it's terrible advice

These are the best poker players out there

Do you seem to be alive only by feeling and intuition?

(laughs) Look closely!

These people take their time and analyze carefully, long ago when shrewdness and intuition brought them to the top.

Intuition isn't as perfect as we think

It would be nice if, when faced with a challenge, the answer would spring up from a magical source of inspiration.

The reality is that intuition is vulnerable to wishful thinking and preconceptions.

So when does intuition work?

Studies have shown that intuition can be relied on in many everyday things, such as finding out your friend is angry before you even say anything, or whether you're likely to be parked in a tight parking space.

But when it comes to big things, like what my career path is going to be, or who I should marry, why would I prefer to use my intuition instead of taking the time to analyze it thoroughly?

Even though it's not based on any data

My third lesson is that you shouldn't ignore your intuition, but you shouldn't overestimate it either.

Let's use a meme to summarize today's three lessons, with a poker twist.

"Success is sweetest when it comes to large sample sizes."

(Laughter) "Intuition is your best friend, just like cost-benefit analysis."

(Laughter) "I don't know the future, but I can try to guess."

thank you

(applause)

I invite you all to the Continent of Darkness.

It's a continent hidden beneath the surface of the earth.

Most of it is still unexplored, and it's a legendary place that hasn't been elucidated.

Dramatic vistas like this enormous underground chamber and a world of amazing biodiversity and minerals abound.

Through the efforts of intrepid explorers over the past three centuries, and thanks in part to satellite technology, we know almost all of the Earth's surface.

But we still know very little about what's hidden inside.

Caves, like this deep Italian shaft, are so hidden that their exploration prospects and geographic features are under-understood and under-appreciated.

Because we're surface creatures, our perception of the Earth's interior is distorted in a way, just like our perception of the depths of the oceans and the upper atmosphere.

But about a century ago, a systematic study of caves began, showing that caves exist on every continent.

Some cave systems, like Mammoth Cave in Kentucky, are more than 600 kilometers long.

The Krubera Cave in the Caucasus is the deepest cave ever explored, with the deepest part being more than 2,000m below the surface.

That deep would take weeks to explore.

Caves can be found in karst areas

In karst regions, water seeps through crevices and fissures, dissolving soluble rocks to create tunnels and waterway drainage systems, a three-dimensional network.

Karsts cover almost 20 percent of the continent's surface, and cavernologists have explored nearly 30,000 kilometers of cave passages around the world in the last 50 years, which is a big number.

But geologists estimate that there are 10 million kilometers of caves still waiting to be discovered and mapped.

So for every meter of known and explored caves, there are dozens of kilometers of unknown caves.

On a truly endless continent, you'll never be able to find out

And there are caves that aren't included in this, like intraglacial caves, volcanic caves -- unlike karsts, they're created by lava flows.

And this terrain isn't unique to Earth, as other planets like Mars show.

But I'll show you that you don't even need to go to Mars to explore an alien world.

I'm a speleologist, a cave explorer

My passion for caves began when I was still a child, in the karst regions of the Alps and the Dolomites, not far from my home in northern Italy.

But my quest for new entrances to unknown continents eventually led me to the farthest reaches of the earth.

In 2009, I had the opportunity to visit the table-shaped mountain tepuis, located in the basin of the Orinoco and Amazon rivers.

I was captivated at first sight by that group of large mountain massifs.

Surrounded by dizzying vertical cliffs, silvery waterfalls disappear into the forest.

I was deeply moved by its primitive form, and felt the existence of a soul that has lived for millions of years.

One of the inspirations for this dramatic landscape is Conan Doyle's 1912 novel The Lost World.

This is truly a "lost world"

Scientists consider these mountains to be "islands of time" that separated from the surrounding lowlands tens of millions of years ago.

Surrounded by 1,000m high walls, it looks like an impregnable fortress.

In fact, only a handful of mountains have been climbed and surveyed.

There's also a scientific paradox: this mountain is made of quartz, a very common mineral in the earth's crust. Rocks made of quartz are called quartzite, and quartzite is the hardest and least soluble mineral on earth.

I don't think there's a cave in a place like that.

But here, for the last 10 years, experts from Venezuela, Brazil, Italy, Slovakia, and the Czech Republic have been exploring caves.

What the hell is going on?

To understand this contradiction, let's consider the time factor. The history of tepuis is extremely long, beginning with the formation of rocks 1.6 billion years ago and resulting from land uplift 150 million years ago, around the time the Pankea supercontinent broke up to form the Atlantic Ocean.

Imagine, over millions and millions of years, water carving the surface of a tepui into strange shapes and fissures, creating the urban wilderness of rocks and towers that characterize the famous tepui landscape.

But no one could have predicted what was going on inside during that long period of time.

In 2010, I worked on one of the mountains, Auyantepui, famous for Angel Falls, the world's tallest waterfall, falling 979 meters vertically.

I used satellite imagery to look for indications of the existence of a cave system, and I eventually found an area of ​​collapsed surface with boulders and piles of stones, indicating that there was a cavity underneath.

I knew for sure that there was something inside the mountain.

So we tried several times to reach the place by land or by helicopter, but it was very difficult.

It's very windy and the annual rainfall is close to 4,000mm, so it's really hard to find good conditions.

It wasn't until 2013 that I finally landed, and I started exploring caves.

it's a huge cave

It's a huge network under the surface of the Tepui Plateau, and in just 10 days, we've explored more than 20 kilometers of cave passages.

It was a gigantic network of underground aqueducts, great halls, very deep shafts.

It's a place you won't believe

I named it "Imawari Yeuta"

Means "house of the gods" in the native Pemon language.

I don't think it's ever been visited by aboriginal people.

It was an unreachable place for them.

But their legends mention caves in the mountains.

So when I did my research, I used the utmost care and respect because it was a place of aboriginal beliefs and a sacred place.

We have taken special steps to ensure that our presence does not pollute the environment, and we have decided to share our discoveries with the indigenous peoples.

This cave bears the marks of many years

It probably took 50 to 100 million years to form, and may be the oldest accessible cave on Earth.

What you see is exactly the trace of a lost world

Forget everything you know when you enter a quartzite cave.It's different from the usual limestone caves and tourist caves around the world.

The stalactites that look normal here are made of opal, not calcium carbonate.

A more bizarre form of mushroom-shaped silica also grows on boulders.

You can imagine the conversation during the expedition.

That's the first line of finding these unknown objects, some of them look like monster eggs.

I was a little bit scared by the number of discoveries, I almost found a dinosaur

I wasn't there

(Laughter) Anyway, through various studies, we know that these artifacts are from living organisms.

This is a colony of bacteria, a mineral structure that uses silica, like stromatolite.

Stromatolites are one of the oldest living organisms alive.

Here in tepui, what's interesting is that this bacterial colony has evolved in complete isolation from the outside world, without contact with humans.

never had contact

Scientifically, it has huge implications. In this place, for example, we may find microbes that are effective in treating disease, or new materials with unknown properties.

In fact, here we discovered a scientifically new mineral structure, the phosphate-sulfate mineral, russiantonite.

Everything you find in caves, including the little crickets, has evolved in total isolation in the dark.

What you feel in this cave is the connection between the living and mineral worlds.

So, as we explore this dark continent and discover its mineral and biological diversity and uniqueness, we may find clues to the origin of life on Earth, and perhaps even discover links between the evolution of life and the mineral kingdom.

This dark, empty environment may actually be a treasure trove of useful information and surprises.

With the La Venta Terrafosa expedition team from Italy, Venezuela, and Brazil, we're heading back to South America soon to explore other tepuis in the deepest part of the Amazon.

There are mountains that are still largely undiscovered, such as Mount Marahuaca, which is nearly 3,000 meters high, and Mount Araca, in the Upper Negro River in Brazil.

We may find even larger cave systems, and their own and unknown worlds —

thank you

(Applause) (Bruno Giussani) Thank you.

He said he wasn't going to Mars to look for unknown life, but I think the last time we spoke was in Sardinia, where he was training European astronauts.

What do speleologists teach?

(Francesco Sauro) Training programs are not limited to Europe, but NASA Roscosmos and JAXA.

Participants will be quarantined in a cave for a week.

We have to work together in a very dangerous environment, an unusual, truly cosmic environment.

Always in the dark, using science to accomplish many missions.

It's a lot like a trip to Mars or the International Space Station.

(Giussani) In principle (Sauro) Yes

Giussani: Can you go back to that photo?

(audience) It was great!

(Applause) (Sauro) Thank you to the photographers of the La Venta Corps, because it's all done by them.

(Giussani) So you took a photographer with you.

cave explorer and photographer

It was strange to see, but in the total absence of light, it's unbelievably well exposed.

how?

How does your colleague take pictures?

SAUL: As if you were in a darkroom, you open the camera shutter and use the lights to map out the environment.

(Giussani) Like this... (Sauro) Yes, leave the shutter open for about a minute and illuminate the surroundings.

As a result, you can get the picture you want.

(Giussani) It's the result of scattering light.

let's try it at home

(Laughter) (Giussani) Thank you (Sauro) Nice to meet you.

(applause)

Can you just lift your arm and wave it from side to side, like I do -- like a royal?

we can imitate what we see

Hundreds of arm muscles can be programmed

Soon we will be able to look inside the brain and program and control the hundreds of brain regions that we see there.

I will talk about the technology

For thousands of years, humans have wanted to look inside the human mind, inside the human brain.

What's coming out of the lab now has that potential.

this can seem very difficult

Shrinking a spaceship and injecting it into the bloodstream

It was terrifyingly dangerous. (Laughter) You would be attacked by white blood cells in your blood vessels.

But finally we have the technology to do it.

Dive into my colleague Peter's brain

Using MRI (magnetic resonance imaging) without harming the human body

No need to inject anything, no radiation

You dive into Peter's brain structure, you literally dive into his body, but more importantly, you get into his mind.

As Peter moves his arm, the yellow dot there becomes a point of contact with Peter's mind movement.

You've probably seen electrodes control robotic prostheses, brain imaging and scanners that let you see inside your brain.

But that process usually required days or months of analysis.

We've made it a few milliseconds with technology, so Peter can see his brain in real time when he's inside the scanner.

You can see 65,000 sites activated per second.

By looking at the patterns in your brain, you can learn how to control it.

So far, there have been three ways to influence the brain: a therapist's couch, drugs and a scalpel.

This will soon be the fourth method

Deep channels are formed in the mind and brain as thoughts are formed.

An example of this is chronic pain, where you withdraw your hand when you touch something hot.

If the pain doesn't go away after six months or six years, it's the product of brain circuits that no longer serve.

If we can see the activity in the brain that produces pain, we can create a 3D model and look at the information that the brain processes in real time to pinpoint the area of ​​pain.

Now raise your arm again and make a bicep.

Now imagine that soon you'll be able to see inside the brain and select areas of the brain to do the same thing.

Here's a selection of pathways in the brain of a patient with chronic pain.

It may surprise you, but we're literally reading people's brains in real time.

It looks at your brain activity and controls the pathways that generate pain.

They're learning how to activate their own drug-releasing system.

At the same time, what you see in the upper left is brain activity during pain control.

If you control your brain, you can control your pain.

This technology is still under investigation, but in clinical trials it has reduced chronic pain in patients by 44 to 64 percent.

This is different from the movie "The Matrix", you can only do it for yourself, you control it.

I've seen inside my brain and soon you'll see

What do you want to control then?

All the facets that make up who you are You will see all the experiences

I don't have time to go into too much detail today, but this is the area we're working on right now.

I have one big question for you to think about.

We will be the first generation to use this technology to enter the human mind and brain.

what do you use it for?

A few years ago I broke into my house

I was driving home in the dead of winter in Montreal, near midnight. After visiting my friend Jeff across town, the thermometer on my front door was reading -40. Don't worry if it's Celsius or Fahrenheit.

I stood on the doorstep, fumbled in my pockets, and realized I didn't have the key.

In fact, I could see the key through the window, and it's still there on the dining table.

I ran around frantically trying to open other doors and windows, but they were locked.

At least I had my cell phone, so I thought about calling a locksmith, but it would take a long time for the locksmith to come in the middle of the night, and it was very cold.

I have an early morning flight to Europe the next day, and I need my passport and luggage, so I can't go back to Jeff's house and stay the night.

So, in desperation and freezing cold, I found a large rock and broke the basement window, cleaned up the shards of glass, crawled in, found some cardboard, and stuck it to the broken window.

It's expensive, but it shouldn't be more expensive than calling a locksmith in the middle of the night, so I figured the balance would be zero in that situation.

I'm a neuroscientist, so I know a little bit about how the brain works when it's stressed.

Stress releases cortisol, which increases your heart rate, regulates adrenaline levels, and reduces your ability to think.

So the next morning, I woke up sleep-deprived, worried about a broken window, worried about calling a contractor, freezing cold, an upcoming meeting in Europe, and cortisol in my brain, and my ability to think was low, but my ability to think was low and I didn't realize it.

(Laughter) I didn't realize I didn't have my passport until I went to the check-in counter at the airport.

(Laughter) It took 40 minutes, but in the snow and ice, I rushed home, grabbed my passport, and rushed back to the airport.

Those eight hours didn't let me sleep, I had a lot of time to think.

(Laughter) And I started thinking about what I could do, what I could do to prevent bad things from happening.

At the very least, if something bad happens, it minimizes the risk of a complete fiasco.

I started thinking about it, but it didn't take shape until about a month later.

My colleague and Nobel laureate, Danny Kahneman, and I somewhat embarrassedly told him about breaking a window at dinner and forgetting my passport, and Danny introduced me to "hindsight of foresight."

(Laughter) He was inspired by psychologist Gary Klein, who wrote a book about this a few years ago, also called "pre-analysis."

You know postmortem

When disaster strikes somewhere, a team of experts comes to find out why, right?

As Danny puts it, "pre-analysis" is about looking ahead and trying to figure out all the problems that might arise, and find ways to prevent them from happening or to minimize the damage.

So what I want to talk to you about today is what you can do with the "pre-analysis" method.

Sometimes it's easy to understand, sometimes it's not

Let's start with the obvious

Decide where to put things that are easy to lose at home

This sounds obvious, and it's true, but there's a lot of scientific analysis that backs this up based on how spatial memory works.

A brain tissue called the hippocampus evolved over thousands of years to remember the location of important objects, such as wells, fish spots, fruit tree groves, and the homes of fellow and enemy tribes.

The hippocampus in the London taxi driver's brain is enlarged.

Hippocampus helps squirrels find nuts

And if you're wondering, here's an experiment I did, showing that even if a squirrel's sense of smell was blocked, it could still find a nut.

Instead of using smell, the squirrel used the hippocampus, a brain function that has evolved exquisitely for searching.

But it's very good for things that don't move much, but it's not very good for things that move.

This is why I lost my car keys, my reading glasses and my passport.

