reached a new milestone of neurotypical development.

Now, are children bad liars?

Do you think you can easily spot their lies?

Why not try it?

yes? OK.

So, let me show you two videos.

In the video, the children will answer the researcher's question, "Did you peek?"

So tell me which children are lying and which children are telling the truth.

This is my first child.

are you ready?

(Video) Adult: Did you peep? Children: No.

Kang Lee: This is my second child.

(Video) Adult: Did you peep? Children: No.

KL: Okay, if you think number one is lying, raise your hand.

Raise your hand if you think child number 2 is lying.

Well, as a matter of fact, Child #1 is telling the truth and Child #2 is lying.

It seems that many of you are not good at spotting children's lies.

(Laughter) Now, we've played similar kinds of games with so many adults from all walks of life.

And we show them a lot of videos.

In half the video the children lied.

In the other half of the video the children told the truth.

And let's see how these adults behaved.

There are as many people who lie as there are people who tell the truth, so if you guess randomly, you have a 50% chance of getting it right.

So if your accuracy is around 50%, it means you are good at detecting lies in children.

So let's start with undergraduates and law school students who typically have limited experience with children.

No, you can't detect a child's lies.

Their performance is close to coincidence.

But what about social workers and child protection lawyers who work with children on a daily basis?

Will they be able to catch the child's lies?

No, I can not.

(Laughter.) What about judges, customs officers, and police officers who routinely deal with liars?

Will they be able to catch the child's lies?

No, I can not.

how are your parents?

Can Parents Detect Other Children's Lies?

No, I can not.

So can parents catch their children's lies?

No, I can not.

(Laughter) (Applause) So you may be wondering why it's so hard to detect lies in children.

Let me illustrate this with my own son Nathan.

This is the look on his face when he tells a lie.

(Laughter) So when a child is lying, their facial expressions are usually neutral.

But behind this neutral look, the child is actually experiencing many emotions: fear, guilt, shame, and perhaps even a little liar's joy.

(Laughter.) Unfortunately, such feelings are temporary or hidden.

Therefore, it is almost invisible to us.

So for the past five years, we've been trying to find ways to uncover these hidden emotions.

So we made a discovery.

We know that there is a rich network of blood vessels under the skin of the face.

As we experience different emotions, the blood flow in our face subtly changes.

And these changes are controlled by autonomous systems beyond our conscious control.

Seeing changes in facial blood flow can reveal a person's hidden emotions.

Unfortunately, these emotion-related changes in facial blood flow are too subtle to be detected by the naked eye.

Therefore, we have developed a new imaging technique called "transcutaneous optical imaging" to reveal people's facial emotions.

For that, we use regular video cameras to record how people experience different hidden emotions.

Then, using our image processing technology, we extract percutaneous images of facial blood flow changes.

By viewing transcutaneous video images, facial blood flow changes associated with various hidden emotions can now be easily identified.

And by using this technology, it is now possible to uncover the hidden emotions associated with lies and detect people's lies.

It can be done non-invasively, remotely, and at low cost, with an accuracy of about 85%, well above chance levels.

We also discovered the Pinocchio effect.

No, not this Pinocchio effect.

(Laughter) This is the real Pinocchio effect.

When a person lies, facial blood flow in the cheeks decreases and facial blood flow in the nose increases.

Of course, lying is not the only situation that evokes hidden emotions.

So we asked ourselves how our technology could be used beyond just detecting lies.

One application is education.

For example, this technology allows this math teacher to identify and help students in her classroom who may have high levels of anxiety about the subject she is teaching.

And you can use this in healthcare as well.

For example, I Skype every day with my parents who live thousands of miles away.

And with this technology, you can not only know what's going on in their lives, but simultaneously monitor their heart rate, stress level, mood and whether they're in pain.

And perhaps in the future, you could be at risk of heart attack or high blood pressure.

And you may wonder if this can also be used to reveal politicians' sentiments.

(laughs) For example, during a discussion.

The answer is yes.

Using television footage, we will be able to detect the heart rate, mood, stress of politicians, and in the future we will be able to detect whether politicians are lying to us.

This can also be used for marketing research, for example to find out if people like a particular consumer product.

You can also use it on dates.

So, for example, if your date is smiling at you, this technology can help determine if she really likes you or if she's just trying to be nice to you.

And in this case, she's just trying to be nice to you.

(Laughter) So transcutaneous optical imaging technology is in the very early stages of development.

There will be many new applications that we don't know about today.

But what I do know for sure is that lies are never the same again.

thank you very much.

thank you.

(applause)

I have a confession.

I love looking into people's trash.

Now, it's not creepy.

I'm usually just looking for old electronics, things I can take to a workshop and hack.

I have a CD-ROM drive fetish.

Each has 3 different motors so you can build things that move.

It has a switch so you can turn it on and off.

There's even an outrageous laser so you can turn cool robots into awesome robots.

Now I have made a lot of things out of garbage and some of these things are even kind of useful.

But the point here is that garbage to me is just an opportunity to play, get creative and build something to entertain yourself.

This is something I love so much that I've made it part of my daily routine.

I lead a university-based biology lab that values ​​curiosity and exploration above all else.

We are not focused on any particular problem, nor are we trying to solve any particular disease.

This is a place where people can come and ask interesting questions and find answers.

And I realized a long time ago that if I challenge people to make the equipment they need out of the trash I find, that's a great way to foster creativity.

And what happened is that artists and scientists from all over the world started coming to my lab.

Not only because we value unconventional ideas, but because we test and validate them with scientific rigor.

So one day, while I was hacking something and taking it apart, I suddenly had an idea. “Can we treat biology like hardware?”

Can we dismantle biological systems, put the parts together, and put them back together in some new and creative way?

My lab has started working on this and I would like to show you the results.

Can anyone tell me what kind of fruit this is?

Audience: Apple!

Andrew Pelling: Yes, it's an apple.

Now, actually, I want you to notice that this is much redder than most apples.

That's because they cultured human cells.

We took perfectly harmless Macintosh apples, removed all apple cells and DNA, and then transplanted human cells.

And what remains after all the apple cells are removed is this cellulose scaffold.

This is what gives the plant its shape and texture.

As you can see, these little holes are where the apple cells used to be.

Therefore, we transplant mammalian cells that can be seen in blue.

What happens is that these people start multiplying and fill this entire scaffold.

This is weird, but it really reminds me of how our own organization is structured.

And we found in preclinical studies that these scaffolds can be implanted in the body and the body can actually keep them alive by pumping cells and blood supply.

This is when people started asking me, "Andrew, can you make body parts out of apples?"

And I think I've come to the right place.

(Laughter) Actually, I discussed this with my wife.

She is a musical instrument maker and a woodcarver.

So I asked her, "Could you literally carve an ear out of an apple?"

And she did.

So I took her ear to the lab.

Then we started preparing them.

Yes I know.

(laughs) It's a nice lab.

(Laughter) And then we grew the cells on top of that.

And here is the result.

Listen, my lab does not manufacture ears.

In fact, people have been working on this for decades.

Here's the problem. Commercial scaffolds are made from proprietary products, animals and cadavers, which can be very expensive and problematic.

I used an apple, but it cost me a penny.

Also, what's really nice here is that these things aren't that hard to make.

The equipment you need can be made out of trash, and all you need for critical processing steps is soap and water.

So what we did was put all the steps online as open source.

And we've created a mission-driven company to develop kits that make it easy for anyone with a sink and a soldering iron to make these things at home.

I'm really curious if one day we'll be able to repair, rebuild and augment our own bodies with what we make in the kitchen.

Speaking of the kitchen, it's asparagus.

It tastes good and makes your pee smell weird.

(Laughter) Well, I was in the kitchen and I looked down at the asparagus stalks and realized that all I could see were tiny little containers.

Imaging them in the lab shows how cellulose forms these structures.

This image reminds me of two things. The structure and organization of the blood vessels, nerves and spinal cord.

Now the question is: can we grow axons and neurons in these channels?

If possible, asparagus could be used to form new connections between damaged and severed nerve ends.

Or maybe the spinal cord.

Don't get me wrong. This is very challenging, really hard work, and we're not the only ones working on this.

But we're the only ones using asparagus.

(Laughter) We have very promising pilot data right now.

And we're working with tissue engineers and neurosurgeons to see what's really possible.

So listen, all the work I've shown you, the things I've built around me on this stage, and the other projects my lab is involved in, are all direct results of me playing with your trash.

Play -- Play is an important part of my scientific practice.

In doing so, you train your mind to be unconventional and creative, and decide to create human apple ears.

So the next time you see old, broken, dysfunctional, crappy technology, think of me.

Because I want

(Laughter) Seriously, please find a way to contact me. Let's see what we can build.

thank you.

(applause)

How many of you can raise your hand and know at least one person on the screen?

Wow, it's almost full.

Indeed, they are very famous in their field.

And do you know what they all have in common?

They all died of pancreatic cancer.

But while this news is very, very sad, their personal stories have helped us raise awareness of how deadly this disease can be.

It is the third leading cause of cancer death, with only 8% of patients surviving 5 years or more.

This is a very small number, especially when compared to breast cancer, which has a survival rate of almost 90%.

So it's not all that surprising that being diagnosed with pancreatic cancer almost certainly means facing a death sentence.

But what's shocking is that this figure hasn't changed one bit over the past 40 years, despite even greater advances in other types of tumors.

So how can we make pancreatic cancer treatment more effective?

As a biomedical entrepreneur, I love tackling seemingly impossible problems, understanding their limitations, and striving to find new and innovative solutions that can change the outcome.

The first bad news about pancreatic cancer is that your pancreas is literally in the middle of your stomach.

It is displayed in orange on the screen.

But you can barely see it until you remove all the other organs in front of it.

It is also surrounded by many other vital organs such as the liver, stomach, and bile ducts.

And what makes pancreatic cancer one of the most painful tumors is its ability to grow within these organs.

It also cannot be surgically removed by a doctor, as is usually done in breast cancer, etc., because it is inaccessible.

For all these reasons, therefore, chemotherapy remains the only option for patients with pancreatic cancer.

This brings us to the second bad news.

Pancreatic cancer tumors have few blood vessels.

Why should we pay attention to tumor blood vessels?

Consider for a moment how chemotherapy works.

The drug is injected into a vein and travels throughout the body until it reaches the tumor site.

It's like driving on a highway and trying to reach your destination.

But what if your destination doesn't have a highway exit?

you will never get there.

And it's exactly the same issue with chemotherapy and pancreatic cancer.

The drug travels throughout the body.

They reach healthy organs and are highly toxic throughout the patient, but few reach tumors.

Therefore, its effectiveness is very limited.

To me, a systemic treatment that targets a specific organ seems highly counterintuitive.

However, over the last 40 years, while a great deal of money, research and effort has been spent on discovering new potent drugs to treat pancreatic cancer, nothing has been done to change the way drugs are delivered to patients.

So, I have two pieces of bad news, and hopefully I can give you some good news.

Together with collaborators at MIT and Massachusetts General Hospital in Boston, we have revolutionized the way cancer is treated by enabling localized drug delivery.

Basically, we parachute you to the top of your destination, avoiding having to drive all the way down the highway.

We have implanted this drug in such a device.

They are flexible enough to be folded to fit inside a catheter, allowing doctors to implant them directly over the tumor in minimally invasive surgery.

However, they are rigid enough to act as a cage when placed over the tumor.

In fact, it physically prevents tumors from invading other organs and controls metastasis.

The device is also biodegradable.

That is, once inside the body, it begins to dissolve, delivering drugs only locally, more slowly and effectively than current systemic treatments.

Preclinical studies have demonstrated that this topical approach can improve response to treatment by 12-fold.

So we delivered a known drug only locally where it was needed most, enabling a 12-fold more potent response and reducing systemic toxic effects.

We are working relentlessly to take this technology to the next level.

We are in the process of finalizing the necessary preclinical studies and animal models before seeking approval for clinical trials from the FDA.

Currently, the majority of patients die from pancreatic cancer.

We hope that one day we may be able to alleviate their pain, extend their lives, and make pancreatic cancer a curable disease.

Reimagining how drugs are administered not only makes them more potent and less toxic, but also opens the door to finding new and innovative solutions to nearly every other impossible problem in patients with pancreatic cancer and beyond.

thank you very much.

(applause)

I worked as a war correspondent for 15 years before I realized I had a real problem.

Something was really wrong.

This was about a year before 9/11 and America was not yet at war.

We weren't talking about PTSD.

We weren't yet talking about the effects of trauma and war on the human psyche.

I was in Afghanistan for several months because the Northern Alliance was fighting the Taliban.

And at that point the Taliban had an air force, fighter planes, tanks, artillery, and we really got hit pretty badly some times.

We saw some very ugly things.

But I didn't think it was affecting me.

I didn't think much of it.

I'm back in New York where I live now.

One day, I got on the subway and for the first time in my life, I learned about true fear.

I had massive panic attacks.

It was much scarier than when I was in Afghanistan.

Everything I saw seemed to kill me, but I could not explain why.

The train was too fast.

There were too many people.

The lights were too bright.

Everything was too loud and everything was moving too fast.

I retreated to the stanchion and just waited.

I couldn't take it anymore, so I ran out of the subway station and walked everywhere.

It turned out that I had short-term PTSD, or post-traumatic stress disorder.

As animals, as primates, we have evolved to survive dangerous times. When life is in danger, it is tempting to react to unfamiliar sounds.

I want to sleep lightly and wake up well.

You want to see nightmares and flashbacks of things that could kill you.

The reason why you want to get angry is because anger makes it easier to fight, or makes you feel a little sick and depressed.

I will keep you safe.

It's not very pleasant, but it's better than being eaten.

Most people recover quickly from it.

It takes weeks, months.

I had recurrent panic attacks that eventually subsided.

I had no idea it had anything to do with the wars I saw.

When I thought I was going crazy, I thought I wasn't crazy anymore.

However, about 20% of people will have chronic long-term PTSD.

They cannot adapt to temporary dangers.

They become maladjusted to everyday life without help.

Long-term PTSD has been found to be more prevalent among those who were abused as children, suffered childhood trauma, have low levels of education, and have a family history of mental illness.

If you served in Vietnam and your brother has schizophrenia, you are much more likely to get long-term PTSD from Vietnam.

So I started researching this issue as a journalist and noticed something really strange going on.

The numbers seemed to go the wrong way.

In every war we've fought as a nation, beginning with the Civil War, the intensity of the fighting has declined.

As a result, the number of casualties decreased.

But disability rates are rising.

They should be heading in the same direction, but they are heading in different directions.

The recent wars in Iraq and Afghanistan thankfully caused about one-third the casualties of the Vietnam War.

But they also produced a 3x failure rate.

About 10 percent of the U.S. military is actively engaged in combat, less than 10 percent.

They shoot people, they kill them, they get shot, they watch their friends get killed.

It's incredibly traumatic.

But that's only about 10 percent of our military.

However, about half of our military have applied for some form of PTSD compensation from the government.

And suicide logically doesn't even fit into this.

We've all heard the tragic statistic that an average of 22 veterans commit suicide every day in this country.

Most people don't know that the majority of those who commit suicide are Vietnam War veterans, that generation. And their decision to take their own life may actually have nothing to do with the war they fought 50 years ago.

In fact, there is no statistical association between fighting and suicide.

If you're in the military and often participate in combat, you're less likely to commit suicide than if you weren't.

In fact, one study found that people who were deployed to Iraq or Afghanistan were slightly less likely to commit suicide afterwards.

I studied anthropology at university.

I did fieldwork on the Navajo Reservation.

I wrote a paper on Navajo long-distance runners.

And recently, when I was researching PTSD, I had this thought.

Thinking back on the work I did when I was younger, I thought the Navajos, the Apaches, the Comanche—I mean, these are very warlike nations—they probably didn't suffer from PTSD like we did.

I suspect that when their warriors returned from fighting the U.S. Army and fighting among their tribes, they would have quickly returned to tribal life.

And perhaps it's not what happens outside that determines the rate of long-term PTSD, but what kind of society you come back to.

And perhaps a return to a close, cohesive tribal society would soon overcome the trauma.

And if you return to a marginalized modern society, you may be traumatized for the rest of your life.

In other words, maybe the problem isn't them, the veterans. Perhaps the problem is with us.

Indeed, modern society is harsh on the human spirit by any measure.

As society's wealth increases, suicide rates rise, not fall.

People living in modern societies are up to eight times more likely to suffer from depression in their lifetime than those living in poor agricultural societies.

Our modern society produces perhaps the highest rates of suicide, depression, anxiety, loneliness, and child abuse in human history.

I saw a study comparing women in Nigeria, one of the poorest and most disturbed, violent, corrupt countries in Africa, with women in North America.

And urban women in North America had the highest rates of depression.

It was also the wealthiest group.

Now let's go back to the US military.

10% are in combat.

About 50% apply for PTSD compensation.

That means about 40 percent of veterans were actually untraumatized abroad, but found themselves dangerously alienated and depressed when they returned home.

So what is happening to them?

What's going on with the phantom 40 percent of people who have problems but don't know why?

Perhaps it is this. Perhaps they experienced some kind of tribal intimacy within the unit when they were abroad.

They ate together, slept together, and worked together.

They trusted each other's lives.

And then they have to go home, abandon everything, and come back to the modern world, a society that is tough on people who weren't even in the military.

It's hard for everyone.

And we continue to focus on trauma, PTSD.

But for many of these people, it may not be traumatic.

Yes, soldiers are traumatized and traumatized people need to be treated for it.

But for many of them, perhaps it's some kind of alienation that bothers them.

So maybe we just have the wrong words for some of it, and just changing our language and understanding would help a little.

"Post-deployment alienation disorder".

Perhaps just calling it that way can help some people stop imagining trying to imagine trauma that hasn't actually happened in order to describe the feelings that are actually going on.

And indeed, it is a very dangerous feeling.

That alienation and depression can lead to suicide.

These people are in danger.

It's very important to understand why.

The PTSD rate in the Israeli military is about 1 percent.

In theory, every Israeli citizen should serve in the military.

When soldiers return from the front lines, they are not going from a military environment to a civilian environment.

They are coming back to a community where everyone understands the military.

Everyone has participated in it or will participate in it.

Everyone understands their situation.

It's as if they were all in one big tribe.

It has been shown that when laboratory rats are traumatized and caged alone, trauma symptoms are maintained almost indefinitely.

And if you put that same lab rat in a cage with other rats, after a few weeks it's pretty much fine.

After 9/11, New York City's homicide rate dropped by 40 percent.

Suicide rates have gone down.

Since 9/11, New York's violent crime rate has declined.

Even past war veterans who suffered from PTSD said their symptoms lessened after 9/11 happened.

The reason is that if you traumatize an entire society, we will not fall apart and turn against each other.

we will come together we unite

Basically we are tribalized, but that process of unity is so comforting and so good for us, it also helps people who are struggling with mental health issues.

In the London air raids, the bombing reduced admissions to psychiatric wards.

For a while, it was just the United States that the American soldiers returned.

we were stuck.

We were trying to understand the threat to ourselves.

We were trying to save ourselves and the world.

But that has changed.

Now, American soldiers and American veterans are returning to a country so divided that two political parties literally accuse each other of treason, enemies of the state, and attempts to undermine their own security and welfare.

The gap between rich and poor is at an all-time high.

The situation is only getting worse.

Race relations are terrible.

Racial injustice has led to demonstrations and riots in the streets.

And veterans know that the tribe that treated them that way, indeed the platoon that treated them that way, would never survive.

I'm used to it.

Veterans leave and come back to see their country with fresh eyes.

And they see what's going on.

This is the country where they fought.

No wonder they are depressed.

No wonder they are scared.

We sometimes ask ourselves if we can save our veterans.

I think the real question is whether we can save ourselves.

I hope the veterinarian will be fine.

It's time for this nation to come together to help the men and women who fought to protect us.

thank you very much.

(applause)

When railroads began to shuttle people through the countryside, many argued that they would never replace horses.

Less than a century later, people repeated the same predictions about cars, phones, radios, televisions, and computers.

Each had its own critics.

Even some experts argued that it would not become widespread.

Of course, no one can predict exactly what the future will look like and what new inventions will emerge there.

But time and time again we have failed to predict that current technology will change the future.

And recent research has revealed similar patterns in our personal lives. We cannot predict our own changes.

In a 2013 paper called "The End of the Historical Illusion," three psychologists documented our inability to predict personal change. Named after political scientist Francis Fukuyama's prediction that liberal democracy is the final form of government, or, as he puts it, "the end of history," their work highlights how we see ourselves as the finished product of the moment.

The researchers recruited more than 7,000 participants between the ages of 18 and 68.

They asked half of these participants to report their current personality traits, values, and preferences, along with each indicator 10 years ago.

The other half described their current selves and predicted what they would be like 10 years from now.

Based on these responses, researchers calculated the degree of change reported or predicted by each participant.

We compared predicted and reported changes for all age groups in the sample.

They then compared the extent to which 18-year-olds believed they would change with the extent to which 28-year-olds reported that they had changed.

Across all age groups, overwhelmingly, people's predictions of future changes were poor relative to the changes recalled by older people.

A 20-year-old expected to still like the same foods at 30, but a 30-year-old no longer has the same tastes.

30-year-olds expected to have the same best friends at 40, but 40-year-olds had lost touch with their best friends.

And we predicted that 40-year-olds would retain the same core values ​​that 50-year-olds revisited.

Overall, older people changed less than younger people, but they also underestimated their ability to change.

Wherever we are in life, the illusion of the end of history persists. We tend to think that most of our personal changes happened in the past.

One consequence of this mindset is that we tend to overinvest in future choices based on current preferences.

On average, people are willing to pay about 60% more to see their favorite musician 10 years from now than they would pay to see their favorite musician 10 years ago.

The risks associated with going to a concert are low, but similar miscalculations are likely when it comes to more serious commitments such as a home, a partner, or a job.

At the same time, there is no real way to predict what our tastes will be in the future.

Without the illusion of the end of history, it would be difficult to plan for the long term.

So the end-of-history illusion applies to our personal lives, but what about the wider world?

Can we expect the current situation to continue?

If so, fortunately, there are countless records that remind us that the world sometimes changes for the better.

Our own historic moment is not the end of history. It can be both a source of concern and a source of comfort.

I want to talk about sex for money.

I'm not like most people you've ever heard talk about prostitution.

I am neither a police officer nor a social worker.

I am not a scholar, a journalist, or a politician.

And, as you probably noticed from Mariam's blurb, I'm not a nun either.

(Laughter.) Most of them would say that selling sex is degrading. no one will choose it. that it is dangerous. Women are abused and killed.

In fact, most of them would say, "We need a law against this!"

Perhaps it seems reasonable to you.

It seemed reasonable to me until the last few months of 2009, when I was working two dead-end minimum-wage jobs.

Monthly paychecks only topped up the overdraft.

I was exhausted and life was going bad.

Like many people before me, I decided that sex for money was a better option.

Don't get me wrong. I wanted to win the lottery instead.

But it didn't happen right away and the rent had to be paid.

So I signed up for the first shift at the brothel.

It's been years since then and I've had a lot of time to think.

I reconsidered the ideas I once held about prostitution.

I have thought a lot about consent and the nature of work under capitalism.

I have been thinking about gender inequality and women's sexual and reproductive labor.

I experienced exploitation and violence at work.

I've been thinking about what I need to do to protect other sex workers from these things.