So at home, we have a place to put our keys, either on the door or on a plate.

Put your passport in the designated drawer

Place the reading glasses on the same table

If you pick a spot and stick to it, it's always there when you need it.

how about traveling

Take a picture of your credit card or driver's license or passport with your phone, email it to yourself, and it'll be in the cloud.

Easy to reissue if lost

These are relatively straightforward

Remember, when you're stressed, your brain releases cortisol.

Cortisol is toxic and impairs your ability to think.

So to do a "pre-analysis," you have to recognize that you're not at your best when you're stressed, and you have to be prepared.

Perhaps there is no more stressful situation than when you are faced with making a medical decision.

At some point, we'll all be in that position, making a very important decision about the future treatment we're going to get to help ourselves and our loved ones.

I will talk about that

I'm talking about a specific medical condition.

This applies to all medical decisions, and indeed financial and social decision-making, where due diligence of the facts helps with any decision.

So let's say you go to the hospital and the doctor says, "According to the test results, your cholesterol is a little high."

We all know that high cholesterol levels increase the risk of heart disease, heart attack, and stroke.

So you don't want high cholesterol, so the doctor says, "I'm going to prescribe you a cholesterol-lowering drug called a statin."

You may be familiar with statins, one of the most widely prescribed drugs in the world today, and someone you know may be taking them.

So I think, "Yes, give me a statin."

But at this point, I have a question to ask: I'm going to ask you a statistic that most doctors don't want to talk about, and drug companies even less want to talk about.

is the number of cases requiring treatment

What is the number of cases needing treatment?

It's the number of people who need to take drugs, have surgery, or have some kind of medical procedure before one person can be saved.

What a bullshit statistic, you think?

this number should be 1

My doctor won't prescribe medicine if it doesn't work

But in practice, medical practice doesn't work that way.

This is not the doctor's responsibility, but rather the responsibility of scientists like me.

I didn't fully understand the underlying mechanism.

GlaxoSmithKline estimates that 90% of drugs work for only 30% to 50% of people.

So how many people do you think need treatment for the most widely prescribed statin?

How many do you need to take before one survives?

300 people

This figure is based on a study by research doctors Jerome Groopman and Pamela Hartsband, confirmed by independent Bloomberg.

I also looked through this number

To prevent one heart attack, stroke or other adverse event, 300 people need to be on the drug for a year.

You're probably thinking, "That's a 1 in 300 chance of lowering your cholesterol.

ok, please give me a prescription

But at this point, we should also ask the other stats: "Tell me about the side effects," right?

This particular drug causes side effects in 5% of patients.

Some of them are terrible. Muscle weakness, joint pain, gastrointestinal problems.

but wait

Stress is degrading your ability to think, so let's think about how to deal with it in advance.

You don't have to create chains of logic on the fly.

300 people take drugs, right? 1 person is saved, 5% of 300 people have side effects, 15 people.

You're 15 times more likely to have side effects than you are to be helped by medication.

It's not about whether you should take a statin.

I'm saying you should talk to your doctor about these things.

It's a medical ethics requirement, an essential part of informed consent.

You have a right to know this information so that you can start talking about whether or not to take risks.

You might think that this number was brought up to shock you, but in reality, this number of cases needing treatment is typical.

The most common type of prostate cancer removal surgery in men over 50 has 49 need-to-treat cases.

That's right, for every person saved, there are 49 surgeries.

In this case, 50% of patients will have side effects.

Side effects include impotence, erectile dysfunction urinary incontinence, rectal tear fecal incontinence

Even if you're in that 50%, if you're lucky, these symptoms will go away in a year or two.

The idea of ​​"pre-analysis" is to think ahead of the questions you might ask to move the discussion forward.

You don't want to think about everything on the spot.

You also want to think about things like quality of life.

Because most of the time, you have a choice: do you want to live a short life with no pain, or do you want to live a long life with a lot of pain in the end?

These are the things to talk about and think about with your family and loved ones now.

I may change my mind on the spur of the moment, but at least I'm practicing these ideas.

Remember, your brain releases cortisol when you're stressed, and one of the things that happens when you do that is that much of your body stops working.

There is an evolutionary reason for this

When you face a predator, you don't need your digestive system, your libido, or your immune system. It doesn't matter if your body is wasting your metabolism on these things because you might not be able to react quickly enough and you might end up with a lion's lunch.

Unfortunately, one of these things disappears completely under stress, as Danny Kahneman and his colleagues show us: rational, logical thinking.

We need to learn to think ahead for these kinds of situations.

The key here is to recognize that we are all flawed.

we all make mistakes sometimes

"Pre-analysis" is about thinking ahead of any failure, putting in place ways to minimize the damage, and preventing bad things from happening in the first place.

Back in Montreal that snowy night, when I got home from a business trip, I had a contractor install a key box with a combination lock on my front door with an easy-to-remember number.

To be honest, I still have a pile of unsorted letters and a lot of emails I haven't read.

It's not completely neat, but I think of this codification as a gradual process.

thank you very much

(applause)

One girl I've never met changed my life and thousands of others.

I am the CEO of DoSomething.org

It's one of the world's largest organizations for young people.

In fact, it's bigger than the Boy Scouts of America.

Homosexuality is tolerant, but—

(Laughter) It's true that SMS is the way to communicate with young people, because that's how young people communicate.

We have more than 200 activities planned this year, from collecting peanut butter for donations to making Valentine's cards for the withdrawn seniors.

message them

Its open rate is 97%

So many Hispanics and urban people.

We collected 200,000 peanut butter jars and over 365,000 Valentine's Day cards.

(Applause) But it also had an unexpected effect.

Every time we send a message, we get a reply with a message that has nothing to do with peanut butter, hunger, or the elderly.

The worst message I've ever received is this: "You sexually abused your father.

have received

I was told not to tell anyone, please help me."

I can't believe this is happening

It was hard to believe that a human being could do such a terrible thing, and this girl let us know something so private and personal-

We shouldn't wait for things to get serious, I thought we should open up an SMS helpline for these suffering people.

So we very quietly started the Crisis Text Line in Chicago and El Paso -- a few thousand people.

Four months later, we were operating in 295 area codes across the United States.

It's grown faster than when Facebook first started without marketing.

(Applause) SMS is very personal.

no one can hear me

Every day at lunchtime, the messages skyrocket. At the lunch table, the girl looks like she's texting the cute boy over there, but she's actually asking us for advice about anorexia.

"Uh" or "Yeah" nods Hyperventilation or shouting will not be sent via SMS

receive only facts

The message is "I want to die

I have sleeping pills in front of me."

Counselors say, "Why don't you put your pills in your drawer while you're messaging?"

We exchanged messages for a while.

The counselor asks the girl for her address, because texting is asking for help.

With address information and SMS buying time, the counselor requests intervention and rescue.

Then it goes quiet for 23 minutes, no response from the girl.

And then there's this message, from the little girl's mother, "I don't understand why, I was at home, and now my daughter and I are in an ambulance going to the hospital."

I'm a mother myself, so really -- a month later, I got a message from a little girl.

"I just got discharged from the hospital.

I was diagnosed with manic depression, but I think I'm fine now."

(Applause) I should point out that this is not an uncommon interaction, but on average, we call for help 2.41 times a day.

30% of messages are about suicide and depression - a huge number.

The great thing about Crisis Text Line is that it allows strangers to consult with strangers on their most private matters and calms agitated consulters.

It's amazing, we've received more than 6.5 million total messages in less than two years.

(Applause) But what drives my enthusiasm, what motivates me, what inspires me is the data, which is 6.5 million messages.

It allows us to predict

We can learn from those data and draw different conclusions.

We can work smarter and the world will be a better place.

How can we use the data for that?

I'm sure some of you have seen a therapist or a psychiatrist before, so you don't have to raise your hand.

(Laughter) How do you know they're good?

A Harvard degree hanging on the wall?

You may have graduated in the bottom 10%.

(Laughter) My husband and I met with a marriage counselor, and I thought she was a genius, and she said, "We're two weeks later -- your husband needs to come back next week."

(Laughter) If you know our data, you're going to be a great counselor.

99% of people who type the words "paralysis" and "sleeves" in their messages are thinking of a wrist cut.

"Milligrams" and "rubber bands" are 99% drug addicts.

If it's "sex," "oral," or "Mormonism," I'm asking myself if I'm gay.

That's interesting information for a counselor to understand, but we use an algorithm to pop up an automated pop-up that prompts the counselor, "There's a 99% chance that your list will be cut - ask one of the following questions."

or "99% chance of drug addiction, 3 drug rehab centers near sender"

will be more accurate

On the day Robin Williams committed suicide, hotlines all over America flooded.

Sad that a famous comedian tried to commit suicide, every phone call in America had a three hour wait time.

The number of consultations has also risen sharply

In our SMS counseling, if you send a message saying, "I want to die" or "I want to commit suicide," the algorithm will read it and put it at the top of the queue as a priority treatment.

Respond to severity, not first-come, first-served

(Applause) We can also use this data to make the world a better place, because we have the world's first real-time crisis map.

Think about it, we have all the data from 6.5 million messages tagged with natural language processing, and the number of eating disorder consultations of the week is highest on Mondays.

Most drug overdoses of the day occur at 5am

Montana is a beautiful place to visit, but you probably wouldn't want to live there, because it's the number one state in which people want to commit suicide.

So we made this data available to the public for free.

Remove all personally identifiable information

Published at CrisisTrends.org

If we recognize that eating disorders are at their worst on Mondays, schools can prepare meals accordingly and ensure that counselors are available on Mondays.

I want to tell my family that drug intake peaks at 5am.

I wish someone would take care of the Native American reservations in Montana as well.

(Applause) The data, the evidence, the policy, the research, the journalism, the surveillance, the administration of the schools -- make it all better.

I don't think of myself as a "mental health activist."

I consider myself a “national health activist.”

I'm a bit of a geek, so I'm pretty excited about this data.

no not a little

I'm pretty geek

(Laughter) I love data.

The only difference between me and people in hooded trainers who work for well-funded companies is that I'm not particularly interested in trying to find a Chinese restaurant at 2 a.m. in Dallas, or tapping my watch to hail a cab, or building an app to find a date.

What I really want to do is -- (Laughter) (Applause) I want to use technology and data to make the world a better place.

To help that girl, the girl who texted her father that she was being sexually abused.

I haven't heard from her since then.

I hope she's somewhere safe and well. I hope she sees this talk and sees that her despair and courage inspired Crisis Text Line and fueled me to face the toughest days.

(applause)

When I was a kid, my parents used to tell me, "You can make a mess, but you have to clean up after yourself."

freedom comes with responsibility

I was just imagining a wonderful world where anything is possible.

I grew up in a bubble of innocence, or maybe a bubble of ignorance, because adults lie to protect children from the ugly reality.

And as I got older, I began to realize that the adults were making a mess and not cleaning it up themselves.

Fast forward in time, and now as an adult, I'm teaching science and invention that anyone can do at Hong Kong Harbor School.

Shortly after I started, I was walking along the beach with my students and came across a pile of garbage.

As good citizens, we cleaned up the beach. I told you, the kid in the picture isn't drinking, and even if he was, I didn't give it to him.

(Laughter) It's a shame that today, 80 percent of the ocean is covered in plastic.

it's a terrible story

For decades, people have been sending out big boats with big nets to collect plastics from the oceans, look at them under a microscope, sort them, and plot the data on maps.

But this work is very time-consuming and expensive, and using large ships is risky.

So I wanted to work with my students, ages 6 to 15, to come up with a better way.

I turned a small classroom in Hong Kong into a workshop.

I started by building this little workbench, which has different heights so that little kids can get involved.

Kids with power tools are cool and totally safe —

(laughs) — I can't say for sure.

Let's go back to plastic

We collected the plastic and shredded it into pieces like the ones found in the ocean.

we did it like this

First, let the children let their imaginations run free.

My job is to take the best parts of each child's ideas and combine them into something that hopefully works.

Instead of collecting pieces of plastic, we decided to just collect data.

We're going to use robots to figure out what's going on with the plastic in our oceans, and because they're robots, kids will be fascinated by them.

The next step is a quick prototype.

I'm doing it so quickly that there's still something left in the bento box I used.

(Laughter) I put a desk lamp and a webcam into the plumbing and built a robot that slowly moves over water that contains plastic, and here's a video captured by the robot.

Pieces of plastic are slowly passing in front of the sensor, and a computer on board processes the images, measures the size of each piece of plastic, and estimates the total amount of plastic in the water.

We've detailed how to build this invention on our site for inventors, Instructables, and hopefully someone will improve it further.

And what's really cool about this project is that the kids see some familiar problem and they immediately start trying to solve it.

[You can do your own research on familiar issues.] My students in Hong Kong are very well informed.

I've been watching the news and the internet a lot, and I came across this photo.

This is a child not even 10 years old scooping up an oil spill with his bare hands, in Bangladesh, at Sundarban, the site of the world's largest mangrove forest.

The children were very shocked, because this is where people live, where they drink and bathe and fish for food.

Also, as you can see, water, mud, and crude oil are all brown, and when you put them together, you can't tell them apart.

But there's a good, very simple method called spectroscopy that allows us to see what's in water.

So I built a simple prototype of a spectrometer, and different substances produce different spectra when illuminated with light, which can be used to identify substances in water.

I sent this prototype sensor to people in Bangladesh.

What's really cool about this project is that beyond just looking at and working on problems at hand, the children are concerned about other children far away, and they're trying to be creative and help them.

[You can investigate even distant problems.] This second experiment encouraged me to go further in this direction, towards a more difficult problem, a problem that is very dear to me.

I'm half Japanese, half French, but do you remember the huge earthquake that hit Japan in 2011?

It was a very strong earthquake that caused a huge tsunami that caused devastating damage to many towns on the east coast of Japan.

14,000 lives were lost in the blink of an eye

The tsunami also damaged a nuclear power plant on the coast of Fukushima.

Reportedly, 300 tons of contaminated water leaked from a nuclear power plant into the Pacific Ocean.

There are now traces of cesium-137 contamination throughout the Pacific Ocean.

Everywhere you go on the West Coast of the United States, you can observe the effects of Fukushima.

But if you look at this map, most of the radioactive material has been washed off the coast of Japan, and it looks blue and safe.

but the reality is more complicated

I've been visiting Fukushima every year since the disaster, working with other scientists to independently measure radioactivity in the ground and in the rivers, and I wanted to take my children on this study.

Of course, my parents wouldn't let me, so I didn't take them with me.

(Laughter) Instead, I reported to "mission control" every night, and we're all wearing different masks.

You might think that we don't take this issue seriously, but children really do, because they have to live with radioactive contamination for the rest of their lives.

We talked with the kids about the data that we had collected and what to do next: strategies, schedules, things like that.

And I started by creating a very rough topographic map of the area around the nuclear power plant.

We made an altitude map, sprinkled it with pigments that looked like radioactive material, and sprayed it with water to simulate rain.

This allowed us to see radioactive dust flowing from mountains to rivers to the ocean.

It's a very rough estimate.

With this in mind, I planned a research trip to get as close to the nuclear power plant as possible for the average person.

We went by boat 1.5 kilometers off the power plant, and with the help of a local fisherman, we collected sediment from the seafloor with a sample collector that we designed and built ourselves.

And then we put it in little bags, and we sent hundreds of little bags of specimens to universities, and that's how we created maps showing radiation levels on the ocean floor, especially in the estuaries where fish breed, in hopes of helping local fishermen and the sushi we all love to be safer.

(Laughter) I think you can see that we're moving forward, step by step, from immediate problems to distant problems to global problems.

It's really exciting to be able to tackle these different scale problems with very simple open source technology.

At the same time, I became frustrated just by starting to measure human problems.

Because we haven't even started working on solving the problem yet.

And I knew I had to do something drastic and find a better way.

Classrooms started to feel cramped, so we found a place in an industrial area in Hong Kong and turned it into the largest hackerspace with a focus on socio-environmental impact.

It's in the heart of Hong Kong, and you can build basically anything there, using woodworking, metals, chemistry, and even a little bit of biology and optics.

It's also a place where children and adults can play together.

It's a place where children can achieve their dreams with the help of adults, and where adults can be children again.

(Student) Accelerate! Accelerate!

For example, can we create vehicles of the future that use renewable energy?

and so on

Or maybe we could turn a regular wheelchair into a cool electric car for transportation for the elderly.

Plastic and oil and radiation are a huge negative legacy, but I think the worst legacy we leave to our children is the lie.

We can no longer afford to shield our children from ugly realities, because we need their imaginations to come up with solutions.

As citizen scientists, makers, and dreamers, we must raise the next generation to care about the environment and other people, and to actually tackle the problems.

thank you

(applause)

Today, I would like to talk about three topics that are related to solving complex problems that are deeply rooted in modern human society.

Sometimes poverty, social inequalities, poor health, unemployment, violence, drug addiction, all of these problems can converge on one person.

This is the story of such a person

Let's call it an error

I live in a rundown apartment complex in a city in England.

The shops have gone bankrupt, the pubs have closed, the children's playground is nearly empty, and the air in Ella's house is visibly tense. Noise levels are deafening.

TV at maximum volume

son and daughter in the middle of a fight

Another son, Ryan, is yelling out of the kitchen, and the dogs in the bedroom are struggling behind the door.

error is stuck

40 years of living in a family on the edge of a cliff

I only know that kind of life, and I don't know how to get out of it

Men are unlucky, they are always violent, and sadly one of the children was taken into the care of an orphanage.

The other three children have a lot of problems and none of them go to school.

Ella says she's repeating the cycle of her mother's generation.

But when we first met, Ella and her family were covered by 73 different welfare services run by 24 city departments, and most of the staff knew Ella and her partner and children.

Whenever there was an argument or something like that, he would casually call the welfare service and ask for mediation.

Ella's home is regularly visited by social workers, youth counselors, health counselors, housing counselors, tutors, and local police officers.

The government has announced that 100,000 families in the UK are in similar situations, struggling to break through a vicious cycle of economic, social and environmental poverty.

They say it costs £250,000 a year per family to tackle these problems, but nothing changes.

All well-meaning visits are in vain.

This chart shows a family in a similar situation to Ella who lives in the same city.

It illustrates a 30-year history of welfare interventions.

Like Ella, none of these interventions are based on one holistic plan.

No final goal in sight

No one is tackling the underlying problem

They're all preventive measures, or remedies for individual problems.

A police officer comes and says something like, "I'm just here to leave a message, and I'm going home."

So I've been traveling the world, living in families like Ella's, wanting to see if there's anything we can learn from places where the welfare system isn't working.

What it's like to live in a home environment like Ella's

what is actually going on? what should i change?

First, I realized that "cost" is a very elusive concept.

The government says it costs £250,000 a year to support a family like Ella, but the truth is, it's the system that costs £250,000.

Not a single penny of money goes directly to Ella's family and produces results.

Rather, they are stuck in the middle of a high-cost system spinning around Ella and her family.

I talked to the staff on the ground, and it turned out that the situation was hopeless.

In Tom's case -- Ella's son, 14-year-old Ryan, -- 86 percent of his time is spent on institutional work, meeting with colleagues, filling out forms, having another meeting about that form, and even worse, even the remaining 14 percent of his time with Ryan is spent gathering data and information to enter into systems.

So my conversation with Ryan was, "How often do you smoke? How often do you drink? When did you go to school?"

It is like this

This type of engagement leaves little room for normal conversation.

This doesn't create the necessary relationship between Tom and Ryan.

When this diagram was made, the welfare workers working in the field were staring wide-eyed.

This drawing was also put up on walls throughout the office.

The vast amount of time spent with good intentions turned out to be utterly useless in the end.

It seemed hopeless at one point, but then I saw what I had to do, and I realized that I had to change my ways.

Here, Ella's city leadership did something very drastic, deciding to reverse the ratio of time spent on Ryan.

This means that employees who become involved with Ella and similar families spend 80 percent of their time with their family members and only 20 percent of their work on the institutional side.

What's even more drastic is that the target family decides who should be in charge.

Ella and another mother also attended interviews and were selected from among the qualified candidates for their positions.

There were so many applications, because people who aspire to social work are originally motivated by wanting to help people rather than running a system.

Two mothers asked everyone who came to the interview, "What would you do if your son started acting violently?"

The first person answers, "Find the nearest exit and slowly move away. If I still hear the noise, I'll call my boss."

Mothers say, "You are the system, get out!"

The next candidate was a police officer. "I'm going to jump on your son and put him down. I don't know what he's going to do after that."

Then the mothers said, "Thank you."

People who answered truthfully, "I don't know if they're right," were selected because they didn't try to cover it up with jargon and because they could see the human side.

Mothers were convinced that these people might be rough, but they would stick with them no matter what.

This new team and family were allotted a tiny fraction of their previous budget, but they could spend whatever they wanted.

A family decided to eat out

We sat at McDonald's and talked and listened to each other, something that this family hadn't had in a long time, at the request of another family.

There were also requests for home repairs and renovations.

Some mothers used this money to start social projects.

And then, in a very short space of time, something new sprung up: the bond between the team and the staff.

And then a miraculous change happened

As you can imagine, Ella went back and forth several times during this process.

But she completed an IT training course, got her first job, her kids went back to school, and her neighbors used to wish Ella and her family could move somewhere else, but now they're on good terms.

A new neighborhood relationship has begun.

Involved in this process are the same family members as before and the same service personnel as before.

It's just that the mechanisms that encourage change in relationships have changed.

I mention Ella for a reason, because relationships are the most important resource for solving our most esoteric societal problems.

But in our time, politics, social policy, and welfare systems have wreaked havoc, and human relationships have all but collapsed.

This situation has to change from the ground up.

So what are human relationships?

I think it's simply about the bond between people, the feeling of belonging, the feeling of belonging, the bond that makes you feel supportive and happy when, like Ella, you take the plunge and try something new.

And it's no coincidence that human relationships are irrelevant to those who manage the social institutions that are supposed to support Ella's family, because they are intentionally left out of the model of social security that was designed in England and spread around the world.

He helped design the world's first social security system and published the Beveridge Report, because people in William Beveridge's time believed that so-called "worldly men" could not be trusted.

Instead, they valued impersonal, emotionless "institutions" and officials working mechanically within them.

Beveridge's impact on how the modern system views social issues is immeasurable.

The Beveridge Report sold 100,000 copies in its first week of publication.

It is said that there were people lining up all night in the rain in November to buy it.It was read by people all over the country, colonies here and there, people all over Europe, and people all over the United States, and it had a tremendous impact on the design of the welfare state system all over the world.

The culture, the bureaucracy, the institutions of the welfare state have spread all over the world and become the norm.

It has penetrated so deeply into us that no one is even aware of it anymore.

It's no secret that these institutions have achieved remarkable results during the 20th century.

It has increased life expectancy, eliminated epidemics, built multi-family housing, and provided education for nearly everyone.

But at the same time, we can also say that we sowed the seeds of the problems that are prevalent in our time.

Now let me tell you the second story.

In this day and age, what could be more life-threatening than smoking for the rest of your life?

the answer is loneliness

Government statistics show that one in three people over the age of 60 don't see or talk to anyone for a week.

1 in 10 people, 850,000 people, don't talk to anyone for a month.

It's not just the UK, it's a problem that's happening all over the Western world.

In countries like China, where it's even more serious, rapid urbanization and mass migration are leaving older people in rural areas.

The Social Security system that Beveridge designed and brought to the world cannot address this class of problem.

Loneliness is a pervasive relationship problem that cannot be addressed by traditional bureaucratic approaches.

A few years ago, I had the opportunity to meet with about 60 elderly people in my hometown of South London to understand this issue.

I went shopping, I played bingo, but mostly I listened and observed.

I was wondering if there was anything I could change

If you ask them, they have two hopes

Someone to climb the ladder to change the light bulb, or someone to pick me up when I get home from the hospital.

I want practical help when I need it

I'm also looking for fun

I want to go out, have fun with like-minded people, and make friends, as we all have been doing all our lives.

So I set up a phone line and some jack-of-all-trades and started a service called Circle.

It's a way for members of the community to call a toll-free number for help when they need it.

There were really a lot of things

Your pet is sick, or your DVD is broken, or you forgot how to use your cell phone, or you actually want me to pick you up on the way home from the hospital.

There are a lot of events at "Circle", such as knitting, darts, museum tours, hot air balloons, and so on.

But what's interesting is that something very important has happened, and over time, the relationships that were created within the "circle" gave way to the day-to-day service.

Let's talk about Belinda

Belinda is a member of The Circle, and she's in the hospital for hip surgery, so she called her local Circle and said she wouldn't show up for a while.

When local manager Damon called back and asked if there was anything we could do,

Belinda said, "Oh, it's okay. Jocelyn is shopping. Tony is looking at the garden. Melissa and Joe are coming to cook and visit."

At this time, five of the members had already taken care of their personal belongings while they were in the hospital.

Belinda, who is 80 years old and still feels 25 at heart, said that before joining, she was very depressed because her life seemed to be at a dead end.

But then, the simple act of inviting him to the first event set the stage for what would later become a natural friendship, a friendship that eliminates the need for expensive social services today.

It's the relationships that make the difference

There are three factors that have made it possible for us to put human relationships at the center of solutions to social problems today.

The first is the nature of the problem. The quality of the problem and the solutions needed have changed from what it used to be.

The second is the cost, which is the labor cost, the administrative cost.

The third is technology.

I talked about the first two earlier.

It's the power of technology that has allowed these efforts to scale up and now reach thousands of people.

The technology we used was really simple and mundane, like databases and mobile phones.

The Circle uses this super-simple foundation to allow small local teams to support up to 1,000 members.

Compared to the 1970s, the scale of the community support organizations that existed at that time was simply unachievable.

Using the power of technology, we can turn the Beveridge model upside down with human relationships.

The Beveridge model is a system that allows everyone to equally manage the use of limited operating resources in an organization.

Working on the front lines, I know very well that up to 80 percent of operational resources are being used to prevent people from using it.

Workers are overwhelmed with paperwork that gets more complicated every year, and the point is that it's a system that either slows down the use of services or manages people who are waiting.

Services such as our Circle, which are centered on human connections, are the opposite of this.

So the principle is that the more people you have, the more relationships you have, the more effective you are.

And finally, my third story is about unemployment.

In Britain, as everywhere in the world, the main aim of our welfare state is to get people to work, to educate them for work and to keep them healthy.

But this system doesn't work either.

As a countermeasure, the institutional side will further systematize and streamline the current system to shorten the processing time and subdivide the users as much as possible.In other words, they are trying to efficiently narrow down the target of the service.

But in this day and age, the opportunity to find a job

Most referrals and reviews

In fact, in the UK today, most new job listings aren't advertised.

You can find a job by asking your friends to apply, by receiving recommendations from friends, and by connecting with diverse and rich people.

"I found you in an ad," you might say, but in retrospect, maybe it was all thanks to a friend who showed you the ad and recommended you apply.

But of course, these people who need the most diverse and rich human connections are the ones who are the furthest away from it.

With these facts and the costs and shortcomings of the existing system in mind, we designed a new system that puts relationships at the center.

It is a service that promotes gatherings with people inside and outside the workplace, and supports systematic cooperation to tackle new challenges.

It's very difficult to compare the results of the old system with the results of this new system, but just looking at the first 1,000 registrants, it's three times as good as the old welfare service, at a fraction of the cost.

Again, with the help of technology, we don't use social networking sites to connect people.

We use technology to connect people face-to-face, to build authentic relationships, and to help them find jobs.

In 1948, late Beveridge published his third report.

I wrote there that I had made a terrible mistake.

It ended up leaving people and communities behind.

And as a result, he writes, both institutions and people themselves have come to see people only within the framework of institutions and procedures.

At that time, the blood relationship was already diluted.

Unfortunately, this third report was read less than his previous report.

But in this day and age, we need to re-center people and communities in creating new systems and services, what I call human-centered welfare.

We need to move away from the old, procedural, inadequate, and outdated models that support families like Ella's. We need models that address issues like loneliness.

The answer is relationships

Human relationships are the most important resource

thank you

(applause)

A year ago, we were invited to exhibit our work at the Swiss Embassy in Berlin.

I'm used to being invited, but this time I was really nervous.

The Swiss Embassy in Berlin is special

It's the only building in the government district that survived World War II, and it's right next to the Federal Chancellery.

No one is closer to Chancellor Angela Merkel than a Swiss diplomat.

(Laughter) Berlin's government district also has the "Reichstag", the Reichstag, and the Brandenburg Gate.

Germany is a developed country in terms of democracy, but the constitutional rights of its citizens are limited in the bureaucracy.

The right to assemble and demonstrate is restricted.

This is an interesting situation from an artist's point of view.

In order to exercise our right to participate and express ourselves, we always have to follow a certain order and are subject to certain constraints.

And it's only when you realize that you're relying on regulation that you can see it in a new light.

Existing rules shape how we perceive, how we act, how we live.

In other situations, this becomes extremely important.

Over the past two years, from the rooftops of the US and UK embassies, Secret Service agents have been tapping the entire district, including the mobile phone of German Chancellor Angela Merkel.

The British intelligence agency GCHQ's antenna is hidden behind a white cylindrical radar dome, and the American NSA's intelligence collection base is covered with a radio-passing curtain.

But how do we deal with disguised and invisible forces?

With my colleague Christoph Wachter at the invitation of the Swiss Embassy

I thought I would take advantage of this opportunity.

If someone's watching us, they must be listening to what we're talking about.

(Laughter) We installed a series of antennas on the roof of the Swiss embassy.