Maybe you've thought about them too.

This talk will introduce the four main legal approaches applied to sex work around the world and explain why they don't work. Why would a ban on the sex industry actually exacerbate all the harms to which sex workers are susceptible?

Now let's talk about what we sex workers actually want.

The first approach is outright criminalization.

Half the world, including Russia, South Africa and most of the United States, regulates sex work by criminalizing everyone involved.

That is, sellers, buyers and third parties.

Lawmakers in these countries seem to hope the fear of being arrested will deter people from prostitution.

But when faced with a choice between obeying the law and providing for yourself and your family, you will take risks and work anyway.

Criminalization is a trap.

Having a criminal record makes it difficult to get a regular job.

Potential employers will not hire you.

Assuming you still need the money, you'll be stuck in a more flexible and informal economy.

The law forces sex to continue to be sold, which is the exact opposite of its intended effect.

Criminalization exposes them to abuse by the state.

In many places, you may be forced to pay bribes or have sex with police officers to avoid arrest.

For example, Cambodian police and prison guards have been documented to subject sex workers to what can only be described as torture, including threats at gunpoint, beatings, electric shocks, rape, and denial of food.

Another worry is that if you sell sex in Kenya, South Africa, New York, etc., you could be arrested by police if you are caught with condoms. Condoms can be legally used as proof of sex sales.

Clearly, this increases HIV risk.

Imagine being arrested with a condom and knowing it will be used against you.

It's a pretty strong incentive to want to keep them at home, right?

Sex workers working in these places face the difficult choice of risking arrest or engaging in risky sex.

what would you choose?

Do you carry condoms with you to work?

What if you're afraid the police will rape you when they put you in the van?

The second approach to regulating sex work seen in these countries is partial criminalization, with sex trafficking legal but peripheral activities such as running brothels and street soliciting prohibited.

Such laws, which exist in the UK and France, essentially tell us sex workers, 'You can sell sex, just do it behind closed doors and alone.'

By the way, running a brothel is defined as two or more sex workers working together.

Making it illegal would mean that many of us would be working alone, clearly making us vulnerable to violent criminals.

But we can also be vulnerable if we choose to cooperate and break the law.

A few years ago a friend of mine was attacked at work and was nervous, so I said I could watch the customer from my house for a while.

Meanwhile, another guy got mean.

I told the man to go away or I will call the police.

And he looked at us both and said, "You girls can't call the police.

We work together and it's illegal here. ”

he was right

In the end he walked away without violence, but the man was able to threaten us because he knew we were breaking the law.

He was confident that he would get it done.

A ban on street prostitution can do more harm than it prevents.

First, to avoid arrest, street activists take risks to avoid detection. This means working alone or in isolated locations like dark forests that are vulnerable to attack.

You will be fined for prostitution outside.

How am I going to pay that fine without going back to the streets?

The first thing you saw on the street was that you needed money.

And the fines add up, and you end up in a vicious cycle of selling sex to pay the fines you get for selling sex.

Let's talk about Mariana Popa, who worked in Redbridge, East London.

The street workers in her patch usually waited for customers in groups to ensure safety and warned each other on how to avoid dangerous men.

However, during a police crackdown on sex workers and their clients, she was forced to work alone to avoid arrest.

She was stabbed to death in the early hours of October 29, 2013.

She worked late to pay off the fine she received for her solicitation.

So if criminalizing sex workers hurts them, why not criminalize those who buy sex?

This is the third approach I want to talk about, the purpose of the Swedish or Nordic model of sex work law.

The idea behind the law is that selling sex is inherently harmful, so removing that option would actually help sex workers.

Despite growing support for what is often referred to as the "end demand" approach, there is no evidence that it works.

Prostitution is as common as ever in Sweden.

Why?

That's because people who do prostitution often have no other income options.

If you need that money, the only effect of a drop in business will be that you will be forced to either lower your prices or offer more risky sexual services.

You can also ask your manager for help if you need to find more customers.

So instead of stopping what is often referred to as pimping, such laws actually give oxygen to potentially abusive third parties.

For my job security, I don't take appointments from people who call me from unlisted numbers.

For home or hotel visits, I try to ask for full names and details.

If I were working according to the Swedish model, my clients would be afraid to tell me that information.

If later found to have committed violence, you may have no choice but to accept an appointment from an untraceable man.

If you want money, you have to protect your customers from the police.

Working outdoors means working alone or in a secluded area, as if you were made a criminal yourself.

You'll be able to get into your car faster, spend less time negotiating, and maybe make split-second decisions.

Is this guy dangerous or just nervous?

Can you afford the risk?

Can you afford not to?

I often hear people say, "If prostitution was legalized and regulated, it wouldn't be a problem."

We call this approach legalization and it has been adopted by countries such as the Netherlands, Germany and Nevada in the United States.

But it is not a good model of human rights.

And in state-controlled prostitution, commercial sex takes place only in certain legally designated areas or venues, and sex workers are obliged to follow special restrictions, such as mandatory registration and medical examinations.

Regulation sounds great, but politicians intentionally make sex industry regulation expensive and difficult to comply with.

It creates a two-tiered structure of legal and illegal labor.

We sometimes call it "backdoor criminalization".

Wealthy and well-connected brothel owners can comply with regulations, but marginalized people find it impossible to jump the hoops.

Also, even if it is possible in principle, it takes time and money to acquire licenses and suitable venues.

For those who need money tonight and are desperate, it is not an option.

They may be refugees or fleeing domestic violence.

In this two-tiered system, the most vulnerable are forced into illegal employment and are therefore still exposed to all the dangers of criminalization mentioned above.

So.

Every attempt to control or stop the occurrence of sex work appears to make the situation even more dangerous for those who sell sex.

Fear of law enforcement forces them to work in isolation and in solitude, which can be exploited by clients and even police officers knowing they can escape.

Fines and criminal records keep people from prostitution and force them to continue.

A crackdown on buyers forces sellers to take dangerous risks and fall into the arms of potentially abusive managers.

These laws also reinforce prejudice and hatred against sex workers.

When France briefly introduced the Swedish model two years ago, it prompted civilians to launch vigilante attacks on people working on the streets.

In Sweden, opinion polls show that far more people want sex workers arrested now than they did before the law was enacted.

If bans are so harmful, you may wonder why bans are so prevalent.

First, sex work continues to be a survival strategy for all sorts of underrepresented minority groups, including people of color, immigrants, people with disabilities, LGBTQ and especially trans women.

These are the groups most severely addressed and punished by the ban.

I don't think this is an accident.

These laws have political support precisely because they target people voters don't want to see or know.

Why else would people support a ban?

Well, many people have a legitimate fear of human trafficking.

People think foreign women who are kidnapped and sold into sex slaves can be saved by shutting down the entire industry.

Now let's talk about human trafficking.

Forced labor occurs in many industries, especially those with immigrant or vulnerable workers, and needs to be addressed.

However, the best way to address this issue is to enact legislation that targets specific fraudulent practices rather than the industry as a whole.

When 23 illegal Chinese immigrants drowned while collecting cockles in Morecambe Bay in 2004, there were no voices calling for the entire fishing industry to be outlawed to help victims of human trafficking.

The solution is clearly to give workers more legal protections so they can resist abuse and report it to authorities without fear of arrest.

The buzz around the word trafficking implies that all illegal immigration into prostitution is coerced.

In fact, many migrants decided to turn themselves over to smugglers out of economic necessity.

Many do this knowing full well that they will be selling sex once they reach their destination.

And yes, it's common for these smugglers to demand exorbitant fees, force immigrants to do jobs they don't want to do, and abuse vulnerable immigrants.

That applies to prostitution, but it also applies to farm work, hospitality work, and domestic work.

After all, no one wants to be forced into any kind of job, but many immigrants are willing to take that risk given what they are leaving behind.

If people were allowed to migrate legally, there would be no need to put their lives in the hands of smugglers.

Problems arise from the criminalization of immigration as much as from the criminalization of sex work itself.

This is a lesson of history.

Trying to ban things people want or need to do, such as drinking, border crossing, abortion, prostitution, etc., creates more problems than it solves.

Bans have little impact on the amount of people who actually do those things.

But whether it's safe when you do it makes a big difference.

Why else would people support a ban?

As a feminist, I know the sex industry is a deep-rooted site of social inequality.

It is true that most sex buyers are men with money and most sellers are women without money.

You can agree with all of this, and I agree, but I still think Prohibition is a terrible policy.

In a better, more equal world, far fewer people might sell sex to survive, but a better world simply cannot be legislated.

If someone needs to sell sex because they are poor, homeless, or illegal and unable to find legal work, removing that option will not make them any less poor, housed, or change their immigration status.

People worry that selling sex is degrading.

Ask yourself. Is it more demeaning than being hungry and seeing children hungry?

There is no demand to ban the wealthy from hiring nannies or doing manicures, even though most of those in that labor are poor immigrant women.

What makes some feminists uncomfortable is the fact that poor immigrant women are being marketed for sex.

I also understand why the sex industry evokes strong emotions.

People have mixed emotions when it comes to sex.

But policy decisions cannot be based on mere emotions. In particular, policy decisions cannot be made over the heads of those who are actually affected by those policies.

When we obsess over abolishing sex work, we worry about the specific manifestations of gender inequality rather than its root causes.

People get very hung up on the question, "So you want your daughter to do that?"

that's the wrong question.

Instead, imagine her doing it.

How safe is she at work tonight?

Why couldn't she be safer?

So we have looked at full criminalization, partial criminalization, the Swedish or Nordic model and legalization and how they do harm.

A question you haven't heard is, "What do sex workers want?"

After all, we are the ones most affected by these laws.

New Zealand decriminalized sex work in 2003.

It is important to remember that decriminalization and legalization are not the same thing.

Decriminalization means eliminating laws that punitively target the sex industry and instead treating sex work like any other type of work.

In New Zealand, people can work together for safety, and employers of sex workers are accountable to the state.

Sex workers can refuse visits to clients at any time for any reason, and 96 percent of street workers report feeling the law protects their rights.

While the number of people actually doing sex work in New Zealand has not increased, the decriminalization of sex work has made it much safer.

But the lesson from New Zealand is not just that that particular law is good, but crucially, that law was written in partnership with sex workers. Namely, the New Zealand Prostitutes Group.

When it came to making sex work safer, they were ready to hear it directly from the sex workers themselves.

Here in the UK I am part of sex worker driven groups like the Sex Workers Open University and the British Prostitutes Collective.

And we are part of a global movement for decriminalization and self-determination.

The universal symbol of our movement is the red umbrella.

Our call is supported by international organizations such as UNAIDS, World Health Organization and Amnesty International.

But we need more allies.

Sex worker rights matter to you if you care about gender equality, poverty, migration or public health.

Make space for us in your movement.

That means raising your voice, not just listening to sex workers.

Resist those who silence us, who say that prostitutes are too victimized, too hurt to know what is best for them, or too privileged to be kept from real suffering and not representative of the millions of voiceless victims.

This distinction between victim and empowered is imaginary.

It exists purely to discredit sex workers and make it easier for us to be ignored.

No doubt many of you work for a living.

Well, sex work is work too.

Like you, some of us love what we do and others hate it.

After all, most of us have mixed feelings.

But it doesn't matter how we feel about our work.

And it's never how others feel about our work.

Importantly, we have the right to work safely and on our own terms.

Sex workers are real people.

We have had complex experiences and have had complex reactions to those experiences.

But our request is not complicated.

Ask expensive escorts in New York City, brothel workers in Cambodia, street workers in South Africa, and every girl on the roster at my previous job in Soho, and they'll all say the same thing.

You can speak to millions of sex workers and countless sex work driven organizations.

We want full decriminalization and labor rights as workers.

Today, I am just one sex worker on stage with messages from around the world.

thank you.

(applause)

James Lysen.

You may know him as a Pulitzer Prize-winning New York Times reporter.

Long before anyone knew Edward Snowden's name, Risen wrote a famous book that exposed the NSA's illegal tapping of Americans' phones.

But it's another chapter in the book that may have an even more lasting impact.

In it, he describes a devastating US intelligence operation in which the CIA literally handed over the blueprints for a nuclear bomb to Iran.

If that sounds crazy, read on.

It's unbelievable.

But do you know anyone who didn't like that chapter?

US government.

For nearly a decade, Risen was the subject of a US government investigation, with prosecutors demanding that one of Risen's alleged sources testify against him.

And in the process, he has become the face of the US government's recent pattern of prosecuting whistleblowers and spying on journalists.

As you know, the First Amendment to the Constitution gives the press the right to release confidential information in the public interest.

But that right cannot be exercised if the media cannot protect the identities of the brave men and women who collect and tell the news.

So when the government knocked, Raisen did what many brave reporters have done. He refused and said he would rather go to jail.

So from 2007 to 2015, Raisen lived in fear of being sent to federal prison.

That was until a few days before the trial, something strange happened.

After years of insisting it was important to their lawsuit, suddenly the government dropped their claims on Risen altogether.

In the age of electronic surveillance, it turns out there are few places where reporters and sources can hide.

And instead of trying and failing to get Mr. Risen to testify, he could instead use Mr. Risen's digital trail to testify against him.

There, in complete secrecy and without his consent, prosecutors obtained Risen's phone records.

They obtained his email records, financial and banking information, credit reports, and even travel records, including a list of flights he had taken.

And it was in this information that they used to convict Risen's alleged source and CIA whistleblower Jeffrey Sterling.

Unfortunately, this is just one case out of many.

President Obama has made a promise to protect whistleblowers, but instead the Justice Department has prosecuted more than all other administrations combined.

Now you can see how this can be a problem, especially since the government considers many of its activities to be secret.

Since 9/11, virtually every major story on national security has been the result of whistleblowers who have come to journalists.

Therefore, the government's growing ability to spy on everyone risks compromising the media's ability to do what the First Amendment protects.

But just as technology has allowed governments to circumvent the rights of journalists, so too has technology enabled news organizations to better protect their sources.

And you can start from the moment you start speaking, not from the witness stand after the fact.

Communications software that wasn't available when Riisen was writing the book now exists and is far more resistant to surveillance than regular email and phone calls.

For example, one such tool is SecureDrop, an open-source whistleblowing system originally created by the late internet luminary Aaron Swartz, now developed at the nonprofit organization I work for, Freedom of the Press Foundation.

Instead of sending an e-mail, visit the websites of news outlets such as the Washington Post.

From there, you can upload documents and submit information just like any other contact form.

It is then encrypted and stored on servers that can only be accessed by news organizations.

As such, governments can no longer secretly request information, and much of the information they request will never be available in the first place.

But SecureDrop is really just one piece of the puzzle for securing press freedom in the 21st century.

Unfortunately, governments around the world are constantly developing new spying techniques, putting us all at risk.

And it's up to us to make sure tech-savvy whistleblowers like Edward Snowden aren't the only ones with the means to expose wrongdoing.

It is equally important to protect the next veteran medical whistleblower who warns that hospitals are overcrowded, the next environmental activist who warns about Flint's sewage, the next Wall Street insider who warns about the next financial crisis.

After all, these tools aren't just made to help brave men and women expose crime, they're meant to protect all of our constitutional rights.

thank you.

(applause)

I know there's a lot of big stuff at TED, but I want to talk about very small things.

It's so small, just one word.

The word is "nonconformist".

It's one of my favorite words because it's so literal.

In other words, he was a person who was a bit unfamiliar with society.

or incompatible people.

Or "people who cannot adapt well to new situations and environments."

I am a card-carrying nonconformist.

And I'm here for the other misfits in this room, because I'm never alone.

Talk about non-conformers.

Somewhere in my early thirties, my dream of becoming a writer came before me.

In fact, it came in the form of a letter in my post telling me that a short story I had written had won a huge literary prize.

The short story was a little bit about my life as a competitive swimmer, my crappy home life, and how grief and loss can drive you crazy.

The prize was a trip to New York to meet with prominent editors, agents and other authors.

In a sense, wasn't that the dream of an aspiring writer?

Do you know what I did the day the letter arrived at my house?

Because I am me, I put the letter on the kitchen table, poured a huge glass of vodka with ice and lime, and sat in my underwear all day just staring at the letter.

I was thinking about how I've messed up my life so far.

Who was I to go to New York and pretend to be a writer?

Who was I?

i'll tell you

I was a nonconformist.

Like many other children, I came from an abusive home and narrowly escaped.

I am already in a marriage that has gone through two spectacular failures.

I failed college not once, but twice, maybe a third time, but I won't talk about it.

(Laughter.) And I went through rehab for drug use.

And I had two nice stays in prison.

So I'm on the right stage.

(Laughs) But I think the real reason is that I was a social misfit. It was because she died the day my daughter was born, and I still didn't know how to accept that story and live my life.

After my daughter died, I was also homeless for a long time, living under an overpass in a deep sense of grief and loss like a zombie I encountered along the way.

Maybe we all will if we live long enough.

As you know, homeless people are the most heroic misfits because they depart just like us.

So I missed out on daughters, wives, mothers, academics, and pretty much every other category out there.

And the dream of becoming a writer really was like a small, sad stone in my throat.

I took the plane and flew to New York City where the writers were.

Misfits, I can see your heads shining.

I can take you out of your room.

I would have liked it at first.

Pick 3 famous authors you want to meet and they will go find you.

You're seated at the Gramercy Park Hotel, drinking scotch late into the night with cool, smart, stylish people.

And you have to pretend you're cool, smart, and stylish.

And I had to meet many editors, authors and agents at very fancy lunches and dinners.

Ask how gorgeous it is.

Audience: How gorgeous!

Lydia Yuknavic: I confess. I stole 3 linen napkins from 3 different restaurants -- (laughter).

Then I tucked the menu into my pants.

(Laughter) I just wanted a keepsake so that when I got home I could believe it really happened to me.

Look?

The three writers I wanted to meet were Carol Masot, Lynn Tillman, and Peggy Phelan.

They weren't famous best-selling authors, but to me they were giants of female authors.

Carol Masot wrote the book that became my art bible.

Lynn Tillman gave me permission to believe my story could be part of the world.

And Peggy Phelan reminded me that maybe my brain is more important than my chest.

They weren't mainstream women authors, but I think they carved their way into the mainstream with their body stories in the way water cuts through the Grand Canyon.

I was so happy to be able to spend time with three female writers over 50 that I almost died.

And the reason I almost died of joy was because I had never known such joy before.

I had never been in a room like that.

My mother never went to college.

And my creative career up until that point had been kind of a humble, sad, stillborn thing.

My first night in New York, I wanted to die there.

I was just like, "Kill me now. I'm fine. This is beautiful."

Some of you in this room will understand what happened next.

First, they took me to Farrar, Strauss and Giroud's offices.

Farah, Strauss and Giroud were like a big dream press for me.

So T.S. Eliot and Flannery O'Connor were published there.

The lead editor man sat me down and talked for a long time, trying to convince me that there was a book in me about my life as a swimmer.

Well, it's kind of like a memoir.

I sat there with my arms crossed on my chest as he spoke to me, smiling and nodding like a numb fool while nothing, nothing, nothing came out of my throat.

So finally he tapped me on the shoulder like a swimming coach.

And he wished me luck, gave me some free books, and escorted me out the door.

Next they took me to the WW office. At Norton, I was convinced I would be escorted out of the building just for wearing Doc Martens.

But that didn't happen.

Being in Norton's office felt like reaching into the night sky and touching the moon while the stars sewed your name into space.

I mean, how big of a deal was that for me?

Do you understand?

Editor-in-chief Carol Hawke-Smith bent over my face with bright, daring eyes and said, "Send me something right now!"

See, most people, especially the TED folks, would have run to the mailbox.

It took me over a decade to imagine putting something in an envelope and licking a stamp.

Last night I gave a great reading at the National Poetry Club.

And at the end of the reading, Catherine Kidde of Kidde Hoyt &amp;amp;amp;amp;amp;amp;amp;amp;amp;amp;amp;amp; The Picard Literary Agency walked straight up to me, shook my hand, and offered to represent me on the spot.

I was standing there and I was deaf.

Has this ever happened to you?

And all the people in that room were so beautifully dressed that I almost cried. All that came out of my mouth was, "I don't know. I have to think about it."

Then she said, "Okay, then," and walked away.

All the hands you gave me, those little sad stones in my throat...

See, I'm trying to tell you something about people like me.

Social Misfits -- We don't always know how to expect big things, say yes, or make choices, even when it's right in front of us.

It's a pity that we have.

It's embarrassing to want good things.

It's embarrassing to feel something good.

It's a shame that we don't truly believe we are entitled to be in a room with people we respect.

I would like to go back and coach myself if I can.

I would be just like the women over 50 who helped me.

I taught myself how to want things, how to stand up, how to ask for them.

"You! Yes, you! You are part of this room," I said.

The brilliance rains down on us all and we can do nothing without each other.

Instead, I flew back to Oregon and just 'feel sorry for myself' drinking a few small bottles on the plane, watching the evergreens and rain come back into view.

If I was a writer, I wondered if I was a kind of misfit writer.

What I mean is that I came back to Oregon with no book deal, no agent, just a head and heart full of memories of sitting near beautiful authors.

Memory was the only prize I was allowed.

Still, I could hear them in my dark house, even with my underwear on.

They said, "Don't listen to people who try to shut you up or change your mind."

They said, "Give a voice to a story that only you know how to tell."

they said: “Sometimes telling stories saves lives.”

Now, as you can see, I am a woman over 50 years old.

And I am a writer.

and i am a mother

And I became a teacher.

Who do you think is my favorite student?

It didn't happen the day that dream letter arrived in the mail, but I wrote a memoir called "Water Chronology."

It contains stories of how many times I had to reinvent myself from the ruins of my choices, how my seeming failures were actually just strange gateways to something beautiful.

All I had to do was give the story a voice.

Most cultures have myths about chasing dreams.

It's called Hero's Journey.

But I prefer another myth. That's what's a little beside or under it.

It's called the myth of the misfit.

And it looks like this: Even in the moment you fail, you are beautiful in the moment.

You don't realize it yet, but you have the capacity to reinvent yourself infinitely.

That's your beauty.

You can become a drunk, a victim of abuse, a criminal record, homeless, lose all your property, your job, your husband or wife, or even your children.

You can also lose marbles.

You may be standing in the middle in the midst of your failures, yet I just want to tell you, you are so beautiful.

Your story is worth listening to. Because you, you, the rare and wondrous misfit, you, the new breed of human, are the only ones in this room who can tell stories in a way that only you can.

And I would have listened.

thank you.

(applause)

An alien monolith has been discovered on planet RH-1729, and scientists around the world are racing to unravel its mystery.

Your engineering team has developed an elegant probe to study it.

This probe is a collection of 27 cube modules capable of performing all the scientific tests required for monolith analysis.

Modules can self-assemble to form a large 3x3x3 cube, and individual modules can be placed anywhere on the cube and in any orientation.

It can also be disassembled and reassembled in a different orientation.

Your job is next.

Probes require special protective coatings for each harsh environment they pass through.

The red coating protects it from the cold of deep space, the purple coating protects it from the intense heat of entering RH-1729's atmosphere, and the green coating protects it from alien storms.

Each side of all 27 cube modules can be coated in any way, but only one color coating can be applied to each side.

I need to figure out how to apply the colors so that the cubes are reassembled and appear in the order red, purple, green.

How could we apply a colored coating to the 27 cubes so that the rover could navigate?