It's not as good as the American or British ones.

(Laughter) Ours was an antenna made out of empty cans, and it wasn't camouflaged, it was plain and in full view.

The Berlin Academy of Arts also participated in this project, so we put up another big antenna on the roof of that building, halfway between the NSA and the GCHQ intelligence gathering points.

(Laughter) I've never been so monitored while making installation art.

Helicopters circled overhead, cameras were recording every move, and security guards were patrolling the roof of the U.S. Embassy.

Government districts are subject to strict police orders, but there are no specific laws about digital communications.

So our installation was perfectly legal, and the Swiss ambassador told Chancellor Angela Merkel about it.

The title of the piece is “Can You Hear Me?”

(Laughter) With this set of antennas, we've created a free, open Wi-Fi network, where anyone with a Wi-Fi enabled device who wants to join can freely join and send messages to people listening on a particular frequency.

Text, voice chat, file sharing, anything can be sent anonymously.

And so many people sent

Over 15,000 messages have been sent.

Let's introduce some

"Hello World Hello Berlin Hello NSA Hello GCHQ"

"To NSA employees, do the right thing! Whistleblowing!"

"This is the NSA, we believe in God, we track all but God!!!!

(Laughter) "Anonymous is monitoring the NSA and GCHQ. We are part of the organization.

Wait, I'll shut it down." "This is the NSA's Achilles heel, the Open Network."

"To staff, what kind of lie are you going to tell your grandson?"

"@NSA Neighbors are noisy, attack with a drone"

(laughs) "Let's have sex, not cyber warfare."

We invited embassies and government agencies to our open network, and to our surprise, they joined us.

Files appeared on the network, including classified documents leaked from the Congressional Commission of Inquiry, revealing that the free exchange and discussion of critical information is becoming increasingly difficult for even members of parliament.

We also organized tours to experience and explore the distribution of power locally.

The tour visited the restricted area around the embassy to discuss the possibilities and importance of communication.

If we become aware of the distribution of power and the conditions of communication, it not only broadens our horizons, but also reveals the regulatory background that constrains our worldview and our social, political, and aesthetic conventions.

Let's see a working example

The fate of those who live in temporary housing on the outskirts of Paris is hidden and obscured.

this is a vicious cycle

Poverty, racism and exclusion are nothing new.

The new situation is one in which reality is hidden and humans are blinded in an era of overwhelming global communication and information exchange.

These temporary housing areas are illegal, and the people who live there don't have a chance to make their voices heard.

On the contrary, the risk of people coming out and exposing themselves only gives reason for further persecution, exclusion and oppression.

We were interested in how to find out about this hidden part.

I was looking for some connection and finally found it

That point of contact is not something digital, but something tangible, namely a hotel.

The name of the project is "Hotel Jelem".

Together with Roma (European minority) families, we built several hotels across Europe, in Freiburg, Germany, and in Montreuil, near Paris, in the Balkans.

all in a real hotel

can stay

but this is not a business

it's a symbol

If you apply for an invitation online, you'll live, eat and work for a few days at the Hotel Jelem, a Roma house.

Here, the Roma are not the travelers, but the visitors are the travelers.

The minority is the visitor, not the Roma clan.

The point is not to judge, but to look at the context that determines these diverse and seemingly irresolvable contradictions.

In this globalizing world, continents are getting closer and closer together.

The exchange of cultures, goods, and people continues unabated, but at the same time, the chasm between the privileged world and the world excluded from it only deepens.

recently went to australia

we were able to enter the country without any problems

Because I had a European passport, a visa and a plane ticket.

But asylum seekers who reach Australia by boat are either deported or sent to prison.

Australian authorities are covering up the capture of the boat and the disappearance of the defectors into the detention system.

These procedures are considered a covert military operation.

After making dramatic escapes from danger zones and war zones, men, women and children can be held without trial by the Australian government for years.

We managed to reach out and work with the asylum seekers in custody during our stay, despite the strict scrutiny and isolation.

It was against this backdrop that the installation was born, at the Queensland University of Technology gallery in Brisbane.

It looks like a simple installation

There are stylized compasses on the floor, each pointing in the direction of an immigration detention center, with the distance and facility name written on it.

But the exhibition took place in a form connected to the network.

Above the sign painted on the floor are the headphones.

Audiences will be able to speak directly to the refugees in the camp and have a personal conversation with them.

Because the exhibition was a safe environment, the exiles were free to talk about themselves and their personal stories and their circumstances without fear of consequences.

Audiences talked for hours about separated families, dramatic escapes from battlefields, attempted suicides, the fate of interned children.

Strong emotions were expressed, and many in the audience cried.

Some people visited the exhibition several times

it was a very powerful experience

Europe is now experiencing a large influx of immigrants.

The situation for asylum seekers has taken a turn for the worse due to conflicting policies and calls for a military response.

We also set up communication facilities in remote refugee camps in Switzerland and Greece.

To provide necessary information such as medical costs, legal information and advice.

These facilities are very important.

Thanks to the information on the Internet, we can be safe even on dangerous routes, but this information is censored, and it is becoming increasingly illegal to provide information.

And this leads to the homemade network, the antenna on the roof of the Swiss embassy in Berlin, and the "Can You Hear Me?" project.

Don't take unlimited internet connectivity for granted.

We should create our own connection environment and fight for the ideal of a world where people can connect equally.

This is essential if we are to overcome the silence, the division created by rival political forces.

Only by truly exposing ourselves to the transformative power of this experience can we overcome prejudice and marginalization.

thank you

(Applause) (Bruno Giussani) Thank you, Matthias.

Another member of the artist duo also came.

Christoph Wachter Come on stage

(Applause) First of all, let me give you a little detail.

"Jerem" has a special meaning in Romani.

Matthias Jude: Yes, "Jerem Jerem" is the official Roma anthem, which means "I have traveled a long way."

(Bruno) I would like to add to what I said earlier.

You two recently went to Lesvos and just returned two days ago, where thousands of refugees have been pouring into Greece for the past few months.

how was it? what did you do there?

(Christoph Wakter) Lesbos is one of the Greek islands that is closest to Turkey, and during our stay there were many exiles arriving in overcrowded inflatable boats, and after they landed they were abandoned.

they don't get much of the service

For example, we're not allowed to buy bus tickets or stay in hotels, so many families literally sleep on the streets.

So we set up a network to provide basic communication, and that's because we thought we needed to talk to refugees, not just talk about them.

And when you talk to them, you realize that this is a human problem, a problem of how they live and how they struggle to survive.

(Bruno) And you're allowing them to talk, too.

Thank you for joining us.

Matthias, thank you for speaking with us.

(applause)

My home country, Egypt, is also called Umm al-Dunya, "the mother of the world."

This rich country is full of tales of rebellion, stories of civilization's rise and fall, and religious, ethnic, cultural and linguistic diversity.

Growing up in this environment, I developed a strong belief in the power of storytelling.

In my search for a way to tell my story, I found graphic design.

I would like to introduce you to my project, which is to bring the Arabic language to life through graphic design.

Before that, let's start with the motives.

I believe graphic design has the power to change the world.

At least in my hometown of Cairo, I helped overthrow two dictators.

As you can see from the pictures, the power and potential of graphic design as a tool for positive change is absolutely enormous.

The Egyptian revolution of 2011 was also a grassroots design revolution.

everyone became a creator

People became true designers, and in one night Cairo was filled with posters, billboards and graffiti.

Visual communication was a much more eloquent medium than words, for more than 90 million people have had their freedom of speech suppressed for nearly 30 years.

It is this political and social oppression, combined with decades of colonialism and mis-education, that has gradually eroded the importance of the Arabic script in the region.

All these countries used Arabic

now only green and blue countries

In short, the Arabic script is in decline.

As the world becomes more globalized, there are fears that post-colonial Arab countries will lose the ability to communicate using the Arabic script.

When I was studying for a master's degree in Italy, I saw Arabic letters.

I found myself nostalgic for chewing on the meaning

So one day, I searched for Arabic books in one of the largest libraries in Italy.

To my surprise, it was these books that were classified as "Arabic/Middle Eastern."

(Laughter) Fear, terrorism, destruction—

ISIS (so-called Islamic State)

It pained me to wonder, even from a literary point of view, how the Arabic-speaking world is viewed.

World-famous writers asked themselves what happened to Naguib Mahfouz and Khalil Gibran? Great poets like Mutanabbi and Nizar Kabani?

please think about it

The cultural product of an entire region of the world is so rich and so diverse that it's seen as superfluous, if not completely ignored.

A region's cultural products are being robbed of the opportunity to have real influence in the world's media and in contemporary social discourse.

It reminded me of my belief that design can change the world.

I just want someone to see my work, feel something, and find a connection.

this was the beginning

I wondered how the world could see Arabic-speaking peoples as equal fellow human beings instead of evil terrorists.

How can we preserve the honor of the Arabic script and share it with people of other cultures?

And this is where I had an epiphany: what if I combined the symbol of innocence with the symbol of my Arab identity?

maybe people can relate

What could be more pure, innocent and fun than Lego?

A universal children's toy

You can play with Legos, build them, and imagine endless possibilities.

For me, finding a bilingual way to teach Arabic was a breakthrough, because effective communication and education is the path to a more tolerant community.

But the Arabic and Latin scripts not only represent different worlds, they also pose technical challenges to both the Eastern and Western worlds on a daily basis.

Arabic and Latin scripts differ in many ways, but the main differences are:

Both move the brush up and down, but the lines are completely different.

The Arabic script is written more calligraphically, and in Arabic, the connection of letters is important, and to represent a word, the letters must be almost connected.

The use of punctuation marks and diacritics is also completely different.

But most importantly, Arabic doesn't have capital letters.

Instead, each letter has four glyphs: the initial, the middle, the single, and the last.

I want to introduce Arabic to children and foreign speakers, but above all I want to help refugees integrate into their new homes, and that's why I wanted to create two-way communication in a bilingual learning system.

I named it "Let's play together"

I wanted to use Lego to create a fun and engaging way to learn Modern Standard Arabic.

It says "Together" and "Let's play" here.

Each color-coded area is a letter

As you can see, the letters are described in terms of form, sound and usage, and they are also written in Latin script.

We've put them all together in a fun pocket book, and we've also included a dictionary of 29 Arabic letters, 4 glyphs, and 400 words.

The page looks like this

The letters themselves and their transcriptions in Latin letters are explained below.

Let us show you the production process

I made the letters in my tiny studio in Florence.

I took a picture of each letter, retouched all the images, and chose the right background color and typeface.

In the end, we had a set of characters, 29 characters each with four glyphs.

I made 116 characters in just one week.

I think information can and should be in a fun and compact way.

This is the finished book, which I hope to eventually publish and translate into as many languages ​​as possible in the world, to make teaching and learning Arabic fun, easy and accessible all over the world.

With this book, I want to protect the beautiful letters of my motherland.

(Applause) Thank you.

This project was like a visual meditation, like a Sufi dance, a prayer for a better world.

Two languages ​​made up of the same blocks

Lego is just a metaphor

Because we're all made of the same parts, we can envision a future in which all the walls that separate us fall apart.

No matter how ugly the world around us becomes, No matter how frustrated I am that so many books about the terrorist group ISIS continue to be published instead of the ancient Egyptian goddess Isis, I will continue to create a colorful world.

Shukran means "thank you"

(Applause) Thank you, thank you.

thank you

(Guitar performance begins) (Performance ends) (Applause) (Distortion guitar performance) (Performance ends) (Applause) (Ambient guitar performance begins) (Performance ends) (Applause)

Here is the most amazing animal on earth-

It's tapir

This is baby tapir, the cutest baby in the animal kingdom

(laughs)

no rivals

I've dedicated the last 20 years to researching and conserving tapirs in Brazil, and it's been an amazing time.

But now I'm scratching my head

I'm asking myself, what could I have done to protect this animal that I love so much?

Are we really working effectively to protect the survival of our species?

are you doing enough

So the question is, are our studies contributing to the conservation of tapirs, or are we just documenting their journey to extinction?

The world is facing a variety of nature conservation crises.

This is a well-known fact and is reported daily.

Ecosystems such as tropical rainforests are being destroyed, and climate change is also happening.

This is the American tapir, the species I study, the largest land mammal in South America.

very big and powerful

A grown tapir can weigh up to 300 kilograms.

About half the horse's weight

it's a wonderful creature

Tapirs, which are mostly found in tropical rainforests such as the Amazon, require a fairly large range of habitat to get what they need to reproduce and survive.

But that environment is now being destroyed, and in some areas tapirs have actually been driven out.

It's really, really unfortunate, because tapirs are also very important to the other organisms that live there.

tapirs are herbivores

Half of their diet consists of fruit, and tapirs that eat fruit spread their seeds by moving around their habitat and pooping.

Tapirs play such an important role in shaping and maintaining the structure and diversity of forests, which is why tapirs are known as "forest gardeners."

would be great

If you think about it that way, you can see how severely the tapir extinction would affect biodiversity.

I started this job in 1996, when I was a young man, fresh out of college, in a pioneering research and conservation program.

There was almost no information about tapirs, and the difficulty of observing and studying tapirs was a major factor.

Tapirs are nocturnal, solitary, and very elusive animals, so we started by gathering some basic information about tapirs.

What do conservationists do in the first place?

I need data first

I have to do a field survey

We need long-term data collection to back up conservation efforts. I mentioned earlier that tapir research is very difficult, so we have to rely on indirect research methods at this point.

They capture tapirs, anesthetize them, attach them to GPS-enabled collars, and track their movements, a technique many conservationists around the world use.

By doing this, we can learn a lot about how tapirs use space, how they move on land, what habitats they prefer, and much more.

And we have to spread what we know

Tell people about Baku and let them know how important Baku is.

It's amazing how many people in the world don't know what a tapir is.

In fact, many people think this is a tapir.

but this is not a bug

(Laughter) It's a giant anteater.

Tapirs don't eat ants, absolutely

The next thing we need to do is provide training -- capacity building.

It's also our responsibility to train future conservationists.

Now that we're losing some conservation battles, we need more people doing this work. We need people who have the skills and the drive to pull this off.

At the end of the day, conservationists have to use the data they collect, they have to use the knowledge they have, and they have to do real conservation work.

We started our tapir conservation program in the Atlantic Forest, which is located in the eastern part of Brazil, one of the most biome-endangered areas.

Destruction of the Atlantic Forest began in the early 1500s, when the first Portuguese arrived in Brazil and European colonization of eastern South America began.

And the forest has been almost wiped out for timber, agriculture, cattle ranching, and urban development, and now only 7 percent of the Atlantic Forest remains.

Tapirs have been identified as very small and isolated colonies.

In the Atlantic Forest, tapirs were found to migrate between pastures and farmlands, across clearings, and from one forest to another.

With that in mind, we took the approach of using tapir data to connect patches of forest to identify potential wildlife pathways, and connect those habitats so that tapirs and many other animals can safely traverse the land.

In 2008, after 12 years of work in the Atlantic Forest, we started tapir conservation in the Pantanal, in western Brazil, near the borders of Bolivia and Paraguay.

It's one of the largest freshwater floodplains in the world.

Working in the Pantanal was very refreshing, because the area had a large, healthy population of tapirs, and we were able to study tapirs in the most natural conditions we've ever had, where there's little threat of any kind.

In addition to GPS collars, we also use another technology for observing the Pantanal: camera traps.

It uses a camera with a motion sensor that automatically takes pictures when an animal passes in front of it.

This amazing instrument has allowed us to gather valuable information about the breeding and social organization of tapirs, which is a very important piece of the puzzle in thinking about tapir conservation strategies.

And now, in 2015, we're trying to expand our activities again, to the Campo Cerrado, an open grassland with only shrubs in central Brazil.

Today, this region is at the center of my country's economic development, and natural habitats and wildlife are being rapidly destroyed by a variety of factors, including the same grazing, large-scale plantations of sugar cane and soybeans, poaching, traffic accidents, and many more.

But tapir managed to survive, and that's a big hope for me.

But when I started this new initiative at Campo Cerrado, I felt like I got a slap in the face.

If you drive around here, you'll see dead tapirs along the highway, tapirs wandering among the sugar cane plantations that shouldn't be there, and kids know what tapir meat tastes like because my family poachs it and eats it.

After witnessing the situation in Campo Cerrado, I realized that time was running out.

I'm against the tide

We've spent the last 20 years working hard to save the tapir, but we still have a lot of work to do to save it from extinction.

We have to find solutions to all these problems

Really-

In the world of nature conservation, we've reached the point where we can't do anything with our old ways of thinking.

We have to be more creative than we are now.

I mentioned that traffic accidents are a big problem for tapirs in Campo Cerrado, and to combat this, I came up with the idea of ​​adding reflectors to the GPS collars that tapirs wear.

This is the reflector that we put on to avoid crashes with big trucks.

Tapirs cross the highway after dark, so hopefully this reflector will shine in the car's headlights, alerting drivers to tapirs crossing the road, and alleviating this problem a little.

Now it's just an idea out of common sense

I don't know what's going to happen, but eventually we'll see if we can reduce traffic accidents.

But maybe what we need now is this

I struggle with these issues in my head every day, but I have an appointment with Baku.

From the bottom of my heart, I believe that it is my mission to protect tapirs.

this is my passion

and i'm not alone

I have a huge circle of supporters, so I won't stand still.

I will probably continue doing this for the rest of my life.

And this work is for my namesake Patricia, the first tapir we caught and monitored in the Atlantic Forest many years ago, and for Rita and her baby Vincent of the Pantanal.

And Ted - for the baby tapir I met in the Pantanal again last December.

Also, for the hundreds of tapirs I've been lucky enough to meet, and the many tapirs I'm sure I'll meet in the future, I'll continue this activity.

It's an animal that deserves to be cared for

they need me - they need us

We humans deserve a world where we can step outside and see tapirs and many other beautiful creatures and benefit from them, now and always.

thank you

(applause)

In my first public presentation, I'd like to show you a system that can transmit video from a standard, readily available LED to a solar cell connected to a computer.

Communication is by light only, without using Wi-Fi technology.

What does that mean? You might think that

The gist of it is this: we're going to broaden the adoption of Internet technology, bridge the digital divide, and expand the Internet of Things, or Internet of Things, connectivity to tens of billions of devices.

In my opinion, this kind of expansion of the Internet can only be possible if it is energy neutral.

It's about maximizing the use of existing infrastructure.

This is where you will find opportunities for solar cells and LEDs.

At TED in 2011, I first showed you Li-Fi, high-performance optical communication technology.

Li-Fi uses readily available LEDs to safely and reliably transmit data at incredible speeds.

Data is conveyed by light by encoding it as subtle changes in brightness.

If you look around you, you'll see lots of LEDs, which means there's a lot of infrastructure for Li-Fi communication.

Until now, we've used a special device, a small optical receiver, to receive the coded signal.

I wanted to use the existing infrastructure to receive Li-Fi optical signals.

That's why we turned our attention to solar cells and solar panels.

Solar cells absorb light and convert it into electrical energy.

This is how solar cells can charge mobile phones

Now, the data is encoded as subtle changes in the brightness of the LEDs, so a slight change in the incident light will result in a subtle change in the energy produced by the solar cell.

It means that there's a basic mechanism that uses solar cells to receive data embedded in the light, and that the fluctuations in the energy produced are related to the data that's transmitted.

The question is, can we detect extremely fast and subtle variations in light, such as those transmitted by LEDs?

the answer is yes it is possible

In the laboratory, we were able to receive 50 megabits of data per second using standard, readily available solar cells.

That's faster than most broadband connections today.

Let's see it in action

This box contains a standard, readily available LED lamp.

Here's a standard, readily available solar cell connected to a laptop computer.

There are also devices that visualize the energy produced by solar cells.

This device is still showing some input

That's because solar cells harvest ambient light to produce energy.

So first, let's switch on the lamp, just switch it on for a while, and you'll see the needle on the receiver move to the right.

Solar cells generate energy from artificial light sources

If you turn off the switch, the needle will return to its original state

If you flip the switch again...

We were able to generate energy with solar cells

Now let's play the video

I hit the play button

LED lamps signal moving images by changing the brightness of the light very slightly, but the human eye can't detect this, because the rate of change is too fast.

In order to prove that communication is carried out by this mechanism, let's block the light from the solar cell.

And you immediately know that the energy production has stopped, and the video has stopped playing.

Remove the obstruction and the video will resume playing.

(Applause) Let's try again.

No video playback, no energy production.

This indicates that the solar cell is acting as a receiver.

Now let's imagine a foggy scene with LED lamps as street lights.

I brought a handkerchief to simulate the fog.

(Laughter) If you cover the solar cell with a handkerchief,

As you can see, the energy drops, as expected, but the video continues to play without stopping.

So, even with the cover on, enough light can pass through the handkerchief and reach the solar cell, which can read the information and play video -- in this case, HD video.

The point is that solar cells perform their basic function of producing energy while also acting as receivers for high-speed wireless communications by signals embedded in light.

So we can use the solar cells on the roof of the hut as a broadband receiver that picks up the signal from a laser station on a nearby hill, which is actually a streetlight.

Any type of solar cell

It could be a transparent solar cell embedded in a window, or it could be a solar cell attached to a fixture on a street corner, or it could be a solar cell attached to the billions of devices like these that make up the Internet of Things.

Simply put, charging a device like this on a regular basis is a pain, and changing batteries every few months is even worse.

As I said earlier, this is the first time we've made this public.

It's still a lab trial, but a prototype.

Our team believes we can probably bring it to market within two to three years.

We hope that we can bridge the digital divide and help connect billions of devices to the Internet.

And it doesn't cause an explosion in energy consumption, thanks to solar cells, which have the opposite effect.

Thank you

(applause)

Every time I get a chance to talk to my students at school, I hear them say, "Why are you searching Google?

Why choose Google as your search engine? ”

Mysteriously, the answer that comes back is always these three

The first is "because it searches well." That's the answer. I use Google for the same reason.

Number two: "I don't know any other search engine."

It's a shame, and most of the time I say, "Go google for 'search engine' and you'll find something else interesting."

And the third thing that really comes to mind is that there's always someone who's ready to raise their hand and say, "Because Google always gives you the best and fairest results."

Absolutely always get the best and fair search results—

Every time I hear this, it makes me sick as a human being, even in the digital age, even though I know that people love and care about Google because they believe and think it's fair search results.

A fair outcome is philosophically highly unlikely. Let me explain why.

But first, let me tell you a little bit about the basic principles of search, which people tend to forget.

When you search for something on Google, the first thing you should think about is, "Do you want specific facts?"

where is the capital of france

What are the constituent elements of a water molecule

In this case, please do a Google search.

Not even a scientist can prove that the answer is "London" and "H30".

there is no conspiracy here

All over the world, there is some agreement on the answer to these individual facts.

But what if we could complicate the question just a little bit and say, "Why is there a Palestinian problem?"

No longer are we looking for just one "fact", we're looking for "knowledge", and knowledge is much more complex and nuanced.

To get that kind of knowledge, you have to collect 10, 20, or 100 facts, own them, and say, "These are all true."

But people, regardless of age, race, or sexual orientation, have different values.

So it's like, "Yes, this is true, but this is more important."

And here's where it gets interesting, because we show our humanity.

we argue with each other and start forming a society

To really get an answer, you first sift through all the facts -- your friends, your neighbors, your parents, your children, your co-workers, and through the newspapers and magazines -- until you get to the real knowledge. This is where search engines don't help much.

I told you earlier that I would give you an example of why it's hard to have truly pure, objective knowledge.

I'll do some simple searches first.

First, Michelle Obama, the first lady of the United States.

Click "Image"

As you can see, it's working fine.

Well that's a perfect search result

Only Michelle in the photo, not even the president.

what's going on

very simple

Google has a lot of brains, but in a nutshell, they're looking at two things.

One is the caption below each website photo.

If it says "Michelle Obama" under the photo

it's most likely a picture of her

The next thing Google looks at is the photo file, the name of the file that was uploaded to the website.

For the file "MichellObama.jpeg"

There's no such thing as a photo of Clint Eastwood.

Using these two clues, the search result looks like this - usually

Now, in 2009, Michelle Obama was the target of a racist attack, insulted through search results.

A photo has gone viral and is taking the internet by storm, showing her face distorted to look like a monkey.

The photo was posted all over the internet

And it was posted online in a very intentional way so that it would appear at the top of search results.

The caption would always say, "Michelle Obama," and the filename would be something like "MichelleObama.jpeg."

Yes, for manipulating search results.

sure it succeeded

A Google image search for "Michelle Obama" in 2009 yielded the top results for a photo transformed into a monkey face.

Now, search results are self-cleaning, and that's the beauty of it, because Google measures relevance every hour of every day.

But Google didn't sit still at the time, saying, "This is racist, it's a bad search result, and I need to clean it up myself.

I'm going to write a program and fix it,' I thought, and I did.

I don't think any of you think this is a bad thing.

i don't think so

A little over two years later, the most Googled person in the world, Anders Anders Berin Breivik, did this.

22nd July 2011 - A tragic day in Norwegian history

This man, a terrorist, blew up a government building here in Oslo, Norway, within walking distance of the venue, and then he went to Utoya Island and shot and killed children.

Nearly 80 lives were lost that day.

In many cases, this act of terrorism is said to have had two stages: the bombing of the building and the shooting of the child.

actually it's different

There were three stages.

He blew up buildings, shot children, and waited for the world to Google him.

He had meticulously prepared for all three stages.

His intentions were quickly spotted by Nick Lindqvist, a Swedish web developer and search engine optimization expert from Stockholm.

Nick, who is also very political himself, has posted on his blog and through social media such as Facebook.

I appealed to everyone, "If there's one thing this guy wants right now, it's to control his image.

Let's all break it down

Let's join forces in civilized society to protest against his actions and insult him through search results."

But how?

He called on people to search the Internet for pictures of roadside dog poop -- search for pictures of roadside dog poop -- and put it in their feeds, on their websites, on their blogs.

And then I always put the name of the terrorist in the caption and name the file "Breivik.jpeg."

Tell Google that this is the face of a terrorist.

It was effective

Two years after Michelle Obama, Anders Behrin Breivik's search results were manipulated.

In the weeks after July 22nd, a Google image search for him from Sweden led to a picture of dog droppings at the top of the results, a small protest.

Oddly enough, Google didn't intervene this time.

We didn't try to artificially clean up the search results.

Now the hard question is, what is the difference between these two phenomena?

Is what happened to Michelle Obama different from what happened to Annesh?

Of course not

Exactly the same thing, but Google intervened in one and not the other.

I wonder why

That's because Michelle Obama is a respectable person, and Anders Behrin Breivik is a mean person.

As you can see

This is where people's evaluations come into play. There is only one person in the world who has the power to decide who matters.

"I love you, I hate you

you believe you don't believe

you are right you are wrong you are truth you are lies

You're Obama and you're Breivik."

this is what power is

So remember, behind any algorithm, there's always a human behind it. Each human has their own set of values, and you can't programmatically eliminate their influence.

I want to send this message not just to Google, but to everyone in the world who puts their trust in the program.

be aware of their own prejudices

We must be aware that we are human and we must take responsibility

I want to tell you this because I believe that the time has come when we need to strengthen our unity once again, the connection between humanity and technology.

Let's make this bond stronger than it is now.

At the very least, it should be borne in mind that fair and clean search results, which sound pleasantly seductive, are, and always will be, a myth.

thank you

(applause)

I am very happy to be here

It's an honor to be invited. Thank you very much.

I would like to talk about things that interest me, but unfortunately the things that interest me are the things that other people don't.

First, my title is astronomer.

I'd like to talk about astronomical research, such as radiative transfer in the non-gray atmosphere and polarization in the upper atmosphere of Jupiter -- there are enough people in the bus shelter to be interested.

so i won't talk about this

(Laughter) You might also find it interesting that in 1986 and 1987, hackers broke into computers at the Lawrence Berkeley Lab.

I caught them, and they were working for the Soviet KGB at the time, and they were selling stolen information.

I'd be happy to hear that, but 20 years later, computer security is

frankly i think it's boring

It's annoying...

I...if you do something first, it's science.

the second is called engineering

after that it's just technology

I'm a scientist, so once I do something, then I do something else.

so i won't talk about this

I wrote the obvious in the first book, "The Internet is an Empty Cave"...or maybe the second...I'm not going to tell you what I wrote in that book, or that schools shouldn't use computers.

There's this crazy idea that there should be more computers in schools.

No way in my opinion!

should be excluded from school and not allowed in

I would love to talk about this, but it's so obvious to anyone who walks in and out of a fourth grade classroom that I wouldn't even bother to talk about it, but I could be wrong about this, or anything else.

So don't read what I write

I'm sure you're wrong

I wrote the outline of the lecture about five minutes ago.

(He shows me a note written on the palm of his hand -- Laughter.) When you look at this, the main topic written on his thumb is about the future.

Wouldn't it be nice to talk about the future?

From my point of view, it's strange to ask this gray-haired man about the future.

In fact, if you want to know what the future will look like, if you really want to know about the future, don't ask the engineers, the scientists, the physicists.

Don't ask people who write code

If you want to know what society will be like in 20 years, ask your kindergarten teacher.

they know

It doesn't matter who you are. Ask someone with a lot of experience.

They know what society will be like in future generations.

I don't know, and I don't think most people who talk about what the future holds will know.

We can certainly imagine new and cool things to come.

But if you ask me, the future is not about things.

I think about what society is going to look like. Today's kids are incredibly good at texting, they spend a lot of time looking at screens, but they don't go bowling with anyone.