Pause here if you want to figure it out yourself.

Start by painting the outside of the finished cube red, as you will need it anyway.

Now let's split it into 27 parts and see what we have.

There are 8 corner cubes with 3 red faces each, 12 edge cubes with 2 red faces, 6 sided cubes with 1 red face, and 1 center cube with no red faces.

At this point we have painted a total of 54 faces in red, so the green and purple cubes will need the same number of faces.

When you're done, you'll have 54 sides painted red, 54 sides green, and 54 sides purple.

This is 162 faces, exactly matching the total number of cubes.

So there is no room for waste.

If there was a way to do this, it would probably be highly symmetrical.

Maybe we can use it to help you.

Notice the central cube.

Paint half green and half purple so you can use each cube as a corner and not waste a single face.

You also need a center cube without greens and purples.

So take two corner cubes from the red cube and paint one blank three sides purple and another blank three sides green.

You now have a 6-sided cube with one face each painted red.

This leaves 5 empty faces on each.

You can also divide it in half.

In the first group, paint 3 sides green and 2 sides purple. In the second group, paint 3 sides purple and 2 sides green.

Re-duplicate these piles by rearranging the colors to account for symmetry.

This gives us 6 with 1 green face, 6 with 1 red face, and 6 with 1 purple face.

If you count the fully painted ones, you can see that there are 8 corner cubes of each color, 6 edge cubes of each color, 6 face cubes of each color, and 1 center cube.

That means we only need 6 more green and purple edge cubes.

And there are exactly 6 cubes left, each with 4 empty faces.

Paint two sides of each green and two sides of each purple.

You now have a perfectly painted cube for a wonderful journey.

It remaps to red when in deep space, purple when entering RH-1729's atmosphere, and green when flying through a thunderstorm.

Upon reaching the Monolith, they realize they have achieved what humanity has long dreamed of: contact with aliens.

In 1919, a virtually unknown German mathematician named Theodor Carusa proposed a very bold and in some ways very strange idea.

He proposed that our universe may actually have more than three dimensions as we know it.

It's left-right, front-back, up-down, plus there may be additional spatial dimensions that we haven't seen yet for some reason, Kaluza suggested.

Now, when someone comes up with a bold and crazy idea, sometimes it's just bold and weird, but it has nothing to do with the world around us.

But this particular idea, which we still don't know if it's right or wrong, and finally describes an experiment that may tell us whether it's right or wrong in the years to come, has had a huge impact on physics over the last century and continues to inform many cutting-edge studies.

So I want to talk a little bit about this extradimensional story.

So where are you going?

Before we begin, we need a little backstory. Go to 1907.

This is the year that Einstein reveled in his discovery of special relativity and decided to undertake a new project to fully understand the grand and universal gravitational force.

And at that moment, there were a lot of people around me who thought the project was closed.

Newton gave the world his theory of gravity in the late 1600s, and it worked well, explaining apocryphal movements such as the motion of planets, the motion of the moon, and the apple falling from the tree and hitting people's heads.

All of this can be explained using Newton's work.

However, Einstein realized that Newton left something out of the story. Because even Newton wrote that he understood how to calculate the effects of gravity, but could not understand how it actually worked.

Why would the Sun, which is 93 million miles away, have any effect on Earth's motion?

How does the sun reach out and influence beyond empty inert space?

And that is the task Einstein set himself: to understand how gravity works.

and show him what he found.

So Einstein discovered that the medium through which gravity is transmitted is space itself.

The idea goes like this: Imagine that the universe is the substrate of everything that exists.

Einstein said that space would be nice and flat if matter didn't exist.

However, the presence of matter in the environment, such as the sun, causes the structure of the universe to distort and bend.

And it conveys gravity.

Even the Earth distorts the space around it.

Now look at the moon.

According to these ideas, the moon is kept in orbit. That's because the Moon rolls along the curved environmental valley that the Sun, Moon, and Earth create by their existence.

View this in full frame.

The Earth itself is kept in orbit as it rolls along the valley in an environment curved by the presence of the Sun.

That's this new idea of ​​how gravity really works.

Now, this idea was verified by astronomical observations in 1919.

it actually works. Describe the data.

And this made Einstein famous all over the world.

That's what made Kaluza think.

Like Einstein, he sought a so-called unified theory.

This is, as it were, one theory, one idea, one principle, one master equation that might explain all the forces of nature.

There Kaluza soliloquized that Einstein was able to explain gravity in terms of the distortions and curves of space, or more precisely, space and time.

Perhaps we could play the same game with another known force, then known as the electromagnetic force. We know other powers today, but that was the only other power people thought back then.

As you know, it is the force that causes things like electricity and magnetic attraction.

Karza says that perhaps I could play the same game and explain the electromagnetic force in terms of warps and curves.

That's when the question arose. What causes warping and bending?

Einstein had already run out of space and time, distortions and curves to explain gravity.

Nothing else seemed to warp or bend.

So Kaluza said, well, there may be more dimensions in the universe.

He said that if we wanted to account for another force, we might need another dimension.

So he imagined that the world had four dimensions of space instead of three, and that electromagnetism was the distortions and curves of that fourth dimension. Now, here's the problem. When he wrote down the equations describing the distortions and curves of the universe, which has four spatial dimensions instead of three, he found an old equation that Einstein had already derived in three dimensions. It was about gravity, but with one more dimension, we found another equation.

And when he saw the equation, it was nothing but the equation that scientists have known for a long time to describe the electromagnetic force.

It's amazing, I jumped out.

He was so excited by this realization that he ran around the house shouting "Victory!" --He discovered a unified theory.

It is now clear that Kaluza was a man who took theory very seriously.

In fact, the story goes that he -- when he wanted to learn how to swim, read books and articles on swimming -- (laughter) -- and then jumped into the ocean.

This man is a man who puts his life on the line.

Now, however, for those of us with a little more down-to-earth thinking, his observations immediately raise two questions.

Part 1: If there were more dimensions in the universe, where would they be?

It seems invisible to us.

And two, when we try to apply this theory to the world around us, does it really work in detail?

Well, the first question was answered in 1926 by a researcher named Oskar Klein.

He suggested that there may be two kinds of dimensions. Some dimensions may be large and easy to see, but there may also be small, curled dimensions that are all around us but are too small to be seen.

Let me show you it visually.

So imagine you are looking at something like a cable supporting a traffic light.

Located in Manhattan. You're in Central Park, but that's kind of irrelevant. However, even though cables look one-dimensional from a distance, you and I both know that cables have a certain thickness to them.

However, it is very difficult to see from a distance.

But if you zoom in and take the perspective of, say, a small ant walking around, the small ant is so small that it has access to all dimensions. You can access not only long dimensions, but also clockwise and counterclockwise directions.

And I hope you understand this.

It took a very long time to get these ants to do this.

(Laughter) But this points to the fact that there are two kinds of dimensions: large and small. And perhaps the larger dimensions around us are the ones we can easily see, but the idea is that there may be additional dimensions, such as the circular section of a cable, that are so small that they remain invisible so far.

Let me show you what it looks like.

So, for example, if we look at the universe itself, of course we can only see two dimensions on the screen.

Some will fix it one day, but anything that isn't flat on the screen is a new dimension, getting smaller and smaller and smaller, going far below the microscopic depths of the universe itself. Here's the idea. You can also add additional rounded dimensions. This is the shape of a small circle, but it is so small that we cannot see it.

But if you were a roaming little microscopic ant, you could not only walk in the large dimensions that we all know, like grids, but you could also access tiny curled up dimensions so small that the naked eye and even the most sophisticated instruments could not see them.

But deeply embedded in the fabric of the universe itself, the idea is that there may be more dimensions, as we see there.

Now we have an explanation for how the universe can have more dimensions than what we see.

But what about the second question I asked? When you try to apply that theory to the real world, does it actually work?

Well, Einstein, Caruza, and many others tried to refine this framework and apply it to the physics of the universe as it was understood at the time, but it didn't work in detail.

For example, in detail, the theory failed to correctly calculate the mass of the electron.

So many people worked on it, but this strange but very compelling idea of ​​how to unify the laws of physics was gone by the 40's and certainly by the 50's.

Until something wonderful happens in our time.

In our time, a new approach to unifying the laws of physics is being pursued by physicists like me and many around the world, and it is called string theory, as you pointed out.

And the wonderful thing is that while string theory has seemingly nothing to do with this idea of ​​extra dimensions, a study of string theory finds that the idea has been revived in a brilliant new way.

Let's talk about that.

Superstring theory -- what is it?

It is a theory that attempts to answer the question: What are the fundamental, fundamental, indivisible, incuttable building blocks that make up everything in the world around us?

The way of thinking is like this.

So imagine looking at an object we are familiar with, a candle in a holder, and wanting to know what it is made of.

So we travel deep into the object and examine its constituent parts.

So deep down – we all know that if you go deep enough there is an atom.

We also all know that the atom is not the end of the story.

They have tiny electrons clustered around a central nucleus along with neutrons and protons.

Even neutrons and protons have tiny particles inside them known as quarks.

This is where the traditional way of thinking stops.

This is a new idea in string theory.

Deep within these particles is something else.

Something else is this dancing filament of energy.

It looks like a vibrating string. That's where the idea of ​​string theory comes from.

And just as the vibrating strings of the cello vibrate in different patterns, so does the cello.

It does not generate different notes.

Rather, they generate different particles that make up the world around us.

So if these ideas are correct, the hyperfine landscape of the universe would look like this:

It consists of a huge number of tiny little filaments of vibrational energy vibrating at different frequencies.

Different frequencies produce different particles.

Various particles are responsible for all the richness of the world around us.

And there we find unity. Because matter particles, electrons and quarks, radiation particles, photons, and gravitons are all built from one entity.

So all the forces of matter and nature are brought together under the vibrating string rubric.

That is the meaning of unified theory.

There is a catch here.

If you study the mathematics of string theory, you'll find that space doesn't work in a universe with only three dimensions.

It doesn't work in a universe where space is 4, 5, or 6 dimensions.

Finally, we can study the equation to show that it only works in a universe with 10 dimensions of space and 1 dimension of time.

It brings us directly back to this idea of ​​Kaluza and Klein. That is, our world, properly explained, has more dimensions than what we see.

Now, you might think about it and say, "Well, okay, if you had the extra dimensions and it curled up really tightly, yeah, if it was small enough, we probably wouldn't be able to see it."

But there are tiny little civilizations of green people roaming there, and if you make them small enough, we won't be able to see them either. That's true.

One of String Theory's Other Predictions -- No, it's not one of String Theory's other predictions.

(Laughter.) But that begs the question: are we just trying to hide these extra dimensions, or are they telling us something about the world?

In the remaining time, I would like to tell you about two of its features.

First, many of us believe that these extra dimensions hold answers to perhaps the deepest questions in theoretical physics, theoretical science.

And the question is: Looking around the world, there seem to be about 20 numbers that accurately describe our universe, just as scientists have done for the past 100 years.

These are numbers such as the mass of particles such as electrons and quarks, the strength of gravity, the strength of the electromagnetic force, etc. A list of about twenty numbers measured with incredible precision, but no one can explain why they have such specific values.

Now, can string theory provide the answer?

not yet.

However, we believe that the answer to why these numbers have such values ​​may depend on the form of the additional dimension.

And the cool thing is that if these numbers were anything other than the known numbers, the universe as we know it wouldn't exist.

This is a deep question.

Why are these numbers so finely tuned for stars to shine and planets to form? If you mess around with these numbers, here are 20 dials, and if you mess with those numbers, you know that almost any mess will make the universe disappear.

So can you explain these 20 numbers?

And string theory suggests that these 20 numbers are related to the extra dimension.

Here's how.

So when we talk about the extra dimension in string theory, it's not one extra dimension like the old thinking of Kalza and Klein.

This is what string theory says about extra dimensions.

They have very rich and intertwined geometric shapes.

This is an example of what is known as a Calabi Yau shape. Name is not so important.

But as you can see, the extra dimensions fold and intertwine into very interesting shapes, interesting structures.

And if this is what extra dimensions look like, the idea is that the microscopic landscape of the universe around us would look like this at the tiniest scale.

When we wave our hands, we move around these extra dimensions many times, but they are so small that we do not know them.

So what is the physical meaning associated with these 20 numbers?

Consider this. If you look at the instrument, the French horn, you will notice that the vibration of the airflow is affected by the shape of the instrument.

Now, in string theory, all numbers reflect the way a string vibrates.

So, just as air currents are affected by the twisting and rotation of an instrument, the string itself is also affected by the vibration pattern of the shape in which it is moving.

So let's introduce some strings into the story.

And if you're watching these little fellows vibrating -- they're right there -- right there, be aware that the way they vibrate is affected by extra-dimensional geometry.

So if you know exactly what the additional dimensions are, which I don't know yet, if you know them, you should be able to calculate the allowed notes, the allowed vibration patterns.

And if you can calculate the allowable vibration pattern, you should be able to calculate those 20 numbers.

And if the answers we get from our calculations match the numerical values ​​determined through detailed and precise experiments, then in many ways this will be the first fundamental explanation for why the universe is structured the way it is.

Now, the second and final question I want to address is how can we test these additional dimensions more directly?

Is this just an interesting mathematical construct that might explain some hitherto unexplained features of the world, or could these additional dimensions really be tested?

And we think, which we think is very interesting, in the next five years or so, we might be able to test the existence of these extra dimensions.

Here's what it looks like: At CERN in Geneva, Switzerland, a machine called the Large Hadron Collider is being built.

This is a machine that sends particles in opposite directions around a tunnel at near-light speed.

In some cases, these particles are directed at each other, resulting in head-on collisions.

There is an expectation that if there is enough energy in the collision, some of the debris from the collision could be ejected from our dimension and forced into other dimensions.

How can we know that?

Well, if you measure the amount of energy after the collision and compare it to the amount of energy before, if the energy after the collision is less than before, this is evidence of energy drift.

And if it drifts in the correct pattern that we can calculate, this is evidence that the extra dimension is there.

Let's illustrate the idea visually.

So imagine that there is a particular kind of particle called a graviton. If the extra dimension were real, it would be the kind of debris you would expect it to emit.

But here's the experiment.

You receive these particles. you slam them together.

Collide them, and if we're right, some of the energy of that collision will become debris and fly off into these extra dimensions.

So this is the kind of experiment we'll be looking at in the next five, seven, ten years or so.

And if this experiment comes to fruition, seeing that kind of particles emitted as we notice that the energy in our dimension is less than it was at the beginning will show that the extra dimension is real.

And for me, this is a really amazing story and a great opportunity. Returning to Newton with absolute space offered nothing but the arena, the arena where cosmic events take place.

Einstein came along and said that space and time can be distorted and curved, and that is gravity.

And now string theory has come along and claimed that yes, gravity, quantum mechanics, and electromagnetism are all rolled into one package, but only if the universe has more dimensions than we see.

And this is an experiment that we may try them in our lifetime.

amazing possibilities.

thank you very much.

(applause)

We have historical records that allow us to know how the ancient Greeks dressed, how they lived, how they fought...

But what do they think?

One of the natural ways of thinking is that the deepest aspects of human thought - the ability to imagine, to be conscious, to dream - are always the same.

Another possibility is that the social transformations that have shaped our culture may have also changed the structural pillars of human thought.

Everyone may have different opinions on this.

In fact, this is a longstanding philosophical debate.

But is this question scientifically acceptable?

Here I would like to propose that the characters of culture are archaeological records, fossils of human thought, in the same way that ancient Greek cities can be reconstructed on the basis of a few bricks.

In fact, Julian Jaynes did some form of psychoanalysis on some of the oldest books in human culture and came up with some very wild and radical hypotheses in the 70s. That is, just 3,000 years ago, mankind had what we today call schizophrenia.

And he bases this claim on the fact that the first humans described in these books, in various traditions and places in the world, acted consistently as if they heard and followed voices they recognized as coming from God or the Muses...

What we call hallucinations today.

And over time, they began to realize that they were the creators and owners of these inner voices.

And with this they acquired introspection, the ability to think about their own thoughts.

Jaynes' theory, then, is that, at least in our perception today, consciousness in which we feel we are pilots of our own existence is a very recent cultural development.

While this theory is very nice, it has the obvious problem of being built on a small number of very specific examples.

Therefore, the question is whether it is possible to quantitatively and objectively verify introspection theories that have been accumulated over the history of humankind only about 3,000 years ago.

And the question of what to do with this is very obvious.

It's not like Plato woke up one day and wrote, ``Hello, I'm Plato.

(Laughter) And this really tells us what the real problem is.

We need to find the emergence of concepts that are never spoken of.

The word introspection never appears in the books we want to analyze.

So our way of solving this is to build a space of words.

This is a huge space containing all words, and the distance between words indicates their relatedness.

For example, the words "dog" and "cat" are very close together, but the words "grapefruit" and "logarithm" are very far apart.

And this applies to any two words within a space.

And there are many different ways to construct the space of words.

One is to ask an expert, much like you would look up a dictionary.

Another possibility is to follow the simple assumption that when two words are related, they tend to appear in the same sentence, paragraph, or document more often than would be expected by mere chance.

And this simple hypothesis, this simple method, with some computational tricks involved in the fact that this is a very complex, high-dimensional space, turned out to be very effective.

To give you an idea of ​​how well this works, here's what you get when you analyze it for a few well-known words.

And we first see that words are automatically organized into semantic neighborhoods.

So you get fruits, body parts, computer parts, scientific terms, etc.

The algorithm also identifies a hierarchical organization of concepts.

For example, you can see that scientific terms fall into two subcategories: astronomical terms and physical terms.

And there are some very nice ones.

The word "astronomy," for example, seems a little strange to be there, but it really sits exactly where it should be, between what is the actual science and the astronomical terminology it describes.

You can keep doing this endlessly.

In fact, if you stare at this for a while and try to build a random trajectory, you'll find that it actually feels like you're writing poetry.

Because walking in this space is, in a way, like walking in your mind.

And finally, the algorithm can also identify what our intuition is and which words should lead to neighborhoods of introspection.

For example, words like “self,” “guilt,” “reason,” and “feelings” are very close to “introspection,” while other words such as “red,” “football,” “candles,” and “bananas” are very distant.

And once that space is constructed, the question of the history of introspection, or the history of any concept that previously seemed abstract and vague, becomes tangible and amenable to quantitative science.

All we have to do is pick up a book, digitize it, capture this stream of words as a trajectory, and project it into space. And I ask if this trajectory spends a significant amount of time revolving around the concept of introspection.

This has allowed us to analyze the history of introspection in the ancient Greek tradition. We have the best available documentation of this.

So what we did was just take all the books and put them in chronological order. Take a word by book, project it into space, then for each word ask how close it is to introspection and just average it.

And we ask, are these books getting closer and closer to the concept of introspection as time goes on?

And this is exactly what happens in the ancient Greek tradition.

Thus, for the oldest books in the Homeric tradition, we see a slight increase as the books approach introspection.

Around the 4th century BC, however, this trend began to increase very rapidly, with the number of books increasing almost five-fold, and increasingly approaching the concept of introspection.

And one of the nice things about this is that you can ask if this applies to another independent tradition as well.

So I ran the same analysis for the Judeo-Christian traditions and got pretty much the same pattern.

Again, there is a slight increase in the oldest books of the Old Testament, followed by an even more rapid increase in the newer books of the New Testament.

And about four centuries after Christ, the peak of introspection comes with the Confessions of St. Augustine.

And this was very important. St. Augustine was recognized by scholars, philologists and historians as one of the founders of introspection.

In fact, some believe him to be the father of modern psychology.

Therefore, with the advantage of being quantitative and objective, and of course being extremely fast, our algorithm runs in a matter of seconds and is able to capture some of the most important conclusions of this long traditional investigation.

And, in a way, this is one of the beauties of science, that we can now translate this idea and generalize it to different domains.

So, just as we asked about the past of human consciousness, perhaps the most challenging question we can ask ourselves is whether this tells us anything about the future of our own consciousness.

More precisely, if the words we say today tell us what our minds will be like in the days, months, and years ahead.

And just as many of us now wear sensors that detect our heart rate, respiration, and genes in hopes of helping prevent disease, we can ask if monitoring and analyzing the words we speak, tweet, email, and write can let us know in advance if something might go wrong with our minds.

And along with my brother Guillermo Cecchi on this adventure, we have taken on this task.

And we did that by analyzing audio recordings of 34 young people at high risk of developing schizophrenia.

So what we did is we measured the speech on the first day and then asked if the speech characteristics predicted future onset of psychosis within a period of almost three years.

But despite our hopes, there was failure after failure.

Semantics did not have enough information to predict future organization of the mind.

It was good enough to distinguish a group of schizophrenic patients from a control group, a bit like what they did for ancient texts, but it failed to predict future psychosis development.

But I realized that perhaps the most important thing is not what they say, but how they say it.

More specifically, the question was not what semantic neighborhood the words were in, but how far and how quickly they jumped from one semantic neighborhood to another.

So we came up with this measure, which we call semantic consistency. It basically measures the persistence of speech within one semantic topic and within one semantic category.

And for this group of 34 people, it turns out that an algorithm based on semantic consistency can predict who will develop psychosis and who won't with 100% accuracy.

And this was not even close to being achieved by all other existing clinical measures.

And I remember it vividly. While working on this, I was sitting at my computer and saw a ton of tweets by Polo. Polo was my first student back in Buenos Aires and at the time he was living in New York.

And there was something about this tweet -- I didn't know exactly because it didn't say anything explicitly -- but I had this strong hunch, this strong intuition, that something was wrong.

So I picked up the phone and called Polo, who was actually not feeling well.

And this simple fact, reading between the lines, I could feel his feelings through the words, was a simple but very effective way of helping.

What I want to share with you today is that we are getting closer to understanding how to translate this intuition that we all have, that we all share, into an algorithm.

In doing so, we may in the future see an entirely different form of mental health based on objective, quantitative and automated analysis of the words we write and speak.

thank you.

(applause)

Between your chest and abdomen is probably one of the most important muscles you didn't know you had: the lower esophageal sphincter (LES).

When functioning properly, this circle of tissue plays an important role in helping us eat.

But when the LES malfunctions, it becomes the protagonist of heartburn, a searing, sometimes sour-tasting chest cramp that many people experience at some point in their lives.

We know that humans have battled heartburn for hundreds, if not thousands of years.

However, in recent years the incidence has increased and it has become a common stomach upset worldwide.

Gastroesophageal reflux disease (GERD) is diagnosed when heartburn symptoms become more regular and intense (e.g. more than twice a week).

But what causes this problem and how can I stop it?

Heartburn begins in an area called the gastroesophageal junction, where the LES resides.

This smooth, muscular ring of the LES is regulated by a complex nerve root tree that connects the brain, heart, and lungs.

After food enters the stomach through the esophagus, the muscle's job is to stop the food from being pushed up again.

The LES contracts and compresses the entrance to the stomach, creating a high-pressure zone that prevents leaching of digestive acids.

But if the LES loosens or weakens over time, it will act like a defective, ill-fitting lid, depressurizing the area.

As a result, burned stomach acid and even bolus of food can erupt into the esophagus and, in some cases, into the mouth.

Diet has long been blamed for this internal drama.

Foods such as caffeine and peppermint contain ingredients that have a relaxing effect on the LES and can reduce its function.

Other acidic foods, such as citrus fruits and tomatoes, can leach out with stomach acid and exacerbate esophageal inflammation.

Carbonated drinks can similarly bubble in the stomach and force the valve open.

But researchers have found that food isn't the only trigger.

Smoking poses a risk because the nicotine in cigarettes relaxes the LES.

Consuming excessive amounts of alcohol can have similar effects.

Pregnant women often experience heartburn due to the pressure on their growing baby's belly.

and levels of certain hormones in the body.

Obesity can cause hernias that destroy the anti-reflux barrier at the gastroesophageal junction that normally prevents heartburn.

Many medications such as asthma, hypertension, birth control, and depression can also have unintended effects on LES.

Occasional heartburn is not necessarily a cause for concern.

However, when heartburn starts to occur regularly, the heartburn muscles can weaken over time and allow more acid to escape.

And if it's not treated, it can cause bigger problems.

Over time, the constant acid leak from heartburn causes scar tissue to form, narrowing the esophageal tube and making it difficult to swallow food.

Continued reflux can also damage the cells lining the esophagus, a rare condition called Barrett's esophagus, which can increase the risk of esophageal cancer.

Fortunately, heartburn can often be treated with various medications that help neutralize or reduce stomach acid.

In extreme cases, some people have surgery to tighten the LES to minimize pain.

But often you can stop heartburn before it gets there.

Reducing your intake of certain foods, quitting smoking, and maintaining a healthy weight can all reduce reflux dramatically.

With proper care, the chemical springs in your stomach will be in good condition and you won't have to feel the burn.

I consider it my life's mission to communicate the urgency of climate change through my work.

I traveled north to the North Pole to capture the evolution of polar melting and south to the equator to document subsequent sea level rise.

Most recently, I visited the icy coast of Greenland and the low-lying islands of the Maldives. They connect two seemingly disparate but equally endangered regions of the globe.

My paintings explore moments of landscape transition, upheaval, and stillness, allowing the viewer to emotionally connect with places they may never have the chance to visit.

I chose to convey beauty rather than devastation.

Once you experience the sublime nature of these landscapes, perhaps you too will want to protect and preserve them.

According to behavioral psychology, we act and make decisions based more on our emotions than anything else.

And research shows that art influences our emotions more effectively than scary news reports.

Experts predict an ice-free Arctic summer as early as 2020.

And sea levels could rise 2 to 10 feet by the end of the century.

I have dedicated my career to uncovering these projections in an accessible medium that moves us in ways that statistics cannot.

My process begins by visiting places that are on the front lines of climate change.

We take thousands of photos on site.

Back in the studio, I create very large compositions, sometimes over 10 feet wide, from both memories and photographs of that experience.

I draw with soft pastels that are dry like charcoal but still give off color.

I consider my work to be painting, but others call it painting.

But I cringe when people call me a "finger painter."

(Laughs) But I never used any tools and always used my fingers and palms to manipulate pigments on paper.

Painting for me is a form of meditation.

It calms my mind.

I do not perceive what I am drawing as ice or water.

Instead, the image is stripped down to its most basic form of color and shape.

When the work is completed, the whole composition can finally be experienced as an iceberg floating in glassy water or a wave with rising bubbles.

As you can see, a piece of this size takes about 10 seconds on average.

(Laughter) (Applause) Really, something of this scale would take about 200 or 250 hours.

But actually, I've been drawing ever since I could hold crayons.

My mother was an artist, and since I was a child my house was full of art supplies.

My mother's love of photography drove her to the most remote regions of the planet. And my family and I were fortunate enough to participate in these adventures and support my mother.

We rode camels in North Africa and dog sled near the North Pole.

In August 2012, I led my first expedition, a group of artists and academics to the northwest coast of Greenland.

Originally, my mother was supposed to lead the trip.

She and I were in the early stages of planning because we were going to go together, but then she died of a brain tumor.

The cancer quickly took its toll on her body and mind, and she died six months later.

But during the months of her illness, her devotion to the expedition never wavered, and I promised to carry out her final journey.

My mother's passion for the North Pole resonated with my experience in Greenland, and the strength and ephemerality of the landscape.

The sheer size of the iceberg is overwhelming.

The ice fields come to life with movement and sound in ways I never expected.

I've scaled up the work to give you the same awe that I experienced.

But while the magnificence of ice is evident, so is its fragility.

From the boat I could see the ice sweating under the unseasonably warm sun.

We have had the opportunity to visit many of Greenland's Inuit communities who are currently facing great challenges.

Locals told me about vast areas of sea ice that weren't frozen like they used to be.

And without ice, their hunting and harvesting grounds are greatly reduced, threatening their way of life and survival.

The melting of Greenland's glaciers is one of the biggest contributors to rising sea levels and is already submerging some of the world's lowest islands.

A year after my trip to Greenland, I visited Maldives, the lowest and flattest country in the whole world.

While there, I gathered images and inspiration for a new body of work. It's a picture of waves crashing on the shores of a country that could be completely submerged within this century.

Catastrophic events occur every day, both on a global scale and on a personal scale.

While in Greenland, I scattered my mother's ashes in the melting ice.

Now she remains part of the landscape she loved, but it too has passed and taken on a new shape.

Among the many gifts my mother gave me was the ability to focus on the positive rather than the negative.

My paintings celebrate the beauty of what we are all likely to lose.

It is my hope that they will serve as a record of the changing landscape of the sublime, documenting its transformation and inspiring our international community to take action for the future.

thank you.

(applause)

what do you see?

Most people look at barbershops, but I see a chance. A chance for health, a chance for health equity.

For black men, the barber shop is more than just a place to get a haircut and a beard.

No, it's more than that.

Historically, barbershops have been safe havens for black men.

It's a place we come to for friendship, solidarity, and solace.

It's where we go to escape the stress of busy work and sometimes home life.

A place where you don't have to worry about how the outside world sees you.

It is a place where we do not feel threatened or threatened.

It's a place of loyalty and trust.

So this is one of the few places where we can be ourselves and just talk without fear.

Conversation, shop talk, conversation, that's the nature of the Black Barbershop.

I remember going to the barber shop with my dad when I was a kid.

We went to Mike's barbershop every other Saturday.

And like clockwork, the same group of men were there every time we went, waiting for their favorite barber or just soaking up the atmosphere.

I remember the cheery greetings that warmly welcomed us each time we went.

"Hi, pastor," they said to my father.

He was a local pastor and they treated him like a celebrity.

"Hey young man, how are you?"

They told me so and made me feel just as special.

I remember that the range of conversation was very wide.

The guys talked about politics, sports, music, world news, national news, neighborhood news.

There were talks about women and what it's like to be a black man in America.

But often they also talked about health.

The conversation about health was long and deep.

Men often spoke of doctors' recommendations to reduce salt in their diets, cut down on fried foods, quit smoking, and reduce stress.

They talked about different ways they can reduce stress, such as simplifying their love life. (Laughter) All the ways to treat high blood pressure.

High blood pressure is often talked about in barbershops.

That's because nearly 40 percent of black men have the disease.

This means that nearly every black man has or knows a black man who has high blood pressure.

Barbershop conversations can be about what happens when high blood pressure is not treated properly.

"Hey, did you hear about Jimmy? He had a stroke."

"Have you heard of Eddie? He passed away last week.

Massive heart attack.

he was fifty years old. ”

Despite decades of medical wisdom and science demonstrating that hypertension deaths can be prevented with timely diagnosis and appropriate treatment, hypertension kills more black men than any other disease.

So why does hypertension have such a different fatality rate for black men?

Because hypertension in black men is too often untreated or undertreated, in part due to low engagement with the primary health care system.

Black men, especially those with high blood pressure, are less likely than other groups to have a primary care physician.

but why?

Early research into black men's health revealed that for many people, the doctor's office was associated with fear, mistrust, disrespect, and unnecessary discomfort.

A hospital is a place to go when you are sick.

And when you actually go, you might wait for hours just to listen and be evaluated by a stoic person in a white coat. The person is only given 10 minutes and doesn't care about the story.

So it's no wonder men who don't want the hassle skip going to the doctor at all, especially if they're in good shape.

But here's the problem.

You can feel fine while high blood pressure damages your most vital organs.

This is Denny Mo, owner of Denny Mo's Superstar Barbershop in Harlem.

I have been fortunate enough to have Denny as my barber for the last eight years.

He said to me once, "Hey doctor, a lot of black men trust barbers more than doctors."

This surprised me at first, but it's not so much when you think about it.

Black men average about eight years with my current barber as I have with Denny.

And black men go to barbershops about every two weeks.

Not only do you trust your barber about your appearance and style, but you also trust your secrets and sometimes your life.

Like many barbers, Denny is more than just an artist, businessman, and best friend.

He is a leader and a passionate advocate for the well-being of his community.

When I first walked into Denny Moe's shop, he wasn't just cutting his hair.

He also organized voter registration campaigns to give customers and communities a voice.

With this type of activity and the investment in the community represented by black barbershops, it goes without saying that barbershops are a great place to discuss high blood pressure and other health issues in the community.

First, barbershops aren't medical settings, so they don't have all the psychological negativity that comes with them.

When you're at the barbershop, you're within your territory, among friends who share your history, your struggles, and your health risks.

Second, a barbershop is a place of connection, loyalty, and trust, so it's a place where you can have more open conversations about health, especially high blood pressure.

After all, conversations about high blood pressure have all the ingredients of a great shoptalk: stress and high blood pressure, food and high blood pressure, relationships and high blood pressure, and what it's like to be a black man in America and high blood pressure.

But we don't just talk about high blood pressure at the barbershop.

concrete action can be taken.

Here, we have the opportunity to partner with Denny's Morse around the world to help communities address the health inequalities that impact them uniquely.

When hypertension screening expanded from clinics and hospitals into the community in the 1960s and 1970s, black physicians like Dr. Eli Sanders of Baltimore and Dr. Keith Ferdinand of New Orleans were at the forefront of bringing health promotion to community hubs in urban black neighborhoods.

These pioneers paved the way for my professional journey in barbershops and medicine that began during my medical school years in Chicago.

The first research project I worked on as a medical student was to help design medical interventions that would appeal to black men.

We conducted about a dozen focus groups with a wide range of black men. They found that being healthy for them was as much about feeling healthy as it was being perceived as healthy, and that feeling good was closely related to looking good.

This effort led to the development of Project Brotherhood, a community clinic founded by Dr. Eric Whittaker to provide personalized healthcare for black men.

Part of this bespoke care included having barbers on site, offering free haircuts to men who came in for needed medical care, and letting them know that we care about how they look and feel, and that what's important to them is important to us.

But while there's only one Project Brotherhood, there are thousands of Black barbershops that can pioneer the intersection of wellness and haircuts.

The next stop on my trip was Dallas, Texas. There we learned that barbers can not only be active participants in providing necessary medical services to improve the health of their customers and communities, but they can also be active participants.

We worked with an amazing executive of black barbers to teach them how to measure blood pressure, counsel clients, and refer them to doctors who can help manage high blood pressure.

The barber was not only happy to do it, he was very good at it.

Barber measured blood pressure on thousands of people over three years, resulting in hundreds of black men being referred to doctors for treatment of high blood pressure.

These barber-physician partnerships resulted in a 20% increase in the number of men achieving target blood pressure levels and an average blood pressure reduction of 3 points for each participant.

If this 3-point reduction were applied to all hypertensive black men in the United States, it would prevent 800 heart attacks, 500 strokes, and 900 deaths from hypertension in just one year.

And our experience at the barbershop is no different in New York City, where my journey currently leads me.

An amazing team of diverse research assistants, community health workers, and volunteers has allowed us to partner with over 200 barbershops and other trusted community facilities to reach over 7,000 older black men.

And we have provided high blood pressure testing and counseling to each and every one of them.

Thanks to Denny Mo and countless other barbers and community leaders who shared their vision of opportunity and empowerment to make a difference in their communities, we were able to not only lower blood pressure in our participants, but also impact other health metrics.

So what do you see?

what is your barber shop

Where for you is the place where people with unique problems can find unique solutions?

If you find the place, take a chance.

thank you.

(applause)

I was a Marine with 81st Platoon, 1/1 Weapons Company, Camp Pendleton, California.

Oila!

Audience: Whoa!

(Laughter) I joined a few months after 9/11, and like most people in this country at the time, I was filled with patriotism and retribution and a desire to do something. And coupled with the fact that I'm doing nothing.

I was 17, had just graduated from high school that summer, and was living in the rented back room of my parents' house in the small town of Mishawaka in northern Indiana where I grew up.

More on that later for those who are interested -- (laughter) Mishawaka has a lot to offer, but it's not the cultural capital of the world. So my exposure to theater and film was limited to the plays and blockbuster videos I did in high school. May she rest in peace.

(Laughter) I was so serious about acting that I auditioned for Juilliard in my senior year of high school, but I didn't get in, so I decided college wasn't for me, so I didn't apply anywhere else. This was an act of genius.

I also did Hail Mary's L.A. acting journey, which I always heard about, where an actor moved to L.A. for $7 or something, found a job, and made a successful career.

I got to Amarillo, Texas before my car broke down.

I spent all my money on repairs, I finally made it to Santa Monica, not even Los Angeles, I walked around the beach for 48 hours, basically got in the car, went home, and this is how I ended my acting career, so—(laughter) Seventeen, Mishawaka...

My parents' house, paying rent, selling vacuum cleaners...

Telemarketing, mowing local 4-H fairgrounds.

This was my world until September 2001.

So, after 11 days, I feel an overwhelming sense of obligation and I'm just generally angry at myself, my parents, and the government. Lacking confidence, not having a great job, a fucking mini-fridge that I drove to and from California—I was in the Marine Corps and I loved it. I loved being a Marine.

It's one of the things I'm most proud of that I've accomplished in my life.

Firing weapons was cool, driving expensive stuff and blowing it up was awesome.

But it turns out that what I loved the Marines the most was what I wanted least when I joined: the people. These strange guys—a diverse crew of characters from different parts of the United States—but superficially had nothing in common with me.

And over time, all the political and personal bravado that led me to the military dissolved, and the Marine Corps became synonymous with friends for me.

And then, a few years into service and months into my deployment to Iraq, I dislocated my sternum in a mountain bike accident and had to be medically separated.

It may be difficult for someone who has never been in the military to understand, but it was a shock to me to be told that I would not be sent to Iraq or Afghanistan.

I have a very clear image of leaving the base hospital on a stretcher and the whole platoon waiting outside to see if I'm okay.

And suddenly I was a civilian again.

The reason I wanted to try acting again was because I thought that the civilian problems were small compared to the military. This is me

I mean, what can we really complain about now?

"It's hot.

Somebody please turn on the air conditioner. ”

"This coffee line is too long."

I was a Marine, so I knew how to survive.

I was going to go to New York and become an actor.

If it didn't work out, I was going to live in Central Park and go into the trash can behind my Panera Bread.

(Laughs) I took the Juilliard audition again, and this time I was lucky enough to pass.

But I was amazed at how complicated the transition from military to civilian was.

And I was relatively healthy. I can't imagine going through such a process with mental or physical injury.

But anyway, it was hard.

Partly because I was in acting school—I couldn't justify going to vocal and speech classes, throwing imaginary balls of energy in the back of the room, and practicing self-generating acting while my friends were serving overseas without me (laughs).

But also because I didn't know how to apply what I learned in the military to civilian situations.

That is, both practically and emotionally.

In fact I had to find a job.

And I was an Infantry Marine, I shot machine guns, I shot mortars.

There are not many places in the civilian world where these skills can be demonstrated.

(Laughter) Emotionally, I struggled to find meaning.

Everything makes sense in the military.

Everything you do is either steeped in tradition or has a practical purpose.

You can't smoke on the field because you don't want to reveal your position.

Do not touch your face. Personal health and hygiene should be maintained.

When "Colors" is played, you make this face out of respect for your predecessors.

For this reason, walk like this and talk like this.

Your uniform will stay up to the inch.

How diligently you followed these rules speaks volumes for what kind of Marine you are.

Your rank speaks to your history and the respect you earned.

There are no classes in the civilian world.

Here, you were just another body and I always felt like I had to prove my worth all over again.

And the respect that civilians gave me when I was in uniform didn't exist when I wasn't in uniform.

It didn't seem...

I felt a sense of community, and I felt this sense of community in the military.

How often in the private world have you been put in a life or death situation with your closest friends, constantly showing that they are not going to abandon you?

Meanwhile, at drama school...

(Laughter.) For the first time ever, I really discovered playwrights and characters and plays that had nothing to do with the military, but somehow explained my military experience in a way that was indescribable to me before.

And when I was able to put my emotions into words for the first time and realized how valuable a tool it was, I found myself less aggressive.

And when I look back on my time in the military, I didn't initially think about the typical training, discipline, and pain of it. Rather, it's the small, intimate moments of humanity, the moments of great emotion—friends who were penniless to see their families, friends who got divorced, grieving together, celebrating together, all set against the backdrop of the military.

I have seen my friends struggle with situations like this and I have witnessed it create anxiety in them and in me and my inability to express my feelings about it.

The military and theater communities are actually very similar.

There is a group of people trying to accomplish a mission greater than themselves. it's not about you.

You have a role and you must know your role within that team.

Every team has a leader or director. They may or may not be smart.

They are forced to become intimate with strangers in a short period of time. Self-discipline, self-maintenance.

We thought how nice it would be if we could create a space that combined these two seemingly dissimilar communities and, given their profession, could bring entertainment to a group of people who could bring their entertainment to something a little more thought-provoking than the typical compulsory and fun events they remember "voluntarily asked to go" in the military. (Laughter) All well-intentioned but slightly jarring events like 'win a date with the San Diego Chargers cheerleaders' if you answer a pop culture question correctly. You've won a date. It was a escorted walk on the parade deck with a cheerleader who was already married and pregnant -- (laughter) I don't deny cheerleaders, I love them.

The point is, how wonderful it would be if we could stage a play through characters that were relatable without being condescending.

So we started Arts in the Armed Forces, a non-profit organization, to try and get involved in these two seemingly dissimilar communities.

We choose plays, we choose monologues, from contemporary American theater, of all ages and races, just like military audiences. We gather a great group of theater-trained actors, arm them with incredible material, and keep the production values ​​as low as possible. No sets, no costumes, no lights, just reading, with an emphasis on language, showing that theater can be created in any environment.

Walking into a room with complete strangers and being reminded of humanity is so powerful, and that self-expression is as valuable a tool as a rifle on your shoulder.

And organizations like the military take pride in using acronyms for acronyms, so trying to describe the collective experience can get you lost.

And I don't think there's a better community to learn new ways to express yourself than the community that protects our country.

We have traveled all over the United States and around the world, from Walter Reed in Bethesda, Maryland, to Camp Pendleton, Camp Arifijan, Kuwait, USAG Bayern, New York's On-Broadway and Off-Broadway theaters.

And for the performers we bring, it becomes a window into a culture that otherwise wouldn't have been touched upon.

And for the military, it's exactly the same.

Doing this for the last six years always reminds me that there is a lot to be said for acting.

It's a craft, it's a political act, it's a business, it's whatever adjective applies best to you.

But it's also a service.

I couldn't finish my work, so whenever I was able to serve this ultimate service industry, the military, for me, there are not many things better than that.

thank you.

(Applause.) We're doing Marco Ramirez's "I Am Not Batman."

Jesse Perez, a great actor and a good friend of mine, will be reading, and I just met Matt Johnson a few hours ago.

It's their first time together so let's see how it goes.

Jesse Perez and Matt Johnson.

(Applause) Jesse Perez: It's midnight now and the sky is glowing madly radioactive red.

And if you squint, you might see the moon through a thick layer of cigarette smoke and airplane exhaust that blankets the entire city, like a mosquito net that keeps out angels.

(drums) And if you look up high enough, you'll see me standing on the edge of an 87-story building.

And there, a place of dead gargoyles and broken clock towers that have remained motionless for perhaps a hundred years or so, there I am.

(beats) And I'm making a fool of Batman.

(beat) And I got the Batmobile and the Batrang and the Batcave, really.

And all you need is a broom closet, a back room, or a fire escape, and Danny's hand-me-down jeans are gone.

And my navy blue polo shirt, which looks good on me, had a hole near the butt where it got caught in the chain link fence behind Arturo. But I shoved that part inside, so it wasn't a big deal.

And I feel like I've been...transformed.

(beat) And no one pulls out the belt and whips Batman for talking back.

(beats) Or because he didn't talk back.

And no one calls Batman naive or stupid or skinny.

And nobody fired Batman's brother from the Eastern Taxi Company. They were also downsizing.

Because they got nothing but respect.

And not like fear and respect, just like respect and respect.

(Laughter) Because no one is afraid of you.

Because Batman doesn't hurt anyone.

(beat) Until now. (Double time) Because all Batman really wants to do is save people and one day pay Abuela's bill and die happy.

And maybe even become really famous.

(laughter) Oh, and kill the Joker.

(drumroll) Tonight, like every night, I'm alone.

And I'm watching and waiting like an eagle, or like an eagle, no, like an eagle.

(Laughter) And my cloak flutters in the wind because it's so long, with my pointy ears, and I also have a mask that covers about half my face, and my chest contains bulletproof items so no one can hurt me.

And no one - no one! -- I'm going to step in between Batman...

and justice.

(drums) (laughter) I hear everything from where I am.

(Pauses.) Somewhere in town, there's an old lady picking up Styrofoam leftovers from a trash can and putting into her mouth someone's spitting out sesame chicken.

And somewhere, a doctor in a black lab coat with a wacky haircut is trying to find a cure for the disease that will one day really wipe us all out.

And somewhere there is a man in a janitor's uniform. Spending half my salary on a 40oz bottle of Twist-Off Beer and spending the other half coming home drunk and dizzy from visiting a woman's house on a street where all the lights are turned off by people who want to do their thing in the dark in this city for four hours.

And half a block away from the janitor man, there's a mob of ignorant bastards waiting for the janitor man with rusty bicycle chains and fake Louisville Sluggers, and if they can't find a dime, they won't find them, but they'll just keep hitting him until his arm muscles start to burn and his teeth don't fall out.

But they don't count on me.

They don't count on the Dark Knight and fill their bellies with grocery store-brand macaroni and cheese and cut wiener sausages.

(Laughter) Because they want to believe I don't exist.

From the 87th floor, one of the dorks can be heard saying, "Give me the cash!" -- really quick, "cash please!"

Then I saw the male janitor muttering something in drunken words and turning pale. From the 87th floor, you can hear his stomach about to be thrown out of Dickies.

So I swoop down, crazy fast, and I'm like, in the dark, I'm like, "Whoa!"

And I throw a batarang at that bare bulb.

(Cymbals) And they're all like, "Hey you bastard!"

Who turned off the lights earlier? ”

(laughs) "What's that over there?" "What?"

"Give me what I got, Grandpa!"

"Did anyone hear that?"

"What did you hear? Nothing. No, really—there are no bats!"

But then...

One of three useless things comes to mind.

And Number Two swings blindly at the dark cloak in front of him, but before his fist hits anything, I grab the lid of the trash can and--I'm stuck in my stomach!

And number one comes back with a flying kick, but I also know judo karate, so it goes like this - (drums) twice!

(drums) (laughter) (drums) But before I could do any more damage, suddenly we all heard a "click, click" sound.

And suddenly everything goes quiet.

And the one left with no good holds a pistol and points it straight ahead, as if holding Jesus hostage, threatening to punch a hole in the moon.