Change is happening outside of software.

but i won't talk about it

I'd love to talk to you because it must be fun I'll tell you what I'm doing What am I doing now?

Yeah, there's one more thing I want to talk about this this this (shows ring finger - lol)

Can you see it? I want to talk to you about things that only have one side.

I really want to talk to you about the one-sided thing

I like Moebius strips, but that's not all. There aren't many people in the world who actually make Klein vases.

you may not believe it right away

This is Klein's jar

I'm sure those of you who know him will roll his eyes and say he's stunned.

A vase with only one side, the inside is the outside

No Volume No Orientation

has great qualities

If you glue the edges of the Mobius strips together, you get a Klein bottle, and I make it out of glass.

I'd like to talk about this, but I don't have much to say... (Drinks from Chris' half-drink bottle) (Laughter) (Chris: I've got a cold) By the way, the D in TED is of course the D in design.

Just two weeks ago, I made a small, medium, and large Klein jar for sale.

This is it.

This is Klein's wine bottle. Four dimensions can't hold liquids, but the universe we live in has only three dimensions, so it can.

Because it's three-dimensional, you can put liquids in it.

would be so cool

took a month

I really want to talk about topology, but I won't talk about it.

(Takes a sip from the bottle and looks at the label quizzically - Laughter.) Instead, I'll tell you about my mother, who passed away last summer.

My mother - like all mothers do - collected pictures of me.

can you show this

I was looking through my mother's album, and there were a lot of pictures of me in 1969, sitting in front of a lot of dials.

When I saw this, I couldn't help but scream, oh, when I was working in an electronic music studio!

As a technician, I worked at the State University of New York at Buffalo, an electronic music studio, repairing and maintaining equipment.

Wow! It's a time machine! Oh my god

brought back to the past

then i found another photo

Of course I'm here

This is Robert Moog, the inventor of the Moog synthesizer, who passed away last August.

Robert Moog is a generous and kind man and a very good engineer.

He was a musician, and he took the time to teach me, just starting college.

I came down from Trumansburg to teach, not just Moog synthesizers, but I was sitting here studying physics at the time, 1969-71.

I studied physics, he said, "That's good.

If you're doing physics, don't get into electronic music."

He's my teacher. He came and spent hours with me.

He also wrote me a letter of recommendation for entering graduate school.

That's my bicycle in the picture over there

I realized this photo was taken in my friend's room.

Robert Moog brought a lot of equipment to show me and Greg Flint.

We sat down and talked about Fourier transforms, Bessel functions, modulation transfer functions, things like that.

It's a loss for all of us that Robert died last summer.

All modern musicians are heavily influenced by Robert Moog

(Applause) I'm just going to talk about what we're going to do, and I hope you can see this -- it's a distorted sine wave, almost a triangular wave, that's what I'm seeing on my Hewlett-Packard oscilloscope.

Here we are (indicating letters written on middle finger)

About children Is it okay to talk about children?

Look, we're supposed to be talking about children here.

That's what I want to talk about.My head isn't big enough.

So think small and act small

The best way for me to do something is to do it very small.

So I got my PhD over here, got my degree over there, and so on.

About a year ago, I told my teachers at school that

Then they said, "Then why don't you come and teach me?"

I said, "Yes, I do. I teach graduate school. I teach undergraduate."

"No," they say, "if you care about children, you should be on the front lines.

Shouldn't we actually try it?"

You're right, I teach eighth graders four days a week.

Instead of going to teach from time to time

I am going to work

(Applause) No, no, this isn't about getting applause.

I strongly believe that this is what each of you should do.

Instead of coming to class from time to time

I teach exactly one week, well, three quarters, but that's enough.

I said in science class, "I teach you college-level physics.

without parsing

It's okay if you don't know trigonometric functions

But I need 8th grade algebra, and I'm going to do a serious experiment.

Don't tell me to open chapter 7 and solve the weird problem there

Do real physics."

that's one of the things i do now

(high beep) Before I flipped this switch, something I did in a classroom about three weeks ago was to use a lens to measure the speed of light.

My students in El Salito, with my help, of course, used their worn-out oscilloscopes to measure the speed of light.

25 percent error. How many eighth graders do you know who measured the speed of light?

In addition to that, we also measured the speed of sound.

I want to measure the speed of light here.

I've started preparations. With a little ingenuity, the speed of light

I prepared to measure it, but when I tried to do it here, it turned out that the preparation alone would take 10 minutes!

I don't have time for that

Maybe next time we'll do it at the speed of light!

But until then, let's measure the speed of sound!

A simple way to measure the speed of sound is to bounce the sound off something and look for an echo.

But... my student Ariel said, "Can't you use the wave equation to measure the speed of light?"

We all know that in the wave equation, frequency times wavelength is a constant.

The higher the frequency, the shorter the wavelength. The longer the wavelength, the lower the frequency.

it's simple physics

You learned it in your second year of junior high school, didn't you?

What we don't teach in 8th grade physics, which should really be taught, is that when you multiply the frequency of sound or light by the wavelength, you get a constant.

That constant is the speed of sound (or light)

So if you want to measure the speed of sound, all you need to know is frequency, and that's easy.

here is the frequency counter

Let's set it to A, which is two higher

Now you know the frequency

It's 1.76 kilohertz. Let's measure that wavelength.

I'm going to put out another beam. The bottom beam is my speaking voice.

When I speak, it appears on the screen

If you put it here and move it away from the source, you'll see it move in a spiral.

Move it and stack it on another pile like this

(Laughter) If you're a physicist, you're probably going to roll your eyes.

From here to here is the length of the sound wave

Put down the tape measure and move it from here to here.

I moved the mic... 20 centimeters.

It's 0.2 meters from here

let's go back to elmo

The frequency is 1.76 kilohertz 1760 hertz

wavelength is 0.2 meters

let's do the math

(Takes out slide rule - laughs - applause) 1.76 times 0.2 is 352 meters per second here.

I looked it up in a book and it's 343 to be exact.

With this shoddy setup and this bad drink, I measured the speed of sound.

And that's the story I wanted to tell you the most.

Let's go back to my photos from a million years ago

This was 1971, during the Vietnam War, and I thought, "Oh my God!"

I was studying physics in Landau-Lipschitz and Resnick-Halliday.

I returned home for the midterm exam

There was a riot on campus, a riot!

No more Elmo, there's been a riot on campus, and the police are chasing me.

I was walking around campus, and a police officer looked at me and said, "Hey, are you a student?"

Take out your gun and bang!

A tear gas grenade the size of a Pepsi can grazed the side of my head, whoosh!

I couldn't breathe from the tear gas

The police are chasing you with rifles

I'm going to punch you in the head

"Don't run away!"

I ran frantically across campus and crawled into Hayes Hall.

A building with a bell tower

the cops are chasing

1st floor 2nd floor 3rd floor

I will follow

I came to the entrance of the bell tower

I closed the door and climbed up past the pendulum.

I thought, oh, the square root of the length is proportional to the period. (Laughter) I keep climbing.

I came to the back of the dial

tic tac tic tac

I was inside, so the clock is running backwards.

And I thought about Lorentz contraction and Einstein's theory of relativity.

I went up and climbed a wooden ladder in the back.

When I got to the top, it was a dome-shaped turret.

It's a dome about 3 meters

I looked out and saw the police beat the students in the head, shoot tear gas, and the students threw bricks.

And I thought, what am I doing here?

Why am I here? Then I remembered what my high school English teacher said

When you cast the bell, you engrave a signature.

So I wiped the pigeon poop off the bell and took a look.

thinking why am i here

Let me tell you the words engraved on the bell tower of Hayes Hall, "There is only one truth.

Under the light of truth, may our efforts in science and faith bring steady progress to mankind, From darkness to light From narrow to broad-minded From prejudice to tolerance

The voices of life gather together and call us to learn

Thank you very much

Jenni Zhang: When I first told my parents that I was gay, the first thing they said was, "I'll take you back to Taiwan."

(Laughter) My parents cultivated my sexual orientation in America.

The deviant conception of the West has corrupted me.

I actually think you're right

Of course, there are gays in Asia, just as there are gays everywhere in the world.

And yet, plain and simple, "I'm gay, this is my partner, and I'm proud of who we are."

If you grew up outside of Taiwan or the West, would you have found happy and prosperous LGBT people?

Lisa: I think the same

As an HIV social worker in San Francisco, I met many gay immigrants.

They say they were persecuted in their homeland because they were gay, and that's why they fled to America.

I know how they have been oppressed

After 10 years in this business, I needed a more positive story for myself.

The world is still imperfect, but perhaps not all gay stories are tragic.

Jenny: As a couple, we wanted to hear stories of hope.

So I embarked on a mission to travel around the world, to find people who I call "supergays."

(Laughter) It's about every single LGBT person around the world doing amazing things.

They're brave, they're resilient, and they're especially proud of the way they live their lives.

The kind of person I aspire to be

Our plan was to tell the world their story through video.

Lisa: There was just one problem

We didn't have any reporting or filmmaking experience.

(Laughter) I didn't even know where Supergay was, and I had to believe that I would find him wherever I went.

And I picked 15 countries in Asia, Africa, and South America where LGBT rights differ from those in the West.

I bought a small camcorder and ordered a book on how to make a documentary. (Laughter) You know everything these days.

Jenni: My first trip was to Nepal

Despite rampant poverty, a decade-long civil war and a recent devastating earthquake, Nepal has made significant progress in its fight for equality.

A key figure in that movement is Bhumika Shrestha.

A beautiful, strong, transgender woman, Bumika was expelled from school and imprisoned because of gender representation.

But in 2007, Bhumika and Nepal's LGBT rights group asked Nepal's Supreme Court to protect LGBT people from discrimination.

This is Bumika (Video) Bumika: What am I proud of?

i am transgender

i am proud of my life

On December 21, 2007, the Supreme Court ruled that the government of Nepal should grant transgender identity cards and allow same-sex marriage.

Lisa: In everyday life, Bumika is very confident.

When something as trivial as using a public restroom doesn't fit a rigid definition of gender, it becomes a big problem.

During my travels in Asia, I used to surprise other women in public restrooms.

I wasn't used to seeing people like me.

I needed a strategy just to calm down and go to the bathroom.

(Laughter) So every time I went into the bathroom, I tried to show my feminine side by baring my chest and being as unguarded as possible.

I even waved hello, so that my feminine voice would be heard.

I'm so sick of it but this is me

i can't be anything else

Jenny: After Nepal, I traveled to India.

India has no homophobia in Hindu society.

But it's also a society with deep-seated patriarchy that rejects anything that disrupts the hierarchy of men and women.

When I spoke with an activist, he said, "Empowerment is about ensuring equal rights for men and women, where women's place in society is established.

By doing so, we will also establish the status of LGBT people.”

Lisa: That's where we met Prince Manvandra.

He is the world's first publicly gay prince.

The prince became famous internationally when he appeared on The Oprah Winfrey Show.

His parents disowned the prince and accused him of greatly dishonoring the royal family.

We sat down with Prince Manvandra and asked him why he came out publicly.

Here is the Prince (Video) Prince Manvendra: I felt a strong need to break the prejudice and discrimination that existed in society.

So I decided to openly come out about myself.

Whether gay, lesbian, transgender, bisexual, or of any sexual minority, we all need to come together and fight for our rights.

Gay rights are not earned in courts, but in people's hearts and minds.

Jenny: While I was getting my hair cut, the hairdresser asked me, "Do you have a husband?"

This is an embarrassing question that I've been asked many times by locals on my travels.

When I explained to her that I was with a woman and not a man, she didn't believe me, and she asked me all sorts of things, "How was your parents' reaction? Aren't you sad that you'll never have children?"

I said, "Life has no limits, and Lisa and I are going to start a family one day."

After all, she seems to have dismissed me as a crazy Westerner.

She couldn't imagine such a phenomenon that could happen in her own country.

Until I showed her a photo of a "super gay" I interviewed in India.

She knew Prince Manvendera on TV, and other hairdressers who were interested in meeting him came to hear my story.

(Laughter) And then one afternoon, I had the opportunity to introduce all the beauty salons to the social change that was happening in their country.

Lisa: We moved from India to East Africa, a region known for being bigoted towards LGBT people.

In Kenya, 89% of people who tell their families are disowned.

Homosexuality is a crime leading to imprisonment.

In Kenya, I met the soft-spoken David Clear.

He had a big mission to work for the poor and improve his own government.

So I decided to run for parliament.

He became Kenya's first openly gay parliamentary candidate.

David ran a political campaign without denying himself for who he was.

We feared for his safety because he started receiving death threats.

(Video) David Clear: I was really scared then, because he actually said, "I'm going to kill you."

Yes, people like that are everywhere, and they think they're doing their religious duty.

Jenny: David wasn't ashamed of who he was.

Even in the face of threat, he remained who he really was.

Lisa: The perfect contrast is Argentina.

Argentina has 92% of its population Catholics.

But Argentina has LGBT laws that are more progressive than here in the United States.

In 2010, Argentina became the first country in Latin America to have LGBT laws and the 10th country in the world to accept the freedom to marry.

It was there that I met Maria Rashid.

Maria was the driving force behind the movement

Maria Rashid: (Spanish) I always said, Marriage freedom isn't just for married couples.

It's for the many people who, even if they never get married, get the approval of their colleagues, their families, their neighbors, and receive the message of national equality.

I'm very proud of Argentina because today's Argentina is a model of equality.

And I'm sure in the near future the whole world will have the same rights.

Jenny: I hope my parents can see what we learned when we visited our ancestral land.

Because this is where we met. (Video) 1, 2, 3, gays Welcome to Shanghai!

(Laughter) A community of beautiful young Chinese LGBT people.

Of course, they have their own conflicts

but I'm fighting it

In Shanghai, I had the opportunity to talk to a group of local lesbians, and in my poor Mandarin, we talked about ourselves.

Every time I take the subway in Taipei, I see a lesbian couple holding hands.

I just found out that Asia's biggest LGBT event was just a few blocks away from where my grandparents live.

I hope my parents notice

Lisa: By the end of our "not-so-straight" world trip (Laughter), we had traveled 800,000 kilometers and shot 120 hours of documentary film.

I traveled to 15 countries and interviewed 50 super gay men.

It wasn't hard to find them

Jenny: Yes, tragedy is still happening on the uneven road to equality.

Remember, homosexuality is still a crime in 75 countries.

But everywhere in the world there are also stories of hope and courage, but everywhere in the world there are also stories of hope and courage.

The most important thing we learned from this trip is that equality is not a Western story.

Lisa: One of the key ingredients of this equality movement is the momentum, the momentum that more people will embrace all individuality, the momentum that will use whatever opportunity they have to change their world, and the momentum that more countries will find models of equality for each other.

When Nepal took action against LGBT discrimination, India took the move further.

When Argentina embraced marriage equality, Uruguay and Brazil followed suit.