And the good-for-nothing who hit me in the head trying to give me a flying kick, and the other good-for-nothing who hit me in the gut, both hurried back from the dark figure in front of me.

And the drunk man, the janitor man, is huddled in a corner and praying to St. Anthony, because all he remembers is St. Anthony.

(Double time) And then there's me. The eyes glow white and the cape sways in the wind.

(beat) Bulletproof, my heart was pounding, my heart was beating in Morse code. "Dating only once, come on, try it."

And the man standing up for nothing, the man with the pistol – yes, he laughed.

and he lowers his arm.

And he pointed it at me to give the moon a break.

And he aimed it between my pointy ears, like a goalpost and his special team.

And the janitor man is still calling St. Anthony, but no answer.

And for a moment it seems like...

Maybe I will lose

now!

(Drums) Shoot! shoot! Fluffy!

"Don't kill me, dude!"

snap! Wrist Crack! neck! Slash!

Skin meets acid: "Ahhhhhh!"

And he's on the floor and I'm standing on him and I have a gun in my hand now and I hate guns, I hate holding guns because I'm Batman.

And Asterisk: Batman hates guns because his parents used to freeze with guns.

But for just a second, my eyes glow white and I hold on to this. Because he can speak to useless people in a language he might understand.

Click, click!

(Beat) And the good-for-nothings disappear into the fucking pits of toxic waste and chemical sludge that crawl out.

And it's just me and the man in charge.

Then I picked him up and wiped the sweat and cheap perfume from his forehead.

And as he begged me not to hurt him, I grabbed his janitor's shirt collar tightly and pulled it to my face.

And I say two words to him: "Go home."

And he does, checking the back of his shoulder every 10 feet.

Knowing where he lives, I rushed from building to building on his way there.

And as he took out the key ring and opened the door of the building, I saw his hands trembling.

And before he came through the front door, I was back in bed.

And I hear him turn on the faucet and pour a glass of warm tap water.

And he put the glass back in the sink.

and hear his footsteps.

And they slow down as they get to my room.

And he opens my door creaky, madly slowly.

And he takes a step that he never takes.

(beat) And he's staring away, that face, the color of the summer pavement.

And I pretended I just woke up and said, "Oh, what's wrong, Pop?"

And the man in charge says nothing to me.

But in the darkness, I could see his arms limp and his head facing me.

And he lifted it up because I could see his face, because I could see his eyes.

And his cheeks are dripping, but no sweat.

And he just stands there, breathing, like he remembers my eyes, like he remembers that they're glowing white, like he remembers my bulletproof chest, like he remembers that he's my pop.

And for a long time I said nothing.

Then he turned and put his hand on the doorknob.

And he's not looking at me, but I hear him muttering a few words to me. "sorry".

And I lean over and open the window just a little.

Look up high enough and you might see me.

And from where I was -- I could hear it all.

(Applause.) Thank you.

(applause)

The hero of Don Quixote rides a lean horse and charges an army of giants.

In his eyes, it is considered his duty to defeat these behemoths in the name of his beloved woman Dulcinea.

But this act of courage is poorly thought out.

They are not giants, as his squire Sancho Panza has repeatedly explained to him. They are just windmills.

Don Quixote did not flinch, but his sharp spear was soon caught in their sails.

Never discouraged, the knight stands proudly, even more convinced of his mission.

This sequence condenses many of Don Quixote's beloved things. An epic, illogical and soulful story in which Alonso Quixano becomes the clumsy but brave Don Quixote of La Mancha, known as the Knight of the Sorrowful Face.

Originally published in two volumes, the story follows Don Quixote's journey through central and northern Spain as he battles the forces of evil.

Despite Don Quixote's lofty imagination, its author, Miguel de Cervantes, could never have imagined that his book would become the all-time best-selling novel.

Apart from five years as a soldier and another five years as a pirate slave, Cervantes spent most of his life as a toiled poet and playwright.

It was not until he was in his late fifties that he published his best work, a grand satire of chivalry novels.

At this time, medieval books that documented the adventures of knights and their moral codes dominated European culture.

Although Cervantes was a fan, he was fed up with such repetitive books that focused more on enumerating heroic feats than character development.

To challenge them, he wrote Don Quixote, the story of a hidalgo, a lazy nobleman who spends his days and nights reading chivalric novels.

Enraged by these stories, he makes himself an advocate for the downtrodden.

Everyone in the village tried to persuade him to put an end to his madness, even going so far as to burn some stupid books in his personal library.

But Don Quixote cannot be stopped.

He dresses up in old shining armor, rides a skinny horse, and leaves the village in search of glory.

Cervantes' novel unfolds as a collection of episodes detailing the calamities of the brave knight.

But unlike chivalry books and perhaps all other fiction, Cervantes' story explores the hero's inner world in depth.

Don Quixote matures and undergoes noticeable changes as the story unfolds.

This literary revelation led many scholars to call Don Quixote the first modern novel.

And this character formation does not happen in isolation.

Early on, Don Quixote is joined by a villager-turned-landowner named Sancho Panza.

Sancho and Don Quixote are contrasting studies, one being the grounded realist and the other idealistic.

Their vibrant and evolving friendship, often credited as the original hero-sidekick duo, has inspired centuries of fictional partnerships.

Don Quixote was a huge success.

Numerous editions were published throughout Europe in the 17th century.

Readers were known to enjoy bootlegging even in the Americas, where the Church banned all novels as a sinful distraction.

The book was so well received that readers asked for more.

A rival writer tried to make money with a fake sequel, so Cervantes responded by releasing an official sequel.

Now published alongside the first volume as a completed text, this second volume picks up where the original left off, with only Don Quixote and Sancho becoming folk heroes.

As in the real world, Cervantes incorporated the novel's successes into the world of his characters.

This unconventional metacognition created philosophical complexity as the knight and his squire pondered the meaning of the story.

Unfortunately, Cervantes had sold the publishing rights to the book for a pittance.

He died wealthy with only fame.

But his treatises on the power of creativity and individualism have influenced art, literature, popular culture, and even political revolutions.

Don Quixote argues that our imagination can greatly influence our behavior, change us, and indeed make us human.

The majority of people who have lost a limb still perceive it not as a memory or vague form, but as a perfectly alive detail.

They can bend their phantom fingers and may feel the rubbing of a watch band or the throbbing of an ingrown toenail.

And surprisingly, even people born without limbs can experience hallucinations.

So what causes phantom limb sensations?

The accuracy of these illusions suggests that we have a physical map in our brains.

And the fact that even people without limbs can feel limbs means that we were born with at least the beginning of this map.

However, there is one difference between ghosts that appear after amputation and physical ghosts. The thing is, most of them are painful.

To fully understand phantom limbs and phantom limb pain, we need to consider the entire pathway from the limbs to the brain.

Our limbs are full of sensory neurons that are responsible for everything from feeling textures in our fingertips to understanding where our bodies are in space.

Neural pathways carry this sensory input through the spinal cord to the brain.

Since most of this pathway is outside the limb itself, most of it remains after amputation.

But losing a limb changes the way signals travel through every step of the pathway.

At the amputation site, severed nerve endings become thicker and more sensitive, and may transmit distress signals even in response to light pressure.

Under normal circumstances, these signals are suppressed in the dorsal horn of the spinal cord.

For reasons that are not fully understood, it is possible that inhibitory control of the dorsal horn is lost after amputation, resulting in enhanced signal.

As sensory signals pass through the spinal cord, they reach the brain.

There the somatosensory cortex processes them.

The entire body is mapped to this cortex.

Sensitive body parts with many nerve endings, such as the lips and hands, are represented by the largest areas.

A cortical homunculus is a model of the human body with proportions based on the size representation of each body part in the cortex. The amount of cortex assigned to a particular body part can grow or shrink based on the amount of sensory input the brain receives from that body part.

For example, violinists have greater left hand expression than non-violinists.

The brain also increases cortical representation to enhance the sense of danger warning when a part of the body is injured.

This increase in expression can lead to phantom limb pain.

Cortical maps are most likely also involved in sensing body parts that no longer exist, as they are still represented in the brain.

Over time, this representation may shrink, and with it, the phantom limb.

However, the phantom limb sensation does not always go away on its own.

Treatment of phantom limb pain usually requires a combination of physical therapy, pain management medications, prosthetics, and time.

A technique called mirror box therapy can be very helpful in increasing the range of motion of the phantom limb and reducing pain.

The patient places the phantom limb in a box behind the mirror and the intact limb in front of the mirror.

This tricks the brain into seeing the illusion rather than just feeling it.

Scientists are developing a virtual reality treatment that makes the experience of mirror box therapy even more real.

Prostheses can cause similar effects, and many patients complain of pain when removing the prosthesis, mainly at night.

And phantom limbs may help patients conceptualize and intuitively manipulate the prosthetic limb as an extension of their body.

Many questions still remain about phantom limbs.

It is not known why some amputees escape the pain associated with such phantoms, or why some have no phantoms at all.

And further research on phantom limbs doesn't just apply to people experiencing phantom limbs.

A deeper understanding of these illusions provides insight into the work our brains do every day to construct the world we perceive.

These are important reminders that the reality we experience is subjective in nature.

OK, let's start with a few.

My mother, Jenny, took this photo.

In the middle is my father, Frank.

And to his left are my sisters, Mary Catherine, Judith Ann, and Teresa Marie.

John Patrick is sitting on his lap and Kevin Michael is sitting to his right.

And Susan Diane wore a pale blue windbreaker. myself.

I loved growing up in a big family.

And one of my favorite things was choosing a name.

But by the time child number 7 came along, middle names were all but running out.

It took a long deliberation before finally deciding on Jennifer Bridget.

Parents in this audience all know the joy and excitement of naming a newborn baby.

And I was thrilled and thrilled to be able to help my mother in that special ritual moment.

But that is not the case everywhere.

I travel a lot and see a lot.

However, I was surprised to learn that in some parts of Ethiopia, parents delay naming their newborn babies by more than a month.

why are you late?

How about taking advantage of the special ceremony time?

Well, they are afraid to be late.

They are afraid their baby will die.

And this sense of loss might be a little more bearable without a name.

An unnamed face might help soften their attachment a bit.

So while we are here in one part of the world, a time full of joy and excitement and dreaming about the future of our children, in another world parents are full of fear and dare not dream beyond their precious few weeks.

How is that possible?

How is it possible that 2.6 million babies worldwide die in less than a month of life?

2.6 million.

That's the population of Vancouver.

And the shocking thing is "why?"

Too often we simply don't know.

Now, I remember the last time I saw an updated pie chart.

And the pie chart read "World's Causes of Death for Children Under 5".

And that pie chart had a fairly large section, about 40 percent labeled "newborns."

Well, "newborn" is not the cause of death.

Newborn is just an adjective, an adjective that means a child less than a month old.

For me, "newborn" said, "we don't know anything."

Now I am a scientist. I'm a doctor

I want to fix things.

But you can't fix what you can't define.

So our first step in reclaiming these parents' dreams is to answer the question, "Why do babies die?"

So today I would like to talk about a new approach. Not only does this approach help us find out why babies are dying, I feel it is beginning to completely change the entire field of global health.

It's called "Precision Public Health".

For me, precision medicine comes from a very special place.

I was trained as an oncologist, an oncologist.

I got into this job because I wanted to make people feel better.

But too many times my treatment left me feeling sick.

I still remember young women being driven to my clinic by their mothers. Adult women had to be assisted by their mothers into my examination room.

They were so debilitated by my treatment.

But at the time, on the front lines of the fight against cancer, we had little recourse.

And with the tools we had, we couldn't distinguish between cancer cells we wanted to hit hard and healthy cells we wanted to preserve.

So the side effects you are all familiar with – hair loss, upset stomachs, suppressed immune systems – the threat of infections were always around us.

Then I moved to the biotechnology industry.

This led me to work on a new approach that could better distinguish between healthy and unhealthy or cancerous cells for breast cancer patients.

The drug is Herceptin.

And with Herceptin, we were able to precisely target HER2-positive breast cancer, the most feared form of breast cancer at the time.

And its precision allows it to hit cancer cells hard while being gentler on normal cells.

Great progress.

It seemed like a miracle, and today we are leveraging tools like big data, consumer monitoring, and genetic sequencing all to tackle a range of diseases.

This makes it possible to provide individuals with the right treatment at the right time.

Precision medicine has revolutionized cancer treatment.

Everything has changed.

And I want everything to change again.

So I asked myself. Why should smarter, more accurate, better ways of dealing with disease be limited to the world of abundance?

Don't get me wrong. I'm not talking about bringing expensive drugs like Herceptin into developing countries. I would really like to.

I'm talking about going from precisely targeting individuals to addressing population-wide public health problems.

Okay, so you're probably thinking, "She's crazy."

You can't do that. That's too ambitious. ”

But the problem is, we're already doing this in a limited way, and it's already starting to make a big difference.

I will explain what is happening here.

Well, I said I was trained as an oncologist.

But like many doctors who trained in San Francisco in the '80s, I trained as an AIDS doctor.

It was a terrible time.

AIDS was a death sentence.

All my patients died.

Although things are better now, HIV/AIDS remains a terrifying global challenge.

Approximately 17 million women worldwide are living with HIV.

We know that when these women become pregnant, they can pass the virus on to their babies.

We also know that without treatment, half of those babies will not live to be two years old.

However, antiretroviral therapy has been found to virtually guarantee that mothers do not transmit the virus to their babies.

What should I do?

Well, the one-size-fits-all approach is akin to the chemotherapy blast, which means testing and treating every pregnant woman in the world.

That should be enough.

But that's not realistic.

So instead, target the regions with the highest HIV prevalence.

Certain countries in sub-Saharan Africa are known to be able to test and treat pregnant women, who have the highest infection rates.

This precise approach to public health problems has reduced mother-to-infant HIV transmission by almost half over the past five years.

(Applause.) Pregnant screening in selected areas of the developing world is a powerful example of how precision public health can make a big difference.

So...

How do we do that?

We can do it because we know it.

We know who to target, what to target, where to target and how to target.

And that, to me, is a key component of accurate public health. That is, who does what, where and how.

But let's go back to the 2.6 million infants who die in the first month of life.

Here is the problem. We don't know that.

Believe it or not, the way to figure out the causes of infant mortality in the countries with the highest infant mortality rates is to talk to mothers.

A health care worker asks a mother who has just lost a child, 'Was the baby vomiting? Did he have a fever?'

And that conversation could go on for as long as three months after the baby died.

Now let's put ourselves in the mother's shoes.

It's a heartbreaking, unbearable conversation.

Worse, knowing you had a fever or vomiting doesn't help much because you don't know why.

Without that knowledge, therefore, nothing can prevent that mother, that family, or other families in that community from suffering the same tragedy.

But what if we apply a precision public health approach?

For example, let's say that in a particular region of Africa, babies are found to be dying from a bacterial infection called group B streptococcus, which is passed from mother to baby.

Without treatment, the mother is seven times more likely to die in her next baby.

Once you define a problem, something cheap and safe like penicillin can prevent its death.

You can do it because then you will know.

That's the point. Knowing that, we can deliver the right interventions to the right people in the right places to save lives.

With this approach, and with these interventions and others like them, I have no doubt that a precise public health approach can contribute to achieving the global 2015 targets.

And that means the lives of 1 million babies are saved each year.

One million babies are born each year.

why stop there?

A much stronger approach to public health -- imagine what's possible.

Why hasn't malnutrition been tackled more effectively?

Why not prevent cervical cancer in women?

And why not end malaria?

(Applause) Yes, please clap!

(Applause) I live in two different worlds. One world is inhabited by scientists, the other is inhabited by public health professionals.

The promise of precision public health is to unite these two worlds.

But as you know, we all live in two worlds: the rich world and the poor world.

And what excites me most about precision public health is bridging those two worlds.

Every day in the affluent world brings with it incredible talent and tools—everything at our disposal—to precisely target disease in ways we could never have imagined.

Indeed, we can harness such talents and tools to stop the death of babies in our poor world.

If so, every parent would boldly dream of being able to confidently name their child the moment he or she was born, and that the child's life was measured in decades rather than days.

thank you.

(applause)

thank you very much. Good evening.

Some of you may have noticed that my last name is Nutt.

If so, you can be forgiven for wondering how Nat ended up in a war zone.

In fact, I got an offer right out of medical school and accepted a volunteer contract to work with UNICEF in war-torn Somalia. That amount was the equivalent of $1.

And, you know, I had to pay this dollar in case the UN had to issue an evacuation order.

After all, I was on my way to one of the most dangerous places in the world.

Now, some of you may be asking yourself, but rest assured, I did indeed pay half the money up front.

(Laughter) But, you know, with 50 cents in my pocket, I ended up in Baidoa, Somalia.

Journalists called it the "city of death".

And they called it the City of Death. 300,000 people died there – 300,000 mostly as a result of war-related starvation and disease.

I was part of the team tasked with figuring out how best to respond to this humanitarian catastrophe.

It was just after the Rwandan genocide, and aid funds for the region were drying up.

Unfortunately, many aid organizations have had to cease their activities.

So the question I was specifically asked to answer is one that aid workers are asking themselves in conflict zones around the world. "What are we doing now?"

As you know, the security environment in Somalia at that time did not change much, but it is best described as "Mad Max" through "A Clockwork Orange".

And I distinctly remember going to a nutrition clinic a few days after arriving.

Dozens of women stood in line, holding their babies tightly.

About 20 minutes into my conversation with this young woman, I leaned forward and tried to put my finger into her baby's palm.

And when I did this, I realized that her baby was already stiff.

She was stiff, her little lifeless hands curled up.

She had died hours earlier from malnutrition and dehydration.

I later learned that when her baby was dying, this young woman had been held for two days by several teenage boys armed with Kalashnikovs who were trying to shake her off for more money, money she clearly didn't have.

This is the scene I have faced in conflict zones around the world. A place where there are eight-year-olds, and although they are this big, they have never been to school.

However, they fought and killed with automatic weapons.

Is this the state of the world?

Some would say that war is inevitable for humans.

After all, it is as old as existence itself.

We say never again, but it happens over and over again.

But I've seen the worst of what humans can do to each other, and I still believe that a different outcome could have happened.

Want to know why?

Because after doing this job for over 20 years and traveling in and out of war zones around the world, I've come to understand that there are aspects of this issue that all of us occupying this shared space can change. We can change, not by force or coercion or aggression, but by simply considering all the options available to us and choosing the option that prioritizes peace at the expense of war rather than war at the expense of peace.

Why?

Now, think about this: there are at least 800 million small arms in circulation in the world today.

Like that little baby, the vast majority of civilians dying in conflict zones around the world are dying at the hands of various armed groups who routinely rape, threaten, intimidate, and brutalize civilians, relying on an almost endless supply of cheap, simple, and effective weapons.

how cheap is it?

In some parts of the world, you can buy an AK-47 for as little as $10.

In many places I've worked, getting an automatic rifle was easier than getting clean drinking water.

Now for the important part. Is there anything we can do about this?

To answer that question, let's take a look at this world map.

Now add the number of all countries currently at war and the number of people who died or were displaced as a result of that violence.

That number is a staggering number of over 40 million.

But you'll also notice something else about this map.

You can see that most of those countries are in the Global South.

Let's take a look at the top 20 small arms exporters in the world.

And what do we notice?

Well, you can see it in green.

It turns out that these are mainly countries of the Global North, mainly Western countries.

What does this tell us?

This shows that most of the people dying in war live in poor countries, while most of those who benefit from war, people like you and me, live in rich countries.

And what if we go a little beyond small arms?

What if we looked at all the weapons in circulation around the world?

Who has the biggest business?

Well, about 80% of those weapons come from none other than the five permanent members of the UN Security Council and Germany.

Shocking, isn't it?

Now, some of you may be saying at this point, "Oh yeah, but wait a minute... Nat."

(laughs) Elementary school was great for me.

It was a really great experience.

(Laughter.) But you might say to yourself, all these weapons in the war zone are the result, not the cause, of the violence that plagues them every day.

Places like Iraq and Afghanistan need these weapons to maintain law and order, promote peace and security, and combat terrorist groups. This is certainly a good thing.

Let's take a quick look at this assumption. We know that the small arms trade has boomed since the start of the war on terrorism.

In fact, it's a business that has tripled in size over the last 15 years.

Now compare this to the number of direct deaths in armed conflicts around the world during the same period.

What did you notice?

In fact, I've noticed that this also increased by about 3-4 times.

Basically it goes up and ends at the same point.

Now, a circular argument may be developed here as to whether this increase in deaths is a response to an increase in small arms, or vice versa.

But what do we really have to learn from this?

What we must learn from this is that the relationship is worth scrutinizing, especially given that small arms shipped to Iraq for use by the Iraqi military and small arms shipped to Syria for so-called moderate rebel fighters are now in the hands of ISIS. Or given that weapons shipped to Libya are now actively drifting through the Sahel region, eventually ending up with groups like Boko Haram, Al Qaeda and other armed groups.

And there lies the problem.

Because the first destination is rarely the last destination, small arms threaten everywhere.

Per capita war spending now stands at about $249 a year, about 12 times more than we spend on foreign aid, which goes towards educating, immunizing and fighting malnutrition for children in the global South.

But you can change that balance.

How do we do this?

Well, this is essentially both a supply and demand problem, so it can be approached from both sides.

On the supply side, governments can be encouraged to adopt international arms transparency mechanisms such as the Arms Trade Treaty. This forces rich countries to take more responsibility for where their weapons go and what they are used for.

Here in the United States, by far the world's largest arms exporter, the Arms Trade Treaty was duly signed by President Obama, but it will not enter into force and is non-binding until it is approved and ratified by the Senate.

We need to make our voices heard here.

As you know, limiting small arms does not solve the problem of war.

Enhanced control mechanisms will not solve this problem.

But this is an important step in the right direction.

And it's up to all of us in those rich countries to make a difference here.

What about the demand side?

As you know, there are generations all over the world who are losing their lives in war.

Education, strengthening the rule of law and investing in economic development, especially women, can break the cycle of violence.

I have personally seen how incredibly powerful this kind of effort is all over the world.

But the problem is that it takes time. So if you, as an individual, want to give something, by all means.

But know that how you give is just as important as how much you give.

Regular donations, like monthly donations, are a much more effective way of giving. Because it allows humanitarian organizations to properly plan and invest for the long term and, frankly, to be close to the lives of war-affected families that many of us quickly forget.

When I first boarded a plane to Somalia as a young doctor, I had no idea what it meant to live with war.

But now I can say that I know what it means.

And I know what it means to lie in bed on a pitch black night and hear that haunting "pop, pop, pop, pop, pop!"

I heard an automatic gunshot and was terrified of how many more minutes it would be before it was right above me.

This is a terrifying and painful fear, one that millions of people around the world, especially children, are forced to face every day.

I have been doing this work for many years, but unfortunately the war has killed too many people close to me.

And on at least a few occasions I almost lost my life in war.

But I strongly believe that I can make a different choice here, and that's why I'm standing up and working on what I do every day.

Because war belongs to us humans.

We buy it, we sell it, we spread it, we pay wages.

So we are not powerless to solve it.

On the contrary, only we can do it.

Thank you from the bottom of my heart. And I wish you all the best in your success.

(applause)

Eric Hershberg: So, I don't think Norman needs much introduction, but the audience at TED is global and diverse, and I'm tasked with starting with his background, which could easily take a full 18 minutes.

So instead calculate 93 years in 93 seconds or less.

(Laughter) You were born in New Hampshire.

Norman Lear: New Haven, Connecticut.

EH: New Haven, Connecticut.

(laughter) NL: We have seven seconds left.

EH: It worked.

(laughter) You were born in New Haven, Connecticut.

Your father was a crook – he was right.

He was taken to prison when you were 9 years old.

You flew 52 missions as a fighter pilot during World War II.

You're back -- NL: Radio operator.

EH: You came to Los Angeles to break into Hollywood, first in advertising and then in television.

You weren't formally trained as a writer, but you worked hard.

Your breakthrough, or debut, was a small show called "All in the Family."

What followed was Hollywood's unparalleled string of hits to this day, including "Sanford & Son," "Maud," "Good Times," "The Jeffersons," "One Day at a Time," and "Mary Hartman, Mary Hartman," to name a few.

Not only are they all commercially successful -- (Applause.) Many of them are not only commercially successful, but they're pushing our culture forward by giving underrepresented members of society prime-time first say.

There are seven shows in the top 10 at one time.

At one point, 120 million viewers were watching content per week.

That's more people than the annual Super Bowl 50.

NL: Oh my god.

(Laughter) (Applause) EH: And we haven't even gotten to that terrible part yet.

(Laughter) You ended up putting yourself on Richard Nixon's enemy list -- he had a list.

It is also a line of applause.

(Applause.) You'll be inducted into the Television Hall of Fame the first day it existed.

Then came the movies.

"Fried Green Tomatoes", "The Princess Bride", "Stand By Me", "This Is Spinal Tap".

(Applause) Again, let me give you just a few.

(Applause.) And you wipe the clean slate clean and begin your third act as a political activist focused on defending the First Amendment and the separation of church and state.

Start People For The American Way.

You buy the Declaration of Independence and give it back to people.

You will remain active in both entertainment and politics until you are a ripe old man of 93, then write a book and produce a documentary about your life story.

After all this, they finally think you're ready for a TED Talk.

(Laughter) (Applause) NL: I love being here.

And I love you for agreeing to do this.

EH: Thank you for your question. I am honored.

Now for the first question.

Was your mother proud of you?

(laughter) NL: My mother...

What a starting point!

Let me say this: when I returned from the war, she showed me a letter I had written from abroad, and it was indeed a love letter.

(Laughter.) That really sums up what my mom said.

It was a love letter as if I had written it to you – it was a love letter.

A year later, I asked my mother if I could have it. Because I want to have it for the rest of my life...

she threw them away.

(Laughter) That's my mother.

(Laughter.) The best way to summarize these days, which is also recent, was a few years ago when I started being inducted into the Hall of Fame you mentioned.

It was Sunday morning when I got a call from the operator of the Television Arts Academy. Science.

He called me to tell me they had been meeting all day yesterday and privately told me they were going to start the Hall of Fame and these are the Hall of Famers.

I started saying "Richard Nixon" because Richard Nixon -- EH: I don't think he's on their list.

NL: William Paley, who started CBS, David Sarnoff, who started NBC, Edward R. Murrow, the greatest foreign correspondent, Paddy Chayefsky - who I think is the best writer to ever come out of television - Milton Burr, Lucille Ball, and myself.

Eho: Not bad.

NL: I'll call my mom in Hartford, Connecticut right away.

"Mom, this is what happened, they're starting the Hall of Fame."

When I give her the list of names and me, she says, "Listen, if they want to do that, who can I tell?"

(Laughter) (Applause) That's my mom.

Everyone has that mother part, and I think that's what makes it such a laugh.

(Laughter) EH: And the sitcom Jewish Mother is born there.

So your father also played a big part in your life, mostly through his absence.

NL: Right.

EH: Tell me what happened when you were nine years old.

NL: He was flying to Oklahoma with three guys and my mom said, 'Don't do anything with them, I don't trust them.'

That's when I heard, maybe not the first time, "Hold your breath, Janet, I'm going."

and he went

It turned out that he had picked up fake bonds and was flying across the country to sell them.

But the fact that he was going to fly to Oklahoma and was going to bring me back a 10-gallon hat, like the Ken Maynard hat my favorite cowboy wore.

As you know, this was a few years after Lindbergh crossed the Atlantic.

I mean, it was exotic for my father to go there.

However, when he returned, he was arrested as he stepped off the plane.

That night, newspapers were plastered all over the house, and my father had a cap over his face and was being shackled by a detective.

And my mother was selling furniture because we were moving away. I didn't want to stay in that shameful state in Chelsea, Massachusetts.

And when I sold the furniture, the house was full of people.

In the meantime, a strange horse butt put his hand on my shoulder and said: "Now you are the master of this house."

As I cry, this motherfucker says, "You are the owner of the house now."

And I think that was the moment when I started to understand human stupidity.

So...

It took me years to look back and see it as an advantage.

But -- EH: Interesting to call it profit.

NL: It's an advantage in that it gives us a springboard.

I mean, how foolish it was to say to this crying nine-year-old boy, "You're the owner of the house now."

Then I was crying and he said, "And the men in the house don't cry."

And I...

(laughs) So...

Looking back, I think that's when I learned about human stupidity and used that gift to my advantage.

EH: So you have an absent father and a mother who apparently doesn't have enough?

Do you think you started your journey as a child that you might have never heard of and ended up as an adult with 120 million weekly viewers as a result?

NL: I love the way you asked that question. Because I think I've spent my life, if anything, wanting to be heard.

I think -- that's the simple answer, yes, that was the trigger -- well, there was a lot more.

When my father wasn't around, I was fiddling around with the crystal radio we made together, and I caught a signal. That was Father Coughlin.

(Laughter) Yes, someone laughed.

(Laughter) But no fun, this was a donkey on one horse, on another, yelling out about hating the New Deal and Roosevelt and the Jews.

For the first time, I understood that there are people in this world who hate me because I was born to Jewish parents.

And it made a huge impact on my life.

EH: So you had a childhood with few strong male role models, other than your grandfather.

tell me about him

NL: Oh, Grandpa.

Well, this is how I always talked about that old man.

There were many parades when I was a child.

There was a parade on Veterans Day but no Presidents Day.

We had Abraham Lincoln's birthday, George Washington's birthday, and flag day...

And there are also many small parades.

My grandfather would often take me to stand on the street corner, he would hold my hand, and when I looked up I could see tears running down his eyes.

And he was very important to me.

And he used to write an article for the President of the United States.

Each letter began with "Dear, beloved President," and the President told him something wonderful about what he had done.

But when I disagreed with the president, I also wrote, "Dear President, didn't I tell you last week...?"

(laughs) And sometimes I would run down the stairs to pick up the mail.

We were three flights up to 74 York Street, New Haven, Connecticut.

And I picked up a little white envelope and it said, "Sya C. called this address."

That's the story I told about my grandfather -- EH: They wrote the envelope back -- NL: They wrote the back.

But I've gone back to Phil Donahue and people before him and shown them what they told the story in literally dozens of interviews.

This is the second time I have said that this story was all a lie.

To tell you the truth, my grandfather took me to the parade and we paraded a lot.

The truth is that tears flowed from his eyes.

As a matter of fact, he writes to me from time to time, and I pick up the little envelope.

But all the rest of "My Darling, Mr. President" is a story borrowed by the grandfather who wrote that letter from his best friend, who is his grandfather.

So I stole Arthur Marshall's grandfather and made him mine.

everytime.

When I started writing my memoirs—“Even with this—” What do you think?

"I can experience this."

When I started writing my memoir and thinking about it, I -- I -- cried moderately and realized how much I needed my father.

So much so that I appropriated Arthur Marshall's grandfather.

As with the word "father", I have six children by the way.

Favorite role in my life.

That's my wife Lynn's husband.

But I needed my father, so I stole the man's identity.

Now I've been through a lot of terrible things and come out of the other side and I forgive my dad - the best thing for me is the worst thing for me - the word I want to use and think about him is - he was a villain.

The fact that he lied, stole, cheated and ended up in jail...

I embed it within the word "rascal".

EH: Well, there's a saying that amateurs borrow and professionals steal.

NL: I'm a pro.

EH: You're a pro.

(Laughter) And this quote, widely attributed to John Lennon, turned out to be something he stole from T.S. John Lennon. Elliott.

So you are in good company.

(laughs) EH: I'd like to talk about your work.

You've clearly written about the influence of your work, and I'm sure you've heard about it all your life. What it means to people, what it means to our culture, did you hear the applause when I named the show, you lifted half the people in the room through your work.

But are there any stories about the impact of your work that have surprised you?

NL: Oh my God, I was amazed and delighted from head to toe.

Last year there was an "Evening with Norman Lear" organized by a group of hip-hop impresarios, performers and academies.

Subtext for "Night with..."

The question was, "What do a 92-year-old Jew who was 92 at the time have in common with the world of hip-hop?"

Russell Simmons was also one of the seven on stage.

And when he talked about the show, he wasn't talking about Hollywood, George Jefferson in "The Jeffersons," or the number 5 show.

He was talking about something simple that made a big difference -- EH: Did it influence him?

NL: What it did to him -- I was hesitant about the word "change."

It's hard for me to imagine changing someone's life, but he said yes.

He saw George Jefferson write checks in "The Jeffersons," but he didn't know black people could write checks.

And he said it just affected his life, changed his life.

And when you hear things like that, it's a small thing, because I know there's no one in this audience who could not possibly have been held responsible today for the little thing they did for someone, whether it was a smile or an unexpected hello, that shows how small this event was.

It's possible that it was the dresser on set who put the checkbook on that thing, and George had nothing to do while he was talking, so maybe he wrote it, I don't know.

But -- EH: I should have mentioned that you invented hip-hop, in addition to the long list I shared at the beginning.

(Laughter) NL: Well...

EH: I'd love to talk -- NL: Well, let's try.

(laughter) EH: You've lived a fulfilling life, but you've also built a life of meaning.

And while we're all striving to achieve both, not all of us can.

But even if we could accomplish both of those things, we rarely figure out how to do them together.

Through your art, you have succeeded in advancing culture and achieving global commercial success.

How did you do both?

NL: When I hear you recite all that I have accomplished, my heart goes like this.

According to them, this planet is one of a billion planets in a universe with billions, billions of universes, billions of planets...

I'm trying to save this, but it should be saved.

but ...

As for what I might have accomplished, my sister asked me what I was doing about what was happening in Newington, Connecticut.

And I said, "Write Alderman or Mayor or something."

She said, "I'm Claire Lear, not Norman Lear."

And that was the first time I said what I wanted to say. "Clare, think of all the things you're thinking about what I might have done and what you've done."--she never left Newington--"Considering the size of the planet, etc., could you bring me close enough to measure what I did against what you might have done?"

So...

I believe we all have a responsibility to do as much as I have achieved.

And I get what you're saying -- EH: That's a clear bias -- NL: But here you really need to understand the scale and scope of the creator's business.

EH: But on this planet, you really matter.

NL: I'm the son of guns.

(laughs) EH: So I have one more question.

How old do you feel?

NL: I'm with the person you're talking to.

EH: Well, I'm feeling 93.

(Applause) NL: Get out of here?

EH: Well, I feel like I'm 93 now, but I hope one day I'll feel as young as the person sitting across from me.

Hey everyone, this is the incomparable Norman Lear.

(Applause) NL: Thank you.

(applause)

I am driven by a pure passion to create photos that tell stories.

A photograph can be described as a record of a single moment frozen within a fraction of a second.

Each moment or photo represents a tangible part of our memories over time.

But what if you could capture multiple moments in a photo?

What if photography could actually collapse time, seamlessly compressing the best moments of day and night into a single image?

I created the concept "Day to Night" and I believe it will change the way you see the world.

I know it's the same for me.

My process begins by photographing iconic places, places that are part of what I call collective memory.

I take pictures from a fixed point of view, but never move.

Capturing a moment of human and light over time.

We capture over 1,500 images over 15-30 hours and pick the best moments of the day and night.

Using time as a guide, we seamlessly blend our best moments into a single photo, visualizing our conscious journey through time.

I'll take you to Paris to see the view from the Tournelle bridge.

And I will show you the early morning rowers along the Seine.

At the same time, we can show you the glow of Notre Dame at night.

In the meantime, we will show you the romance of the City of Light.

I'm essentially a street photographer from 50 feet above and everything in this photo really happened on this day.

Day to Night is a global project and my work has always been about history.

I am fascinated by the concept of going to places like Venice and seeing it in person during certain events.

And I decided that I wanted to see the historic regata in action from 1498.

The ship and the clothes are the same as those days.

And the important factor I really want you to understand is that this is not a timelapse, I'm shooting day and night.

I am a relentless collector of magical moments.

And what drives me is the fear of missing one of them.

The whole concept was born in 1996.

LIFE magazine commissioned me to create a panorama of the cast and crew for Baz Luhrmann's film Romeo + Juliet.

When I arrived at the shooting site, I realized that it was a square.

So the only way you could actually create a panorama was to shoot a collage of 250 single images.

So I hugged DiCaprio and Claire Danes.

And when I panned the camera to the right, I realized that there was a mirror on the wall, and the mirror was actually there.

And in that moment, for that one picture, I asked them, "Will you just give me a kiss for this one picture?"

Then I went back to my studio in New York, hand-stitched these 250 images together, and stopped and thought, "Wow, this is so cool!"

I'm changing the time in the picture. ”

And that concept actually haunted me for 13 years until technology finally caught up with my dreams.

Here is a day to night image of the Santa Monica Pier that I created.

And I'll show you a little video to give you an idea of ​​what it's like to be with me as I take these pictures.

First, you have to understand that most of my time is spent at heights, usually on a cherry picker or crane to get views like this.

So this is a typical day, 12-18 hours, non-stop, capturing the evolution of an entire day.

One of the great things is that I love people-watching.

Believe me, this is the best seat in the house.

But this is how I actually create these photos.

So once you've decided on your view and location, you need to decide where the day begins and the night ends.

I call it the time vector.

Einstein described time as a fabric.

Consider the surface of a trampoline. Trampolines flex and stretch due to gravity.

I also see time as a fabric, except that I flatten that fabric and compress it into a single plane.

One of the unique aspects of this work is that the time vector changes when looking at all my photos. Sometimes left to right, sometimes front to back, up and down, even diagonally.

I explore the space-time continuum in 2D still photography.

Now when I take these pictures, it's literally like a real-time puzzle going on in my head.

I build photos based on time and call this the master plate.

It may take several months to complete.

The funny thing about this job is that you have absolutely no control over when you go there and take pictures at any given time.

So you have no idea who will be in the picture or what a great sunrise or sunset it will be. out of control.

If you've had a really great day and all things stay the same, at the end of the process, decide who's in and who's out. It's all based on time.

Seamlessly blend the best moments you've picked during your month of editing into your master plate.

I compress day and night as I see them, creating a unique harmony between these two highly discordant worlds.

Painting has always been a very important influence in all my work and I have always been a big fan of the great Hudson River School painter, Albert Bierstadt.

He inspired a recent series I did about national parks.

This is Yosemite Valley in Bierstadt.

Here is a photo of Yosemite that I made.

This is actually the cover of the January 2016 issue of National Geographic magazine.

It took over 30 hours for this photo.

I was literally on the side of a cliff, watching the stars and the moon shift, and the moonlight shining on El Capitan.

And I captured this transition of time in the whole landscape.

The best part, obviously, is seeing mankind's magical moments as the hours change from day to night.

And on a personal note, I actually had a copy of a Bierstadt painting in my pocket.

And when that sun started to rise over the valley, I literally started shivering with excitement. Because when I saw the painting, I thought, "Oh my God, I'm getting exactly the same lighting as I had in Bierstadt 100 years ago."

Day to Night is about everything, and it's like a collection of everything I love about the medium of photography.

It's about landscapes, street photography, color, architecture, perspective, scale, and especially history.

This is one of the most historic moments I was able to capture, the 2013 inauguration of Barack Obama.

If you look closely at this picture, you can actually see the time changing on the big TV.

We see Michelle waiting with the children. The President now greets the crowd, takes the oath, and now speaks to the nation.

There are many challenging aspects when making a photo like this.

To capture this photo, I took a 50ft scissor lift up into the air and it wasn't very stable.

So every time my assistant and I shifted our weight, the horizon shifted.

So for all the photos you see, about 1,800 in this one, we both had to tape our feet in place every time we clicked the shutter.

(Applause.) I've learned so many amazing things in this job.

I think the most important thing is patience and observation.

When I photograph cities like New York from above, I realize that the people in the cars I live with every day no longer look like people in cars.

They felt like a giant school of fish and it was a form of emergency action.

And I think this photo is really starting to capture that when people talk about the energy of New York.

If you look closely at my work, you can see the story going on.

You realize that Times Square is a canyon, a shadow, and a sunshine.

So I decided to capture the checkerboard time in this photo.

Therefore, wherever there is shadow, it is night, and where there is sun, it is actually day.

Time is something special that we can never understand.

But in a very unique and special way, I believe these photos will start showing up in time.

They embody new metaphysical visual realities.

Spending 15 hours looking at a place gives you a slightly different perspective than if you or I walked in with a camera, took a picture and walked away.

This was a perfect example.

I call it the Sacred Heart Selfie.

I spent more than 15 hours observing people who would not even look at the Sacré-Coeur.

They were interested in using it as a background.

They walked over, took pictures, and left.

And it turns out that this is a totally extraordinary example, and that there is a powerful disconnect between what we think the human experience is and what the human experience is evolving.

The act of sharing is suddenly more important than the experience itself.

(Applause.) And finally, my latest image that has a very special meaning to me personally. This is the Serengeti National Park in Tanzania.

And this was taken in the middle of Seronera, this is not a reserve.

I went especially during peak migrations, hoping to catch the most diverse animals possible.

Unfortunately, when we got there, a drought was occurring at the peak of migration, and it was a 5-week long drought.

So all animals were drawn to the water.

I found this watering hole and felt that if everything works the same, then I have a real chance to capture something unique.

We spent three days researching it and nothing prepared us for what we witnessed on the day of the shoot.

I spent 26 hours photographing in enclosed alligator blinds 18 feet in the air.

What I witnessed was unimaginable.

Frankly, it was biblical.

We observed for 26 hours that all these competing species shared a single resource: water.

Over the same resource, humanity will wage war over the next 50 years.

The animals didn't even moan at each other.

They seem to understand something that we humans do not.

This precious resource of water is something we all must share.

When I made this picture, I realized that Day to Night was a new way of looking at compressing time and exploring the space-time continuum within the picture.

As technology evolves with photography, photography will not only convey deeper meanings of time and memory, but will also construct new narratives of the untold and create timeless windows into our world.

thank you.

(applause)

What do the French do better than others?

If you were to take a poll, the top three answers might be "love," "wine," and "bitches."

(laughs) Maybe.

But let me make a fourth suggestion. it's math.

Did you know that Paris has more mathematicians than any other city in the world?

More streets are named after mathematicians.

And if you look at statistics for the Fields Medal, also known as the Nobel Prize of mathematics, which is always awarded to mathematicians under the age of 40, France has more Fields Medals per inhabitant than any other country.

What is it about mathematics that makes it so fascinating?

After all, it seems boring and abstract, just numbers and calculations and rules to apply.

Mathematics may be abstract, but it's not boring and it's not about computing.

It is our central activity to reason and prove.

It is imagination, the talent we admire most.

It's about finding the truth.

There's nothing quite like the feeling that comes after months of hard thinking when you finally understand the right reason to solve a problem.

The great mathematician André Weil, no joke, likened this to sexual pleasure.

But be aware that this feeling can last for hours, even days.

The reward can be great.

Hidden mathematical truths permeate our entire physical world.

They are inaccessible to our senses, but can be viewed through a mathematical lens.

Close your eyes for a moment and think about what is happening around you right now.

Invisible particles from the surrounding air hit you in billions every second, and everything is in complete chaos.

Yet their statistics can be accurately predicted by mathematical physics.

And open your eyes to the velocity statistics of these particles.

The famous bell-shaped Gaussian curve, or the law of error -- deviation from the mean.

This curve conveys the statistic of particle velocity in much the same way that the population curve conveys the statistic of an individual's age.

This is one of the most important curves ever.

It keeps recurring over and over in many theories and many experiments as a wonderful example of universality so dear to us mathematicians.

Of this curve, the famous scientist Francis Galton said, "If the Greeks had known it, this curve would have been sacred.

It is the supreme law against irrationality. ”

And there's no better way to embody that supreme goddess than with a Galton board.

Inside this board is a narrow tunnel through which small balls drop randomly right, left, left, etc.

Everything is in complete randomness and chaos.

Let's see what happens when we observe all these random trajectories together.

It's a bit of a sport, as you need to break through the (board rocking) traffic.

ah.

I think the randomness is going to trick me on stage.

there it is.

Our supreme unreasonable goddess.

A Gaussian curve is trapped inside this transparent box, like the dream in the cartoon "Sandman".

I've shown it to you guys, but I'll explain to my students why it can't be any other curve.

And this touches on the mystery of the goddess, transposing beautiful coincidences into beautiful explanations.

All science is like this.

And beautiful mathematical explanations are not just for our enjoyment.

They also change our worldview.

For example, Einstein, Perrin, and Smolkhovsky used the mathematical analysis of random orbitals and Gaussian curves to explain and prove that our world is made of atoms.

This wasn't the first time mathematics revolutionized the way we see the world.

It was already happening in the days of the ancient Greeks, over 2,000 years ago.

At the time, only a fraction of the world had been explored, and the planet may have seemed infinite.

But wise Eratosthenes was able to use mathematics to measure the Earth with an astonishing accuracy of 2 percent.

Here's another example.

In 1673, Jean Richet noticed that the pendulum was swinging slightly slower in Cayenne than in Paris.

From this observation alone and clever mathematics, Newton correctly deduced that the Earth is slightly flattened at the poles, say 0.3 percent. It's so small that you wouldn't notice it in a real Earth view.

These stories show that mathematics can make us detach the seemingly infinite earth from our intuition, see invisible atoms, and detect imperceptible changes in shape.

If there's one takeaway from this talk, it's this: Mathematics goes beyond intuition and allows us to explore areas beyond our comprehension.

Here's a modern example that you can relate to: searching the Internet.

World Wide Web, Over a Billion Web Pages -- Would you like to read them all?

Computing power helps, but it's useless without mathematical modeling to find hidden information in the data.

Solve your baby's problems.

Imagine you are in charge of a criminal case. Suppose there are many people who have their own facts.

Who would you like to interview first?

Wise Answer: Main Witness.

Let's say person number 7 tells you a story. However, when asked where it came from, he points to person number 3 as the source.

And perhaps person number 3 points to person number 1 as the primary source.

Right now, the best witness is the first witness, so I'd really like to interview him--preferably.

And from the graph, we can also see that the fourth person is the main witness.

And maybe I even want to interview him first. Because there are a lot of people who introduce him.

OK, that was easy, but what if you have a lot of people to testify?

You could think of this graph as being all the people who testify in complex criminal cases, but it might as well be web pages cross-referencing and cross-referencing content.

Which is the most authoritative?

Not so clear.

Introducing PageRank, one of Google's early foundations.

This algorithm uses the laws of mathematical randomness to automatically determine the most relevant web pages in the same way that Galton Board's experiment used randomness.