When Ireland recognized equality -- (Applause) -- the world stopped and paid attention.

The U.S. Supreme Court has legalized same-sex marriage for the world, something we can all be proud of.

(Applause) Jenny: As we look back in our footsteps, we realize that what we've seen is a story of love.

It's not what I thought it was, it's a story of freedom, adventure and love like you never imagined.

A year after I returned from my trip, same-sex marriage freedom came to California.

I believe love will win in the end

(Video) By the power given to me By the State of California By Almighty God I now declare you two to be each other's lifelong companions.

give me a kiss

(applause)

This is "Air Jordan 3 Black Cement"

This may be the most important sneaker in history.

When this shoe was released in 1988, as you know, Nike's marketing began.

It's the shoe that boosted sales for the entire Air Jordan range and saved Nike.

Air Jordan 3 Black Cement Is The iPhone's Sneaker Equivalent

4 times re-released

All celebrities have been spotted wearing them

There's even a website about how to wear black cement.

It's been happening right under your nose for years, but no one cares.

I'm sure most of the people in this room are thinking right now, "Huh? Sneakers?"

(Laughter) Yes

It's sneakers

Here's an amazing story about sneakers — about data, about Nike, and what it means for the future of e-commerce.

The last time the Jordan 3 Black Cement was released was in 2011, it retailed for 20,000 yen and sold out worldwide in minutes.

Because in the days before the sale, people were lining up in tents outside the sneaker store.

And shortly after that, thousands of pairs were on eBay for two or three times the price.

In fact, four years later, eBay still sells over a thousand pairs.

And that's what happens every Saturday, every week.

With one to three launches each week, every shoe has a story as rich and compelling as the Jordan 3 Black Cement.

That's how Nike creates a market for sneaker-collecting "sneakerheads," including my daughter.

(Laughter) I'm wearing a T-shirt that says, "I love you, Daddy."

Collectors are a very important customer segment for brands

People who set trends, like Apple product geeks.

Who else would buy a million-dollar pair of Back to the Future sneakers?

(Laughs) One pair costs 1,000,000 yen.

This is clearly a transient exception, but the sneaker resale market is not.

It's been thriving for 30 years. It was originally a kind of underground culture, driven by some slightly over-the-top sneaker-lovers -- (Laughter) and now it's kind of an addiction.

In this market, nine million pairs have been resold in the United States alone in the last 12 months, worth 150 billion yen.

That's a conservative estimate, and I know that because I'm a sneaker collector.

this is my collection

It's nothing compared to great collections.

I have about 250 pairs, but it's a small collection.

There are many people who have thousands of pairs.

I'm your typical 37 year old sneaker collector.

I grew up playing basketball in the Michael Jordan era, and I always wanted Air Jordans, but my mom wouldn't buy them for me.

That's where I'm different

After starting three companies, I got a job as a strategy consultant, and I quickly realized that I didn't even know the ABCs of data.

I learned out of necessity and fell in love with data.

So I thought, why not analyze the sneaker data, just for my own enjoyment.

The goal is to create a price guide and look at the market with real data.

And now, four years later, we've analyzed over 25 million transactions, providing real-time analytics for thousands of sneaker models.

Collectors line up in tents to see what's new

Some collectors use our data to back insurance claims.

And one of the world's leading investment banks is using resale data to analyze the shoe distribution industry.

And best of all — collectors have sneaker portfolios.

(Laughter) I can track the evolution of the value of my collection, compare it to others, and see the same analytics data that I have with my online brokerage account.

Which 352 pairs does collector Dan have?

It's easy to see that it's worth a total of 13 million yen -- well, it's a modest collection.

In the asset view, you can see the profit and loss for each shoe.

Dan has made more than 74,000 yen from these shoes alone.

I have those shoes too

(Laughter) It's an unregulated $1 billion industry that's grown on the streets and on the internet, and even created basic financial services for sneakers.

As I was thinking about the reality of the sneaker market, two similarities caught my attention.

Are sneakers more like stocks or more like drugs?

(Laughter) True story, a man emailed me to say that he suspected his 15-year-old son was selling drugs, but he found out it was sneakers.

(Laughter) Now, both parents and children are using our data to buy and sell.

Because sneakers are an investment opportunity like no other.

Not just the kid who sold sneakers, not drugs.

for all children

You must be 18 years or older to trade stocks

I sold chewing gum in 6th grade, lollipops with gum in 3rd grade, and collected baseball cards in high school.

But baseball cards died out long ago, and the candy market is very localized.

For many people, sneakers are a legal, easy-to-enter, democratic stock market, but they're not regulated.

So what you hear a lot is about people killing each other for sneaker riddles.

That sort of thing does happen, and it's tragic, but it doesn't happen as often as the media makes it seem.

It's just a small part of a much bigger and better story.

So the sneaker market has some similarities to the stock market and the illegal drug trade, but the biggest difference is that

It's the presence of something that's at the center and making the rules.

When it comes to sneakers, it's Nike.

Let's explain in numbers

The resale market is 150 billion yen scale

Nike products, including the Air Jordan brand, account for 96% of the resale market

is a monopoly market

Collectors love Air Jordans

Profit in resale market is 1/3 of sales -

So collectors made $500 million last year selling Nike products.

let's look at the retail market

Skechers became America's second-largest shoe brand earlier this year, surpassing Adidas, which is a big deal.

Skecher's net profit for the year ending June was 25.7 billion yen.

So Nike's demographic is nearly twice as profitable as the second largest retailer.

That's -- (Laughter) How is that even possible?

The sneaker market is about supply and demand, but Nike is using limited-edition products to steer supply and distribution to its advantage.

really just supplying

Collectors often jokingly say, "I buy anything at Nike as long as it's exclusive."

It is very rare that a pair of shoes sells for 1 million yen.

It's no different than any other collectibles market, except this isn't a market at all.

It exists to sell more shoes in a pseudo-world engineered by Nike.

And in the process, we've spawned tens of thousands of people with a lifelong passion for sneakers, and I'm one of them.

If Nike wants to kill the resale market tomorrow, it just needs to sell more shoes.

Of course collectors don't want that, and it's not in Nike's interest.

Unlike Apple, which sells an iPhone to anyone who wants it, Nike doesn't make money selling limited-edition items that cost tens of thousands of dollars.

They make money by selling millions of pairs of shoes for thousands of dollars to millions of people.

Sneaker collectors provide the marketing boost, creating the craze, PR and brand value that allows Nike's multi-thousand-dollar sneakers to sell millions.

this is marketing

no one has ever seen it before and it's not in textbooks

For 15 years, Nike has powered artificial commodity markets and created a frenzy like a Facebook IPO every week.

At eight o'clock on a Saturday morning, when I drive past Foot Locker, there's a line of people that wraps around a block, and sometimes some young people have been waiting for a whole week.

You know the line of iPhone enthusiasts that make the news every two years?

Nike lines are 104 times more frequent than iPhones.

Nike sets the rules

to control supply and distribution.

But once the shoes leave the retail channel, it's a lawless land.

It's rare that a market of this size is legal and unregulated.

Nike is not the stock market

Central exchange does not exist

As far as I know, there are 48 online marketplaces.

eBay clones, mobile marketplaces, consignment and brick-and-mortar stores, sneaker competitions and resale sites, Facebook, Instagram, Twitter, literally everywhere a sneaker collector can get in touch, they're buying and selling shoes.

And that means it's inefficient, it's not transparent, and sometimes it's not even credible.

Can you imagine stocks being bought and sold like that?

What if the way to buy Apple stock was to look for 100+ locations online and offline? What if you had to walk the streets hoping to meet someone with Apple stock?

We don't know who has the lowest price, we don't even know if the stock is real.

I'm sure you'll say, "What the hell is that?" Of course, stocks don't trade that way.

But sneakers don't have to be bought and sold like that.

What if the reverse is also true? What if you could buy sneakers like you buy stocks?

What if it wasn't just sneakers, but similar products, watches, handbags, women's shoes, collectibles, seasonal items, and discounted items?

What if there was something like a stock market for buying and selling goods?

It is a commodity trading market

What if you could not only make educated and efficient purchases, but also be able to do all sorts of sophisticated trading methods, just like there are in the stock market?

Shorts, options, futures, you can imagine what it would be like.

You may want to invest in such a commodity trading market.

If you invested in the Air Jordan 3 Black Cement back in 2011, you could show up on stage wearing -- (Laughter) and you could have made a profit of 162 percent, twice as much as the S&amp;P, and 20 percent as much as Apple stock.

(Laughter) That's why I'm talking about sneakers.

thank you

(applause)

Somewhere in the vast universe there must be millions of stars teeming with life. Why can't we find evidence of that? It's a famous question posed by Enrico Fermi in 1950.

where are you all?

Conspiracy theorists claim that UFOs come to Earth all the time, but their reports are just being covered up, but honestly, they're not very convincing.

but the mystery remains

Over the past year, the Kepler spacecraft has found hundreds of planets around stars, and that data suggests that there are 500 billion planets in our galaxy alone.

If one in 10,000 has the potential to support life, there are 50 million possible planets in our Milky Way galaxy, which is why it's a mystery.

Our planet only formed nine billion years after the big bang.

Even in our own galaxy, countless planets were formed first, and the opportunity for life to emerge must have existed billions or even millions of years before Earth did.

Even if some of them started to give birth to intelligent life and create technologies, those technologies would have grown in complexity and power over the course of millions of years on Earth.

We've seen how technology can accelerate dramatically in just 100 years.

In a few million years, intelligent alien civilizations could have easily reached the farthest reaches of the galaxy, perhaps building energy harvesting devices, or colonizing fleets, or magnificent works of art that filled the night skies.

At the very least, they seem to have made their presence known, intentionally or not, through radio signals of some sort, but I haven't found a shred of convincing evidence.

I wonder why?

There are many possible answers, some of which are hopeless, perhaps one superintelligent civilization has taken over the galaxy.

They've been forcing them not to emit radio waves at all, because they're afraid of strong competitors.

It lurks quietly, ready to destroy anything that might pose a threat.

or not so intelligent

Intellectual evolution capable of producing sophisticated technology may be rarer than we imagine.

After all, it's only happened once on Earth in four billion years.

maybe with incredible luck

Maybe we are the first civilization in this galaxy.

Or perhaps civilization contains seeds of self-created technology that run amok and destroy themselves. There are many hopeful views.

I'm not looking for it that hard and I'm not spending that much money.

Only a small fraction of the stars in our galaxy are being searched for interesting signal signatures.

And maybe we're looking wrong, as civilization develops.

We will discover communication technologies that are far more sophisticated and useful than radio waves.

Maybe all the action takes place inside the recently discovered mysterious dark matter and dark energy that make up most of the mass of the universe, or maybe we're looking at the wrong scale.

Perhaps an intelligent civilization should realize that life is, after all, a complex pattern of exquisitely interacting information that is more efficiently realized at small scales.

So, just as on Earth our heavy, clunky stereos turned into beautiful little iPods, intelligent life may have miniaturized itself to reduce its impact on the environment. So our solar system is full of aliens, but we just don't realize it. Maybe our very idea is alien life.

Well, let's admit this is a wild idea.

I was told by an alien

But it's nice that an idea seems to have a life of its own, and that it outlives its creator. Biological life may be temporary.

In any case, within 15 years from now, we may be able to obtain spectroscopic information about promising planets in our vicinity, revealing just how hospitable they are to life.

Meanwhile, the Search for Extraterrestrial Intelligence (SETI) is making data available to the public and inviting millions of citizen scientists, including you, to join the collective search.

There's also an amazing experiment going on, trying to create life out of thin air, which may be very different from the DNA that we know so well.

All of these things will help us understand whether the universe is teeming with life or whether it's just us, whichever it is.

It's awe-inspiring, because even if we're orphans of the universe, the things we think about, dream about, and ask about these problems may be among the most important facts about the universe.

I never tire of the quest for knowledge and understanding.

No, it's actually the opposite, the more you know

the world looks amazing

Outrageous possibilities and unanswered questions drive us forward, so stay curious.

[How many universes are there? ] During long flights, I look up at mountains and deserts and think about how vast this planet is.

And then I remember seeing celestial bodies that are a million times the size of the Earth every day.

The sun is enormous, but when viewed from a larger perspective, it's just one of the 400 billion stars that make up the Milky Way galaxy.

there is beyond

A telescope could detect about 100 billion galaxies, and if we were to compare the stars to a grain of sand, the stars of the Milky Way galaxy could fill a sandy beach nine meters square and one meter deep.

A sandy beach on Earth isn't enough to represent the stars of the entire universe.

For that, we need hundreds of millions of kilometers of sandy beaches.

Stephen Hawking, the star of the field.

He and other physicists now believe the universe is vaster than we can imagine.

This means that the 100 billion galaxies that can be seen with a telescope are probably only a fraction of the total universe.

The universe is expanding at an accelerating rate, and most of the galaxies are moving away from us at such incredible speed that their light never reaches us.

Yet our physical reality on Earth is inextricably linked to distant galaxies that we cannot see.

Such galaxies are also considered part of the universe.

Galaxies are one giant structure, made up of the same types of atoms, electrons, protons and quark neutrinos that make up you and me, subject to the same laws of physics.

But modern theories of physics, such as string theory, suggest that there are vast numbers of universes made up of different types of particles with different properties that obey different laws of physics.

Most of it is devoid of life, and is said to be born and die every billionth of a second, but it still consists of possible universes in up to 11 dimensions as a whole.

It composes a vast multiverse beyond our imagination.

And state-of-the-art string theory predicts that the multiverse will consist of 10^500 universes.

It's a 1 followed by 500 zeros. This huge number is what if every atom in the observable universe had its own universe, and every atom in that own universe had its own universe, and we repeated this two more times.

But the number of the universe is also very small compared to a certain number, and the number is infinite.

Some physicists believe that space-time is literally infinite, containing an infinite number of so-called pocket universes with different properties.

Can you understand?

But quantum theory poses many challenges.

The theory is proven to be unquestionable truth, but its interpretation is difficult to understand.

And some physicists think it makes sense if you think of it as a world very similar to ours, where a huge number of parallel universes are constantly being generated, and many of those universes contain copies of you.

In one universe, you graduated with honors and married the man of your dreams.

We haven't had that much success in the alternate universe.

Some scientists still say that's nonsense.

If you ask how many universes are there, the rational answer is 1. There is only one universe.

But there are some philosophers and mystics who would argue that even this one universe is an illusion.

As you can see, there is still no consensus on this question, we have very different opinions.

What we do know is that the answer is from 0 to infinity

Now, as you probably know, this is a very romantic time to study physics.

We may be experiencing the greatest paradigm shift in human history.

Religion is more than belief

powerful and influential

It affects us all every day, regardless of our beliefs.

Despite the enormous influence of religion in the world today, the standards of oversight and accountability for religion differ from any sector of society.