So let's send a bunch of small digital marbles to this graph and let them pass randomly through the graph.

Each time they land on a site, they follow a randomly chosen link to the next site.

And again, and again, and again.

A small, growing pile is then used to record how many times these digital marbles visit each site.

please.

Random, random.

And from time to time, let's jump in completely randomly to increase the fun.

and see this. Out of chaos, solutions emerge.

The tallest piles are somehow better connected than the others and correspond to sites that are more pointed than the others.

Here you can clearly see which web page you want to try first.

Again, the solution comes from randomness.

Of course, Google has come up with much more sophisticated algorithms since then, but this one was already beautiful.

Still, it's only a 1 in 1,000,000 problem.

With the advent of the digital field, more and more problems are amenable to mathematical analysis, making the mathematician's job even more useful, so much so that a 2009 Wall Street Journal survey of the best and worst jobs ranked mathematics number one among hundreds of jobs a few years ago.

Mathematician -- the best job in the world.

This is because it has application areas such as communication theory, information theory, game theory, compressed sensing, machine learning, graph analysis, and harmonic analysis.

And why not use stochastic processes, linear programming, and fluid simulations?

Each of these areas has huge industrial applications.

And through them, big money is born in mathematics.

And let me admit that when it comes to making money from math, Americans are undoubtedly world champions, there are smart and iconic billionaires and amazing giant corporations, all of which ultimately rely on good algorithms.

Such beauty, usefulness, and richness make mathematics even sexier.

But life as a mathematician is easy, don't you think?

It is filled with confusion, frustration, and a desperate struggle for understanding.

Let me remind you of one of the most impressive days of my mathematician life.

Or should I say one of the most impressive nights.

At the time, I was a longtime resident at the Institute for Advanced Study in Princeton. This is the home of Albert Einstein and perhaps the most sacred place for mathematics research in the world.

And that night I continued working on an unfinished and elusive proof.

It was all about understanding the paradoxical stability properties of plasma, a swarm of electrons.

In a perfect world of plasma, there would be no collisions or friction to provide stability as we are used to.

But still, if we perturb the plasma equilibrium slightly, we find that the resulting electric field spontaneously vanishes or decays, as if by some mysterious frictional force.

This paradoxical effect, called Landau damping, is one of the most important in plasma physics and was discovered through mathematical thinking.

However, a full mathematical understanding of this phenomenon was still lacking.

And together with my former student and principal collaborator Clément Mouot, who was in Paris at the time, we spent months working on such a proof.

Actually, I had already announced that I could solve it wrong.

But the truth is, the proof didn't work.

Despite over 100 pages of complex mathematical discussion, numerous discoveries, and extensive calculations, it didn't work.

And that night at Princeton, a series of argumentative gaps drove me crazy.

I put all my energy, experience and tricks into it and still nothing worked.

1am, 2am, 3am, not working.

Around 4am, I go to bed depressed.

Then a few hours later I woke up and said, "Oh, it's time to drop the kids off at school—" What is this?

I had this voice in my head, I swear.

"Take the second term to the other side and do the Fourier transform and inverse in L2."

(laughs) Damn it, that was the beginning of the solution!

You see, I thought I was resting for a while, but my brain was actually still working.

When that happens, I don't think about my career or my colleagues, I just fight the problem and myself completely.

That being said, it's not a bad thing to be rewarded for your hard work and get promoted.

And after completing a massive analysis of Landau damping, I was fortunate enough to receive the most coveted Fields Medal from the hands of the President of India on August 19, 2010 in Hyderabad. This honor was something a mathematician would never have dreamed of, and I will never forget it.

What do you think about such an opportunity?

Pride, right?

And thanks to the many collaborators who made this possible.

And because it was a collective adventure, it should be shared, not just with collaborators.

We believe everyone can experience the thrill of mathematics research and share the passionate stories of human beings and the ideas behind them.

And I have worked with the staff of the Henri Poincaré Institute, partners of mathematical communication and artists from all over the world to establish there a very special museum of mathematics of its own.

When you come to Paris in a few years, after tasting a crispy baguette and macarons, please visit the Henri Poincaré Institute and share your mathematical dream.

thank you.

(applause)

The world is full of wonderful things and rich cultural heritage.

And when we visit them, we are shocked and fall in love.

But for the most part, the world's population lives without real access to arts and culture.

What connections are made when we begin to explore the traditions, beautiful places and art of this world?

Before starting this presentation, I would like to note some housekeeping points.

First, I am not an art or culture expert.

I fell in love with this by mistake, but I love it.

Secondly, all of these things belong to the amazing museums, archives and foundations we partner with.

None of these are owned by Google.

And finally, what you see behind me is now available on your phone or laptop.

This is our current platform, allowing you to explore thousands of museums and objects at your fingertips and in extremely high-definition detail.

What is surprising is the diversity of its content.

If you only see European paintings, or only contemporary art, I think it would get a little boring.

For example, this month we launched our Black History channel with 82 curated exhibitions that speak to the arts and culture of that community.

We also have wonderful Japanese products centered on craftsmanship called "Made in Japan".

And one of my favorite exhibitions is actually the idea of ​​my talk, but I didn't expect to be a fan of Japanese dolls.

But thanks to this exhibition, I really got to know the craftsmanship behind the soul of Japanese dolls.

Believe me, it's very exciting.

believe me

Let's move on quickly.

One of the things I want to briefly mention about this platform is that you can share it with your kids and friends right now, but you can also travel virtually through all these amazing properties.

One of our recent ideas was about the Guggenheim Museum in New York, where you can feel like you are there.

You can go to the first floor. Naturally, I think most people have been there.

And you can see that it is an architectural masterpiece.

But imagine this accessibility for a child studying architecture in Bombay who has not yet had the opportunity to visit the Guggenheim Museum.

At the Guggenheim Museum, of course, you can see the works and even go inside.

There is a lot of information here.

But this is not the purpose of my talk today.

It still exists today.

What we have now in terms of art and culture, and access to art and culture, lays the groundwork for a very exciting future.

So today, my good friend Cyril Diagne, an artist residing in our Paris office and Professor of Interactive Design at the ECAL University in Lausanne, Switzerland, will take the stage.

What Cyril and our team of engineers are working on is finding these connections and visualizing some of them.

So, from now on, I will go very quickly.

This thing I see behind me -- oh, mind you, it's always better to see the real thing.

Because you might think I'm trying to duplicate the real thing.

Let's move on.

This object behind me is the Venus of Berekhat Ram.

This is one of the oldest objects in the world, discovered in the Golan Heights about 233,000 years ago and is now in the Israel Museum in Jerusalem.

It is also one of the oldest objects on the platform.

Let's zoom in.

Start with this one object.

What if we zoomed out and actually experienced our own cultural big bang?

what would that look like?

This is what we deal with on a daily basis at the Institute of Culture. To make these connections in practice, we are dealing with over 6 million cultural relics that have been carefully selected and provided to us by institutions.

We can time travel and through these we can understand more about our society.

We can look at it from our planetary perspective and try and see what it looks like without borders just by organizing art and culture.

Additionally, it can be plotted over time. As a data geek like me, this is obviously very appealing.

Every decade you can spend hours looking at the decade and its contributions to art, history and culture.

I would love to spend hours showing you every decade, but I don't have the time right now.

So you can actually do it yourself with your phone.

(Applause.) But if you don't mind, I'd appreciate it if you could wait until later to applaud so we don't run out of time. Because I want to show you a lot of wonderful things.

So let me explain very briefly. From here you can proceed to another very interesting idea.

Beyond beautiful images and great visualizations, what is this for and how does it help?

This next idea came from discussions we had with curators at museums. By the way, I fell in love with them. Because they give their lives to tell these stories.

One of the curators told me, “Amit, what if you could create a virtual curator table where you could see all these 6 million objects and see the connections between them?”

Believe me, you can spend a lot of time observing different objects and figuring out where they came from.

It's a crazy matrix experience.

(Laughter) Now let's take the world-famous Vincent van Gogh, who is well-represented on this platform.

Thanks to the diversity of our institutions, over 211 high-resolution stunning works by this artist are organized and preserved in one beautiful view.

And as it resolves and Cyril goes deeper, all self-portraits become visible and still lifes become visible.

However, I would like to mention one very timely simple example. It's a "bedroom".

It is a work that has three copies: one in the Van Gogh Museum in Amsterdam, one in the Musée d'Orsay in Paris, and one in the Art Institute of Chicago. In fact, the Art Institute of Chicago is currently hosting a physical reunion of all three works, probably for the second time in history.

But it's digitally and virtually integrated, allowing everyone to see it in a completely different perspective and not be pushed into a line in a crowd.

So let's take a quick trip through the 'bedroom' so you can experience what we do to all objects.

We want images to say as much as they can on digital platforms.

All you need is an internet connection and a computer. (Applause) And, Cyril, if you can go deeper, right now.

Sorry, this is all live, so we have to give Cyril a little bit. This works for any object, modern art, contemporary art, Renaissance art, sculpture, etc.

Sometimes I don't know what attracts me to a work of art, a museum or a cultural discovery.

For me personally, it was quite a challenge as my mother was not very supportive when I decided to make this a full-time job at Google.

I love my mother, but she thought I was wasting my life on museums.

For her, a museum is a place to go on vacation, just tick it off and you're done, right?

And it took me about four and a half years to convince my beautiful Indian mother that this was actually worth it.

And I did, but then one day I realized she loved gold.

So I started showing her all the objects that contained the material gold.

And the first thing my mother asked me was, "How can I buy this?"

(Laughter.) And obviously my salary isn't that great, so I was like, 'I can't really do that, Mom.

But you can explore them virtually. ”

So now my mother asks me every time we meet. "Do you have more gold or silver in your project? Can you show me?"

That's the idea I'm trying to explain.

It doesn't matter how you get in, as long as you get in.

Once you enter, you will become addicted.

I'm going to jump right in from here, but I actually have a little playful idea for explaining access points, and I'm going to go through it pretty quickly.

We all know that seeing a work of art in person is amazing.

But we also know that most of us can't and it's complicated for those who can afford to do it.

So -- Cyril, may I take an art trip, what do you call it?

There is no better name for this.

But essentially, there are about 1,000 great institutions in 68 countries.

But let's start with Rembrandt.

We may have time to explain just one example.

But that diversity has brought together some 500 stunning Rembrandt objects from 46 institutions in 17 countries.

Suppose you want to see them all on your next vacation.

That's your itinerary. You will probably travel 53,000 kilometers and visit 46 facilities. For reference, it could emit 10 tons of CO2 emissions.

(Laughter) But remember, this is art, so you can probably justify it in some way.

Now let's move on to something a little more technical and interesting.

All the ones shown so far use metadata to establish a connection.

But obviously, the great thing that everyone wants to talk about today is machine learning.

So we thought, let's get rid of all the metadata and see what machine learning can do based solely on visual perception of this entire collection.

What we ended up with is this very interesting map. These clusters have no reference point information, they just use visuals to cluster things.

Each cluster is itself an art of discovery for us.

But one cluster I want to show you soon is this amazing cluster of portraits I found in museums around the world.

If you could zoom in a little more, Cyril.

You can just travel portraits to show you.

And essentially, you can make nature, and you can make a lot of horses and flocks.

When we saw all these portraits we thought: “Can we do something fun for the kids, or something playful to get people interested in portraiture?”

I mean, I've never seen young kids really excited about going to a portrait gallery.

I wanted to understand something.

So we created something called Portrait Matcher.

It's pretty self-explanatory, so let's show Cyril his pretty face.

And what's essentially going on is that, as his head moves, he's collating different portraits from museums around the world.

(Applause.) I don't know about you, but I showed it to my nephew and sister and the reaction was just amazing.

All they ask me is, "When can I go see this?"

By the way, if we are kind, maybe Cyril, can you smile and be happy?

oh that's perfect

By the way, I didn't rehearse.

Congratulations Cyril. great stuff. Oh wow.

Okay, let's move on. Otherwise, it just takes time.

(Applause) Art and culture can be fun too, right?

For our final quick experiment, we'll call all of these "experiments." Our final quick experiment goes back to machine learning.

We show clusters and visual clusters, but what if we could ask machines to name those clusters?

What if you could tag automatically without using actual metadata?

What we have is this sort of explorer that probably successfully matched about 4,000 labels.

Nothing special here. Just feed the collection.

And I found an interesting category.

Let's start with a very easy category - horses.

You would expect the machine to insert the image of the horse, right?

And there it is, but I also noticed that right there, there was a very abstract image that I could recognize and cluster as a horse.

He also has a great head when it comes to horses.

And each is tagged with why it was categorized this way.

So let's move on to another category that I found very interesting and interesting. Because I don't understand how this category came about.

Its name is "Lady in Waiting".

Cyril, if you do it very quickly you'll find that there are great images of women waiting or posing.

I'm confused.

But I've been trying to ask museum officials, "What is this? What's going on here?"

And it's charming.

Getting back to gold in a moment, I wanted to search for gold to see how the machine tags all gold.

However, it is not actually tagged as gold.

We live in an age of masses.

It is tagged "Kebakeba".

(laughter) I'm moving too fast, so I'm being strict with Cyril.

Basically, all the glitz of museums around the world is here organized for you.

And finally, as a conclusion of this lecture and experiment, what I would like you to feel after this lecture is happiness and excitement.

And what do we see when we see happiness?

If you actually look at all the objects tagged "happiness", I think you can expect happiness.

But something very fascinating and interesting emerged. It was this artwork called "I Miss My Pre-Internet Brain" by our friend and resident artist Douglas Coupland.

I'm not sure why this machine feels like it's lost its pre-internet brains and is tagged here, but it's a very interesting idea.

Sometimes I miss my pre-internet brain, but not when it comes to exploring art and culture online.

So get out your phone, get out your computer, and go to the museum.

And I briefly call out to all the wonderful archivists, historians and curators who are sitting in museums and preserving all this culture.

And the least we can do is consume art and culture every day for ourselves and our children.

thank you.

(applause)

As Craig Venter has so elegantly shown, one way to change our genes is to create new genes.

Another is to change our lifestyle.

And what we're learning is how powerful and dynamic these changes are, and that we don't have to wait too long to see the benefits.

When you eat healthier, manage stress, exercise and love more, your brain actually receives more blood flow and more oxygen.

But more than that, the brain visibly gets bigger.

What was considered impossible just a few years ago can now be measured.

It was discovered by Robin Williams a few years before us.

Well, there are a few things you can do to help your brain grow new brain cells.

Some of my favorites include chocolate and tea, blueberries, moderate alcohol, stress management, and the cannabinoids found in marijuana.

I'm just a messenger

(laughter) What were you talking about?

(Laughter) There are other aggravating factors that can lead to brain cell loss.

Common suspects include saturated fat and sugar, nicotine, opiates, cocaine, excessive alcohol use, and chronic stress.

Changing your lifestyle will improve blood flow to your skin and speed up aging. Your skin is less wrinkled.

Increases blood flow to the heart.

We have shown that heart disease can indeed be reversed.

The clogged artery seen in the upper left is visibly less clogged after just one year.

And the PET scan of the heart shown in the bottom left, blue means no blood flow.

After 1 year -- orange and white are maximum blood flow.

We have shown that these changes alone can stop and reverse the progression of early-stage prostate cancer, and thus breast cancer.

In vitro tumor growth was found to be inhibited by 70% in these modified groups compared to only 9% in the comparison group.

These differences were very important.

It also increases blood flow to the genitals, increasing sexual potency.

One of the most effective quit-smoking ads, made by the Department of Health Services, shows that nicotine, which constricts arteries, can not only cause heart attacks and strokes, but also impotence.

Half of smokers have impotence.

how sexy is that?

Now we are about to publish the results of our research as well. This is the first study to show that gene expression can be altered in men with prostate cancer.

This is called a heat map, with different colors showing different genes along the right side.

They found that more than 500 genes were favorably altered. In other words, they turned on the good genes, the genes that prevent disease, and turned off the genes that promote disease.

So I think these discoveries are really very powerful and give many people new hope and new options.

And companies like Navigenics, DNA Direct, and 23andMe are offering your genetic profile, giving some people a sense of, "Well, what should I do?"

That's right, our genes are not destined. And if we make these changes, it's a predisposition. But if you make more changes than you would otherwise, you can actually change the way genes are expressed.

thank you.

(applause)

Have you ever had a Chinese friend ask you, "What is your zodiac sign?"

Don't think they are making small talk.

If you say, "I'm a monkey," they'll know right away that you're either 24, 36, 48, or 60.

(Laughter) Asking for your zodiac sign is a polite way of asking your age.

By revealing your zodiac sign, you are also being evaluated.

Your luck or misfortune, your personality, your career prospects, and your accomplishments for the year are being judged.

When you share your partner's animal sign, they'll paint a mental picture of your personal life.

Maybe you don't believe in the zodiac.

A quarter of the world's population is affected by this, so it would be prudent to do something about it.

So what exactly is the Chinese zodiac?

Most Westerners think of the Greco-Roman zodiac, which divides the zodiac into 12 months.

The zodiac is different.

This is a 12-year cycle labeled with animals starting with the Rat and ending with the Pig, and has nothing to do with astrology.

For example, if you were born in 1975, you are a Rabbit.

Can you see your constellation there?

Our Chinese ancestors built a very complex theoretical framework based on Yin Yang, Five Elements and Zodiac.

For thousands of years, this popular culture has influenced people's important decisions such as names, marriages, births, and attitudes towards each other.

And some of its effects are quite surprising.

The Chinese believe that certain animals get along better than others.

That is why parents choose specific years to have their babies because they believe team efforts with the right mix of animals will bring prosperity to their families.

We also refer to zodiac signs when forming romantic relationships.

I'm a pig You should have a perfect romantic relationship with tigers, goats and rabbits.

The Chinese believe that some animals are natural enemies.

As a pig, I have to be careful with snakes.

Raise your hand if you're a snake.

Let's talk later.

(Laughter) We believe that some animals, such as dragons, are luckier than others.

Unlike Western traditions, the Chinese dragon is a symbol of power, strength and wealth.

It's everyone's dream to have a dragon baby.

Jack Ma's parents must have been very proud.

And they're not alone.

In 2012, the Year of the Dragon, fertility rates in China, Hong Kong and Taiwan increased by 5%.

That means another million babies.

The ratio of boys to girls that year was 120 to 100, as boy babies are traditionally preferred.

As the dragon boys grow up, they face even tougher competition in the love and job markets.

January 2015 saw a peak in caesarean deliveries, according to BBC and Chinese government press releases.

why?

It was the last month of the horse year.

It's not because they love horses, but because they're trying to avoid having an unlucky goat kid.

(laughs) If you're a goat, don't feel bad about it.

It's a baby goat.

I don't see them as losers.

(Laughter) Tigers are also undesirable animals because of their erratic temperament.

In many parts of China, the birth rate dropped sharply at that time.

Perhaps you should think of the zodiac backwards, because tiger and goat babies have much less competition.

Maybe they are lucky people.

Interestingly, when looking at Forbes magazine's 300 richest people in the world, the two most undesirable animals, goats and tigers, rank ahead of dragons.

So you might think that less competition would be much better.

One last interesting point. Many Chinese people base their investment decisions on the zodiac index.

Although the beliefs and traditions of zodiac signs have been around for thousands of years, it is only in recent decades that the trend toward using zodiac signs in making important decisions has really taken off.

Our ancestors were busy surviving poverty, drought, famine, riots, disease and civil war.

And finally, the Chinese have the time, wealth and technology to create the ideal life they have always wanted.

Decisions made collectively by 1.3 billion people have triggered fluctuations in the economy and demand for everything from health care and education to real estate and consumer goods.

China plays such an important role in the global economy and geopolitics that decisions made based on the zodiac and other Chinese traditions will ultimately affect people around the world.

Are there monkeys here?

2016 is the year of the monkey.

Monkeys are smart, curious, creative, and mischievous.

thank you.

(applause)

I am an Iranian American Muslim woman like you.

And I'm also a social justice comedian, and I claim that's my real job.

To explain what it is, let me tell you how I got here.

I have performed all over the country.

And let me tell you, America is majestic, isn't it?

There is breathtaking nature, Waffle House and Diabetes as far as the eye can see.

it's really something

Now, the US population can be divided into three main categories. Mostly great people, assholes, and Florida.

(Laughter) Besides Florida, the most annoying category here is haters.

They're in the minority, but they overcompensate by being extra loud.

They have a Napoleonic complex kind of demographic and certainly some men wear heels.

As a social justice comedian, my goal is to convert these haters. Because they hate racism, violence, Ted Nugent and many other things that lead to negative consequences.

This is not an exhaustive list. You are probably missing 3-7 items.

But the point is, we have to consider the people we don't like.

However, there is variability within this group and tracking all of them is not efficient.

So what I did was create a highly scientific taxonomy of dislikes.

Like a scientist, I put all the haters in a petri dish and this is what I found.

(Laughter) First, there are the trolls.

They are digital haters of all kinds.

These are the people who quit their jobs so they could post videos on YouTube all day long.

Some people hate drive-bys.

Now, these people wait at the light for the light to turn green, and when it turns green they shout, "Go back to your country!"

In the old days, they would actually get out of the car and hate you to your face.

But they're not making it like they used to -- this is another sign of America's decline.

(Laughter) The next category is mission-oriented bigots who mask their hatred by belonging to the group.

These people like to harbor their hatred through seemingly good organizations, such as churches and non-profits, and often prefer to speak in their old-fashioned voice.

But the group I'm most interested in is swing haters.

Those who hate swing are the sisters of those who vote for swing - they just can't decide!

They are like ideological sluts moving from hating to not hating.

And they do so because they don't have enough information.

It's this group that I want to target with my social justice comedy.

why comedy?

Because, as you can see from this graph, the average American likes comedies on the comedy-to-pamphlet scale.

(laughs) Comedy is very popular.

By the way, this is a mathematically accurate graph generated from fake numbers.

(Laughter) Now the question is, why does social justice comedy work?

Because you can laugh first.

And when you laugh, you enter a state of openness.

And in that open moment, a good social justice comedian can poke tons of information and, if they're really skilled, even do a rectal exam.

(Laughter) Here are some ground rules for social justice comedy. First of all, this is not partisan.

This is not a political comedy, it's about justice, and no one is against justice.

Second, it's cozy and warm, making you feel like you're sitting inside a burrito.

The third is funny but snarky, like you're listening to an interesting paper on income inequality wrapped in some really sophisticated poop jokes.

(Laughter.) This is how I see social justice comedy work.

A few years ago, I recruited a large group of Muslim-American comedians in a non-violent way (laughter) and we toured the country to do stand-up shows in Alabama, Arizona, Tennessee, Georgia, where they love Mazzy.

We named this tour "Muslims are Coming!"

(Laughter) We made this into a movie, and after the movie came out, a famous hate group spent $300,000 on an anti-Islamic poster campaign with the MTA, the New York City subway system.

Well, the poster was really aggressive, not to mention badly designed. If you're biased, you'd be better off using a better font.

(Laughter) But we thought, why don't we launch our own poster campaign saying good things about Muslims while promoting the movie.

So me and fellow comedian Dean Obeidala decided to launch a campaign to combat prejudice with fun posters.

We raised money, worked with the MTA for over 5 months, and got our poster approved. Then, two days after it was due to be posted, the MTA decided to ban the poster for its political content.

Let's take a look at some of those posters.

here's one.

Muslim Facts: Muslims invented the concept of hospitals.

OK。

Fact: Adult Muslims can do more push-ups than baby Muslims.

(Laughter) Fact: Justin Timberlake was invented by a Muslim.

(Laughter) Let's take another look.

The ugly truth about Muslims: they have a great frittata recipe.

Now apparently, frittatas are considered political by the MTA.

It, or even just mentioning Muslims positively, was considered political, but it wasn't.

It's about justice.

So we decided to change the Fighting Prejudice and Fun Posters campaign and turn it into the Fighting Prejudice and Fun Litigation campaign.

(Laughter.) The bottom line is, some dirty comedians went up against a big agency in New York City and the comedians won.

(Applause and cheers) Thank you.

It felt so strange to win.

I thought, "Do blonde girls always look like this?"

Because this is amazing! ”

(Laughter) I'll give you another example.

Everywhere I go I get asked, "Why don't Muslims condemn terrorism?"

that's right. But okay, I'll take the food.

So I decided to start thedailydenouncer.com.

It is a website that denounces terrorism every day with weekends off.

Let's look at an example.

These are usually presented as one-panel cartoons that read, "I condemn terrorism! I also condemn people who never fill their paper trays!"

The point of this website is to condemn terrorism while recognizing that it is absurd to have to constantly condemn terrorism.

But if bigotry isn't your thing, social justice comedy can help you with all sorts of issues.

For example, me and fellow comedian Lee Camp went to the Cayman Islands to investigate offshore banking.

Currently, the US loses about $300 billion a year to these offshore tax havens.

I don't want to brag, but at the end of each month I have somewhere between $5 and $15 in disposable income.

So we visited these banks in the Cayman Islands and asked if we could open a bank account for $8.27.

(Laughter) The bank managers would indulge us for 30 to 45 seconds before calling security.

When the guards come out and brandish their weapons, we scream in terror and run away. Because this is the last rule of social justice comedy, sometimes you want to throw it in your pants.

Most of my work is meant to be fun.

It aims to create connection and laughter.

But sometimes the security guards will kick you out of the premises.

Occasionally I receive mean tweets and harassing emails.

Sometimes I get voicemails saying if I keep joking they will kill me and they will kill my family.

And those death threats are never funny.

But I still think social justice comedy is one of our greatest weapons, even if it's dangerous at times.

So we've tried many approaches to social justice, like warfare and competitive ice dancing.

But even then, many things still suck.

So I think it's time to try and tell a really good poop joke.

thank you.

(applause)

I have lived in rural East Africa for about ten years and would like to share with you my firsthand perspective on global poverty.

I believe humanity's greatest failure is the fact that it left over a billion people behind.

Hunger and extreme poverty: These often seem like huge, insurmountable problems too big to solve.

But as practitioners in the field, I believe these are actually very solvable problems if we just put the right strategies in place.

Archimedes was an ancient Greek thinker who taught us that we could move the world by relying on the right levers.

I believe there are three powerful tools we can rely on in the fight against extreme poverty.

This talk is all about these tools and why they make poverty a winnable battle in our lives.

What is extreme poverty?

When I first moved to rural East Africa, I stayed overnight with a farmer's family.

they were wonderful people.

They invited me to their home. We sang songs together and had a simple dinner.

They gave me a blanket to sleep on the floor.

But in the morning there was nothing to eat.

And at lunchtime, I watched the eldest daughter making porridge instead of lunch, feeling more and more sick.

For that meal, all the children drank one drink to survive.

And when they handed me one of those cups, I can't express how embarrassed I felt, but I knew I had to accept their hospitality.

Children need food not only to live, but also to grow physically and mentally.

If they don't eat every day, they will lose their future little by little.

Among the extreme poor, one in three children is underfed and stunted for life.

Add to this poor access to healthcare and 1 in 10 extremely poor children will die before reaching the age of 5.

And only a quarter of children finish high school because they can't afford it.

Hunger and extreme poverty limit human potential in every way.

We consider ourselves a thinking, feeling, and moral human being, but because everyone on Earth matters, unless we solve these problems for all of our members, we will not be up to the mark.

This kid is important.

These kids are important.

This girl is important

As you know, we are outraged to see this situation, but it seems like a very big problem.

I don't know how to take effective action.

But remember our friend Archimedes.

Global poverty is a powerful force.

It's a problem like any other.

I live and work in the field and as a practitioner I believe these are very solvable problems.

So for the next 10 minutes, let's not be sad about the state of the world.

Work your head.

Let's unite our passion for problem solving and figure out what the levers are.

Lever 1: Most of the world's poor are farmers.

Think about how unusual this is.

If this figure represents the world's poor, more than half are engaged in agriculture as their main source of income.

I am really excited about this.

All these people are in one profession.

Think how powerful this is.

More than half of the world's poor earn more money and escape poverty when farmers become more productive.

And it gets better.

Agricultural products are, of course, food.

So when farmers are more productive, they get more food, which not only helps themselves, but also helps feed healthy communities and thriving economies.

And when farmers become more productive, so does the pressure on the environment.

There are only two ways we can feed the world. Either make existing farmland more productive, or clear-cut forests and savannas to create more farmland. This is environmentally destructive.

Farmers are basically very important leverage points.

When farmers become more productive, they generate more income, lift them out of poverty, feed their communities, and reduce the pressure on the land for the environment.

Farmers are at the center of the world.

And not a farmer like this, but this woman.

Most of the farmers I know are actually women.

See the strength and will emanating from this woman.

She is tough physically and mentally and will do whatever it takes to get a better life for her children.

If the future of mankind was to be left in one person's hands, she would have been fine.

(Applause) There's just one problem. Many small farmers do not have access to basic tools and knowledge.

Now they take a little bit of the food grain they saved the previous year, plant it in the ground, and plow it with a manual hand hoe.

These are tools and techniques that date back to the Bronze Age, which is why many farmers are still very poor.

But again, good news.

Lever 2: Humanity actually solved the problem of agricultural poverty a century ago.

Describe the three most fundamental elements of agriculture.

First, hybrid seeds are created by crossing two seeds.

Natural pollination of high-yielding and drought-tolerant cultivars yields hybrids that inherit good traits from both parents.

Second, conventional fertilizers are environmentally sustainable when used responsibly.

A micro-dosing of just a pinch of fertilizer on a plant taller than me increases yields significantly.

These are known as farm inputs.

Inputs from the farm should be combined with good practices.

By spacing the seeds and planting a large amount of compost, farmers increase their yields.

These proven tools and practices have more than tripled agricultural productivity in all major regions of the world, lifting millions out of poverty.

We just haven't finished providing these things to everyone, especially in Sub-Saharan Africa.

All in all, this is great news.

In theory, humanity actually solved agricultural poverty a century ago.

We just haven't been able to deliver these things to you yet.

People remain poor in this century, probably because they live in remote areas.

They don't have access to these things.

Therefore, ending poverty is simply a matter of providing people with proven products and services.

We don't need more genius types now.

The humble delivery man will end world poverty in our lifetime.

Those are the three levers and the strongest lever is simply delivery.

We will end poverty wherever businesses, governments and nonprofits around the world are building networks to deliver goods that improve lives.

Sounds great in theory, but how does it work in practice?

What are these distribution networks like?

I would like to share a specific example that I am most familiar with, my organization, One Acre Fund.

We only serve farmers and our job is to give them the tools they need to be successful.

We start by delivering farm materials to really rural locations.

Now, this may seem very difficult at first, but it is quite possible. let me show off

We bring together a network of farmers to buy produce and store it in 20 warehouses like this.

Then, when delivering the input, we rent several hundred 10-ton trucks and send them out to where the farmers are waiting in the fields.

They then take individual orders and walk them back to the farm.

It's like the Amazon for rural farmers.

Importantly, realistic delivery also includes finance, a method of payment.

Farmers pay us little by little over time and cover most of our expenses.

And surround them all with training.

Our rural field personnel conduct hands-on hands-on training for farmers every two weeks.

Farmers can use these tools to lift themselves out of poverty wherever we serve.

This is our program farmer, Consolata.

Look at the pride on her face.

She has achieved modest prosperity, which I believe is a human right for all hardworking people on earth.

Today, we are proud to serve nearly 400,000 farmers like Consolata.

(Applause.) The key to making this happen is scalable delivery.

In every region, we employ local field workers and serve an average of 200 farmers, with more than 1,000 people living in their households.

There are currently 2,000 local field officers, growing rapidly.

This is our delivery force, we are just one organization.

Many companies, governments, and non-profits have such fleets.

And we believe we are at a point where we can collectively provide agricultural services to all farmers.

Let me show you how this is possible.

This is a map of Sub-Saharan Africa and includes a map of the United States for scale.

I chose Sub-Saharan Africa because it has a large delivery area.

Very challenging.

But when we analyzed every 50-mile by 50-mile block on the continent, we found that half of the farmers live in just these shady areas.

Overall, it's a surprisingly small area.

If these boxes were placed side by side in a map of the United States, they would only cover the eastern United States.

You can order pizza from anywhere in the area and have it delivered to your door hot, fresh and delicious.

If America could deliver pizza to an area of ​​this size, African companies, governments and nonprofits would be able to provide agricultural services to all farmers.

This is possible.

Finally, I would like to make a generalization that is not limited to agriculture.

In all areas of human development, humanity has already invented effective tools to end poverty.

All that's left is to deliver it.

Again, in all areas of human development, super-smart people long ago invented cheap and highly effective tools.

Humanity is thoroughly equipped with simple and effective solutions to poverty.

You only need to deliver these to a fairly small area.

Again using the map of sub-Saharan Africa as an example, remember that rural poverty is concentrated in these blue shaded areas.

Urban poverty is even more concentrated in these green dots.

Again, using the US map scale, this is a very achievable delivery zone.

In fact, for the first time in human history, a vast amount of delivery infrastructure is now available.

Businesses, governments and non-profits around the world have delivery fleets that can fully cover this relatively small area.

We just lack the will.

Each of us has a role to play, if we are willing.

First, we need more people pursuing careers in the field of human development, especially if we live in developing countries.

We need more frontline healthcare workers, teachers, farmer trainers and distributors of life improvement products.

They are delivery men who dedicate their careers to improving the lives of others.

But you also need a lot of supporting roles.

These are roles that are possible only in my organization, and we are just one of many.

It may surprise you, but whatever your technical expertise, you have a role in this battle too.

And no matter how logically possible it is to end poverty, we need more resources.

This is our biggest limitation.

For individual investors, there is a need for a significant increase in venture capital, private equity and working capital available in emerging markets.

But there are limits to what private companies can achieve.

Charity still plays an important role, as private companies often struggle to benefit the extreme poor.

Anyone can contribute, but we need more leadership.

We need more visionary philanthropists and world leaders who will take up the problem of human development and lead humanity to rid the planet of the problem.

If you're interested in these ideas, check out this website.

We need more leaders.

Humans have sent people to the moon.

We invented a supercomputer that fits in your pocket and connects you to anyone on the planet.

We ran a marathon at a pace of 5 minutes per mile.

We are exceptional people.

But we left over a billion members behind.

We could not be a truly moral and just human race until every girl like this girl had the opportunity to reach her full human potential.

Logically speaking, ending extreme poverty is incredibly possible.

All we need is to provide proven products and services to everyone.

If we have the will, each of us has a role to play.

Take advantage of your time, career and collective wealth.

Let's end extreme poverty now.

thank you.

(applause)

Today, 40 million Americans are benefiting from the transition to the new economy.

Too poor to pay for college, they now owe more than $1 trillion to financial institutions.

They are looking for what kind of jobs they can get to pay off their privately held debts.

In America, even bankrupt gamblers are given a second chance.

But it's nearly impossible for Americans to get exempt from student loan debt.

Once upon a time in America, going to college didn't mean graduating in debt.

My friend Paul's father graduated from Colorado State University on GI Bill.

For his generation, higher education was considered a public good, so it was free or nearly so.

not anymore.

When Paul graduated from Colorado State University, he also worked part-time to complete his English degree.

Thirty years ago, tuition fees for higher education were affordable and reasonable, and the accumulated debt could be paid off by graduation day.

not anymore.

Paul's daughter also followed in his footsteps, but with one difference. She was in huge debt when she graduated five years ago.

Students like Kate have to take out loans because the cost of higher education has become unaffordable for many, if not most, American families.

But so what?

There's nothing wrong with borrowing money to pay for your expensive education, as long as you can pay it back with the additional income you earn.

But that's where the rubber meets the road.

Even college graduates earned 10 percent more in 2001 than they did in 2013.

So...

Tuition fees are rising, public funds are falling, household incomes are falling, and personal incomes are falling.

Is it any wonder that more than a quarter of those who have to pay student loans cannot pay them off?

The worst times can be the best times, as certain truths manifest themselves in ways that cannot be ignored.

Today I would like to talk about three of them.

With $1.2 trillion in debt for diplomas, higher education is a consumer good you can buy.

We all talk about education as an investment in improving people by training them for jobs, much like economists do now.

As an investment, employees can be categorized and categorized to make it easier for employers to hire them.

U.S. News and World Report rank universities the same way Consumer Reports ranks washing machines.

The language is strewn with savagery.

Teachers are called 'service providers' and students are called 'consumers'.

Sociology, Shakespeare, football, and science are all "contents."

Student loans are profitable.

You are not alone.

Your debt increases the profits of the student loan industry.

Two 800-pound gorillas, Sallie Mae and Navient, made a combined $1.2 billion last year.

And just like mortgages, student loans can be bundled and packaged, sliced ​​and diced, and sold on Wall Street.

And universities that invest in these securitized loans can double their returns.

The first is from tuition fees and the other is from interest on debt.

With all this money to be made, would you be surprised that some parts of the higher education industry have started engaging in bait and switch false advertising...

Are they taking advantage of the very ignorance they pretend to be educating?

Third, a diploma is a brand.

Years ago, my teacher wrote that when students are treated as consumers, they become captives of addiction and envy.

Just as upgraded versions of the iPhone are sold and resold to consumers, more and more education can be sold to people.

College is the new high school, we already said so.

But why stop there?

For people, certifications, recertifications, master's and doctoral degrees can be sold at a high price.

Higher education is also marketed for status.

Buy a degree to set yourself apart from others, like you would buy a Lexus Louis Vuitton bag.

Therefore, you can become the envy of others.

A diploma is a brand.

But these truths are often eclipsed by very loud sales pitches.

Not a day goes by without a policy maker on TV saying, “You absolutely need a college degree to ride the escalator to the middle class.”

And the usual proof presented is the college premium. In other words, college graduates earn, on average, 56 percent more than high school graduates.

Let's look at this number more carefully. Because that number seems like a lie given the stories we all hear about college graduates working as baristas and cashiers.

Out of 100 people who enroll in some form of post-secondary education, 45 fail to complete their education on time for a variety of reasons, including financial reasons.

Of the 55 graduates, two remain unemployed and a further 18 are underemployed.

So college graduates earn more than high school graduates, but will that pay for exorbitant tuition and lost wages while in college?

Even economists now admit that the only people who benefit from going to college are those who have graduated from college.

But that's only because high school wages have been cut to the bone for decades.

For decades, high school-educated workers have been denied a fair share of what they produce.

And if they had taken what they deserved, going to college would have been a bad investment for many.

college premium?

I think it's a high school student discount.

Two out of three registrants cannot find a suitable job.

And the future for them is not particularly bright, in fact quite bleak.

And it is they who suffer from the most punitive forms of student loans.

And, strangely and sadly, they're the loudest touts about this university's premium stuff.

It's not just ironic marketing, it's cruel.

What should I do?

What if students and parents treated higher education as a consumer product?

Others seem to do the same.

Then, like any consumer product, you'll want to know what you're paying for.

When you buy a drug, you will be given a list of side effects.

Higher education products should be purchased with warning labels to help consumers make informed choices.

When you buy a car, it tells you how many miles you can drive per gallon.

When it comes to Canadian Studies, no one knows what to expect from a degree.

By the way, there is also this.

What if there was an app for that?

A link between the cost of a measure and its expected income.

Let's call it income-based tuition or IBT.

one of you makes this.

(Laughter) Discover your reality.

(Laughter) Income-based tuition has three advantages.

Any user can see how much they can earn from a particular college or major.

Users with such information are unlikely to fall victim to scammers' tactics and sales pitches.

But you also need to choose wisely.

For example, who would pay college more than 15 percent of their additional income?

Income-based tuition has a second advantage.

By tying costs to revenues, university administrators will be forced to find ways to better manage costs and find innovative ways.

For example, students here pay roughly the same tuition regardless of their major.

It's clearly unfair and needs to change.

Engineering students use more resources, facilities, laboratories, and faculty than do philosophy students.

But the result is that philosophy students subsidize engineering students.

Well, then who will continue to make more money?

Why should two people buy the same product and pay the same price, but one person should receive half or one-third of the service?

In fact, college graduates in some majors pay 25% of their income to pay off student loans, while others pay 5%.

Such unfairness would be eliminated if the big companies' prices were set more accurately.

Of course, all this data, one of you is going to do this, right?

All these data must be well designed and may be audited by accounting firms to avoid statistical lies.

We know about statistics, right?

But anyway, the third and greatest advantage of income-based tuition is that it frees Americans from the fear and fact that they will be financially ruined by buying defective products.

Perhaps, as the gentleman just said, America's young and old alike will rediscover their curiosity and love of learning. Start studying what you love, love what you study, start following your passion...

Stimulated by their intellect, follow the path of inquiry they truly desire.

After all, it was Eric and Kevin two years ago, and it was just those young people who prompted me to work with students in debt in America.

Thank you for your attention.

(applause)

War has been part of my life for as long as I can remember.

Born in Afghanistan only six months after the Soviet invasion, I was too young to understand what was happening, but I felt deeply the suffering and fear that surrounded me.

Those early experiences greatly influenced my thinking about current wars and conflicts.

I have learned that for most people, giving in is not an option when the underlying problem is at stake.

Conflicts of this kind, when people's rights are violated, when their countries are occupied, when they are oppressed and humiliated, they need strong ways to resist and fight back.

In other words, no matter how destructive and terrifying violence is, people will use it if they see it as their only option.

Most of us are concerned with the level of violence in the world.

But I'm not going to end war by telling people that violence is morally wrong.

Instead, we must provide them with tools that are at least as powerful and effective as violence.

this is my job

For the past 13 years, I have taught people in the most difficult situations around the world how to use nonviolent struggle to wage conflict.

Most people associate this kind of behavior with Gandhi or Martin Luther King.

But people have been practicing non-violent action for thousands of years.

In fact, most of the rights we have in this country today, as women, as minorities, as workers, as people of various sexual orientations, and as environmentally concerned citizens, these rights were not given to us.

They were won by those who fought for them and sacrificed for them.

But we have not learned from this history, and nonviolent struggle as a technique is widely misunderstood.

I recently met with a group of Ethiopian activists, and they told me something I often hear.

They said they had already tried non-violent action, but it had no effect.

Years ago they held a protest.

The government arrested everyone and that was it.

The idea that nonviolent struggle is equivalent to street protests is really problematic.

Because while protests are a great way to show people want change, they don't, by themselves, actually create change, at least not fundamentally.

(Laughter) Powerful enemies aren't going to give people what they want just because they asked for it well...

Or not so well.

(Laughter) Nonviolent struggle does not work by physically destroying the enemy, but by identifying the institutions the enemy needs to survive and denying their sources of power.

Non-violent activists can neutralize the military by sending soldiers into exile.

They can disrupt the economy through strikes and boycotts.

And you can counter government propaganda by creating alternative media.

There are various methods you can use to do this.

My colleague and mentor, Gene Sharpe, identified 198 methods of nonviolent action.

And protest is only one.

Let me give you a recent example.

Until a few months ago, Guatemala was ruled by corrupt ex-military officials with ties to organized crime.

People were generally aware of this, but most felt that nothing could be done about it – until a group of citizens, just 12 ordinary people, called on their friends to gather in the central square on Facebook with a placard bearing the message "Lenuncia YA" – had already resigned.

Astonishingly, 30,000 people gathered.

They stayed there for several months as protests spread across the country.

At one point, organizers delivered hundreds of eggs to various government buildings with the message, "If you don't have a huevos (ball) to deter corrupt candidates from running, you can borrow ours."

(Laughter) (Applause) President Molina responded by vowing never to resign.

And activists realized they couldn't just continue to protest and ask the president to resign.

They had to leave him no choice.

So they organized a general strike, refusing people across the country to work.

More than 400 businesses and schools have closed in Guatemala City alone.

Meanwhile, farmers across the country blocked major roads.

Within five days, the president had already resigned along with dozens of other senior government officials.

(Applause.) I have been greatly inspired by the creativity and courage of nonviolent people in nearly every country in the world.

For example, a group of activists in Uganda recently released pig crates onto the streets.

From here we can see that the police are at a loss as to what to do with them.

(laughs) Pigs were painted in the colors of the ruling party.

One pig wore a hat, and it was the kind of hat that people would recognize.

(Laughter) Activists around the world are getting better at grabbing headlines, but these lone actions are of little use unless they're part of a larger strategy.

A general never marches his army into battle unless he has a plan to win the war.

But this is how most nonviolent movements in the world work.

Nonviolent struggle is as complex, if not more, than military warfare.

Participants must be well trained and have clear goals, and leaders must have strategies on how to achieve those goals.

The art of warfare has been developed over thousands of years with vast resources and brilliant minds dedicated to understanding and improving how it works.

On the other hand, nonviolent struggle is rarely studied systematically, and although the number is increasing, there are still only a few dozen people in the world who teach nonviolent struggle.

This is dangerous. Because we know that our previous approaches to dealing with conflict are not adequate for the new challenges we face.

The US government recently admitted that the war against ISIS is at a standstill.

But what most people don't know is that people have taken non-violent action against ISIS.

When ISIS took Mosul in June 2014, it announced that it would introduce a new public school curriculum based on its extremist ideology.

But not a single child came to school on the first day of school.

Parents simply refused to send them.

They told journalists they would rather home school their children than brainwash them.

This is an example of just one act of defiance in just one city.

But what if it was done in concert with dozens of other acts of non-violent resistance that have been waged against ISIS?

What if the parents' boycott was part of a larger strategy to identify and cut off the resources ISIS needs to function? Skilled labor needed to produce food. Engineers had to extract and refine oil. Media infrastructure, communications networks, transportation systems, and local businesses that ISIS depends on?

It may be difficult to imagine defeating ISIS through non-violent action.

But it's time to challenge the way we think about conflict and the choices we have in facing it.

This is an idea worth spreading. Learn more about where nonviolent action works and how to make it even more powerful, just like other systems and technologies that are constantly being improved to better meet human needs.

Nonviolent action could be improved to the point where it is increasingly used as a substitute for war.

Violence as a means of conflict can be abandoned in the same way as the bow and arrow. Because we replaced them with more effective weapons.

Through human innovation, we can make nonviolent struggle more powerful than the most advanced techniques of warfare.

The greatest hope for humanity lies not in condemning violence but in ending it.

thank you.

(applause)

What does it mean to spend your time well?

I spend a lot of time thinking about how I spend my time.

Probably overkill -- I'm probably obsessed with it.

My friends think I am.

But I feel like I have to. Because lately, I feel like my time is getting away from me little by little, and when that happens, I feel like a part of my life is disappearing.