For example, if today's international organizations, governments, corporations, etc. say that women cannot be held in positions of responsibility, they cannot be empowered to make decisions, they cannot be entrusted with financial matters, we would be outraged.

there will be sanctions

In today's world religions, that's hardly the case.

It's accepted within religion, and it's unforgivable in everyday life, but I know it because I've been like that for 30 years.

I was the kind of girl who resisted any form of sexism.

I also casually played basketball with the boys

She also said she would be the first female president of the United States.

I'm fighting for the Equal Rights Amendment, a provision that hasn't been in force for 40 years.

I am the first woman in my family, including my father's and mother's side, to work outside the home and receive a higher education.

I've never been content with being excluded just because I'm a woman, except for religion.

I've always been a patriarchal Orthodox Mormon.

I grew up in a fairly traditional household.

I have eight siblings and my mother is a housewife.

my father is a religious cadre in the community

I grew up believing that my existence and worth was determined by following the rules I learned.

Married as a virgin, neither alcohol nor tobacco, and constant service are exemplary children.

Some of the rules were strict, but I followed them because I liked the people there and I loved and believed in their religion.

Mormon teachings determined what to wear, who to date, and who to marry.

Even the underwear was decided

Every believer around me gave 10% of their income to the church, and so did I.

Donated 10% from newspaper delivery to babysitting income

In the religion I grew up in, when children leave for two years of missionary work, parents say, "I would rather kill my child than commit a crime that violates the rules of the religion and return with disgrace."

In the religious environment I grew up in, young people committed suicide every year out of fear of telling the community that they were gay.

But in that religious environment, wherever you were in the world, you could have friends and help each other right away.

This environment was safe, life was certain and clear.

Helped me raise my young daughter

So they accepted without question that only men could be leaders, and they accepted that women weren't allowed to hold the spiritually empowered ministry of God on earth.

I was tolerant of gender differences, even though there were differences in operating budgets, disciplinary committees, and decision-making powers, and I accepted what the religion decreed because I loved my religion.

Until you stop and realize that you're allowing yourself to be the support staff for men to do real work.

Faced with his own contradictions, he joined the ranks of community activists.

I have been working hard for over 10 years.

I wanted to get you noticed first.

You can't change what you can't see

I started writing podcasts blogs and articles

I've listed hundreds of examples of gender inequality in our communities.

Then we set up a support group.

I tried things I couldn't ignore: going to church in pants, attending a men's-only gathering, etc.

It seems simple, but it has cost us and the leaders of our group tremendously.

I lost my relationships, I lost my job

I get harassing emails everyday.

It was also attacked on social media and national newspapers

There were also death threats

I lost my place in the community, and some even lost contact with them.

Most were put on disciplinary committees and rejected by their beloved communities because they wanted and believed they could do better.

Over time, it became possible to predict the reactions of these people.

I know how you feel when you feel that someone is trying to change you or criticize you.

But what was shocking was that during these activities, I was treated just as badly by the secular left, no less violently than the religious right.

None of my non-religious friends knew about this hostility to religion.

"Leave religion alone"

'They are anti-gay and sexist'

What they didn't understand was that this type of animosity isn't about fighting religious extremism, it's about creating religious extremism.

These arguments don't go through, because they told me that being a Mormon was stupid.

With that said, I defended myself, I defended my fellow Mormons, I defended my faith, because we're not stupid.

Criticism and hostility are not valid and I will not listen to these arguments.

I still get a lot of rage when I hear these discussions, because I have family and friends.

My comrades, I defend myself first, but the suffering is real.

How do you respect other people's religious beliefs? While making them responsible for the harm and damage to others caused by their beliefs,

It's a difficult question and we don't have a perfect answer yet.

For the last 10 years, my parents and I have been walking a tightrope.

smart parents and kind people

let me help you understand their point of view

In Mormonism, after you die, if you follow the rules and follow the rules, you can be a family again.

To my parents, the simple things I do, like I do now, showing my shoulders and wearing sleeveless shirts, are devaluing me.

I will never be with my family

When I was 15, my brother died in a tragic accident, and something as simple as this would stop us from being a family.

My parents don't understand why simple things like fashion and women's rights keep me from seeing my brothers again.

We're confronted with this way of thinking, and criticism doesn't change this reality.

My parents and I are in this delicate relationship, where we respect each other and explain each other's points of view, but it's very difficult because each other's way of life undermines our deepest beliefs.

What we've been able to do is get rid of the shells that protect us from attack and face the nuances of trust and distrust, and try to respect each other while defining boundaries.

And what the secular left and the atheists and the religious right don't understand is why religious activism?

Hundreds of people told me, "If you don't like religion, quit."

why are you trying to change?

Because the teachings of the Sabbath lead to politics, to health policy, to violence around the world.

It also influences education and military budget decisions.

These laws are codified legally and culturally.

In fact, my religion has had a huge impact on this country.

For example, on the 8th Amendment, my church raised $22 million against same-sex marriage legalization in California.

Political historians say that if it weren't for the Mormon opposition to the Equal Amendment 40 years ago, there would have been an Equal Amendment in the current constitution.

How many people did you influence?

But you can take your time and fight against each law and rule. Ask yourself: Why is gender inequality the default around the world?

Why the premise?

Because religion doesn't just form the basis of morals, it forms the basis of standards.

Religion can liberate, subjugate, empower, rob, comfort and destroy, and it is often the irresponsible who turn the tables in favor of ethics and morals.

Religion cannot be taken lightly or ignored

need to be taken seriously

As I said, it's not easy to influence religion.

I'll tell you what we've been up to

Our group, a few hundred people, is small, but we made a big impact.

Now, in the hall, there's a picture of a woman hanging next to a picture of a man, and it's the first time.

Women's prayers are now allowed in church-wide meetings, which were previously not allowed in regular meetings.

Last week, in a historic move, three women were invited into the leadership board to oversee the entire Church.

There's a shift in the Mormon community's view that it's allowed to talk about sexism.

It's frowned upon, but it's made a breakthrough. More conservative women have joined in, and it's really made a difference. It's now acceptable to have "woman" and "clergy" in the same sentence.

never before

My daughters and nieces inherited a religion that I never experienced, and we made it more equal.

It wasn't easy standing in line to get into the men's meeting.

There were hundreds of people, and one by one they said at the entrance, "Excuse me, but this is for men only."

None of the women in that line will forget that day Not the boy who passed us will remember that day

If the same thing happened in an international corporation or in a government, there would have been outrage, but in our case it's just religion.

we are all part of the religion

You can't keep looking at religion that way. It's not just affecting me, it's affecting my daughter, it's affecting your daughters, it's impacting their opportunities, what they wear, who they love, who they marry, and their access to reproductive medicine.

We have to restore morality in the general public as well, which requires moral oversight and accountability for religions around the world, but it needs to be done in a dignified way, in a way that creates cooperation, not extremism.

We stand up against sexism through an act of courage that cannot be ignored.

The time has come for half the world's population to have a voice and equality in religions around the world, in churches, in synagogues, in mosques and in shrines.

I'm acting for ourselves What are you all doing for yourself?

(applause)

(music) How many times can you fold a piece of paper?

Let's say you have a piece of thin paper, like the one used in the Bible, which actually looks like silk.

to proceed with the calculation

Let the thickness of the paper be 1/1000th of a centimeter

10 minus 3 centimeters, or 0.001 centimeters.

And let's say the paper is big enough, like a newspaper.

How many times do you think it will fold if you fold it in half?

Another question is, if you could fold a piece of paper as many times as you wanted, how thick would that paper be when you folded it, say, 30 folds?

I encourage you to think about the answer yourself before proceeding.

Let's do it. Fold this paper once.

2/1000th of a centimeter thick

If you fold it in half again, it's 4/1000ths of a centimeter.

Each fold doubles the thickness of the paper.

If you keep folding it in half repeatedly, what happens after 10 folds is the thickness is 2 to the 10th power.

So 2 multiplied 10 times is 1024/1000ths of a centimeter, which is just over one centimeter.

If you continue to fold the paper in half

What will happen?

At 17 folds, the thickness is 2 to the 17th power, or 131 cm, which is over 4 feet.

If you could fold it 25 times, it would be 2 to the 25th power, or 33,554 cm, which would be over 1,100 feet, about the same height as the Empire State Building.

Let's stop for a moment and look back

A paper as thin as the Bible paper, folded 25 times, would be about a third of a kilometer thick.

What do you know? This type of growth is called exponential growth.

As you can see, you can go very fast, very far just by folding a piece of paper.

So in summary, if you fold a piece of paper 25 times, it's about a third of a kilometer thick.

At 30 times, it's 10 kilometers thick, about the average altitude of an airplane.

40 times the thickness is almost 11,000 km average distance to the GPS satellite orbit.

48 times would be millions of kilometers thick."

Since the distance between the Earth and the Moon is about 380,000 km, you can start with a piece of Bible paper and fold it 45 times to reach the Moon.

Fold it one more time and you're back on Earth Teacher: Adrian Paenza Narration: Adrian Paenza Animation: TED-Ed Team

My wife is pregnant with our first child, and when we see her big belly, almost everyone's first question is, "Are you a boy or a girl?"

The reason we ask questions like this so often is because we know so much about the human body.

We take it for granted that our babies will be 50% boys and 50% girls.

But how is that possible?

It's determined by the system of gender determination that has evolved for humanity.

Sex in most mammals is genetically determined by the system of X and Y sex chromosomes

Mammals have one set of sex chromosomes, one inherited from the mother and one from the father.

If both are X, a girl will be born If there is one X and one Y, a boy will be born

A woman's egg can only carry the X chromosome. A man's sperm can carry either an X or a Y. Gender is determined by the father, so there's a 50%, 50% chance that the baby will be a boy or a girl.

In mammals, this works well, but there are animals in the ecosystem that have different gender conventions.

Gender is determined by genes, but some species differ greatly in type from humans.

Some birds and reptiles also have their sex determined by genes, but sex isn't determined by the father, it's determined by the mother.

In this type, males are born with two Z chromosomes, so this male only has a Z chromosome.

But in this animal, when both the Z and W chromosomes are present, females are born.

Even in this system, the probability of being male or female is 50% 50% Gender is determined by whether the sex chromosome in the mother's egg is Z or W

Some groups genetically determine sex in a completely different way.

The ant sex determination, for example, is a very interesting system, because of that system, male ants don't have fathers.

There are clear distinctions between roles within ant colonies.

There are warriors who protect the colony, there are worker ants who gather food and clean the nests and look after the young, and then there is the queen and a few males who reproduce.

The queen ant mates and stores sperm from the male

This is where the interesting part of this system comes from.

If the queen ant uses this stored sperm to fertilize an egg, the egg will produce a female.

But if you don't fertilize it, the egg will become an ant, but then it's a male.

So a male ant will never have a father.

In this way, male ants are like walking sex cells that live with only one copy of the gene.

This system is called the haploid system, and it's not just a system in ants, it's a system in highly socialized insects like bees.

Human sex is genetically determined, and the animals we've seen so far have been genetically determined, so it's tempting to think that all animals are genetically determined.

But there are some animals whose sex is completely unrelated to genes, for example, some animals' sex is determined by the weather.

Alligators and turtles belong to this group

The sex of these species is determined by the temperature at which the embryo develops.

In these species, when the egg is laid, the sex is not yet determined; even when the embryo is halfway through development, the sex is not determined yet;

"At that time" sex is determined by the temperature of the nest

For example, a painted turtle produces females when it's above a certain temperature, and males when it's below a certain temperature.

It's a bit unclear who came up with this combination, but in the case of Painted Turtles, it's either hot gals or cool flirts.

Some tropical fish don't decide whether they're male or female until later in life.

For example, all clownfish are born male, but become female as they grow.

They live in small groups under strict hierarchies, where only powerful males and females reproduce.

And surprisingly, when the dominant female in the group dies, the largest and most powerful male turns into a female and takes the position of the dead female, and the rest of the males move up in rank one by one.

There is yet another type of animal in the sea, the worm, whose sex is determined by very different environmental conditions.

The sex of the worm is determined by the "place" on the ocean floor where the larvae landed.

If a larva falls to the bare seabed, it becomes a female.

But when it lands on a female, the larva becomes a male.

There are species that are genetically determined to be male or female like this.

Some species are determined by the environment

And there are even guys who don't care if they're male or female.

For example, the lizard is it

In the case of desert lizards, it's easy to tell if they're male or female.

They're female, they're all female

They're almost all female, and even if they lay eggs, those eggs will produce female clones.

So male or female

If you look at the animal world as a whole, it depends on the system of sex determination.

In humans, it was the genetic system of the XY chromosomes.

And back to our story, it looks like I'm a boy in my belly!

Why does the word "Shakespeare" make you cringe?

If you ask me, there's a reason for the words he uses.

"Your", "you", "therefore" - "why are you", etc.

But think about it. Why is it so popular?

Why are Shakespeare's plays more performed than anyone else's?

His words are the reason

In the late 16th century and early 17th century, language was man's greatest tool, and there was much to be said.

But it's all about depressing topics

It was a time when the plague was popular.

Shakespeare used so many words

One of the most spectacular feats is the use of swear words.

Swear words united the audience, and no matter where you sat, you could laugh at the play on stage.

Words, especially dialogue in a play, are used for a variety of reasons, including to set the mood, to add atmosphere to the setting, and to develop the relationships between the characters.

Swear words accomplish these goals simply and precisely.

Let's look at Hamlet first.

Just before this conversation, Polonius' daughter Ophelia is in love with Prince Hamlet.

King Claudius is trying to find out why Hamlet has been acting crazy since he married Hamlet's mother.

Polonius offers to use his daughter to get something out of Hamlet.

Here we enter Act 2, Scene 2

Polonius: "Your Excellency, do you know me?"

Hamlet: "I know you're a 'fishmonger'."

Polonius: "No, it's not."

Hamlet: "Well, at least I hope you're that honest."

Now, even if you don't know what "fishmonger" means, you can get a hint from the context.

1: Polonius got a negative response, so it must mean bad things.

2: Fish must have a bad meaning because it smells bad.

3: The word “Monger” doesn’t sound good

Without knowing what it means, you can start building a relationship between Hamlet and Polonius, which means that the relationship is not good.

If you look more closely, you'll find that "fishmonger" means something like a pimp, and here it means pimp of prostitutes, and that's how Polonius appears to offer his daughter for money at the king's request.

This reveals that Hamlet isn't as crazy as he seems, and reveals the animosity between the two characters.

Let me give you another example

"Romeo and Juliet" has some of the best swear words in Shakespeare's plays.

A story of two warring factions, the hapless lovers take their own lives

In every skirmish, terribly offensive language is exchanged.

hope will not disappoint

From the very beginning of act one, we see the distrust and loathing between two families, the Capulet and the Montague families.

Gregory: "Let's glare at each other as we pass each other and show them what we see."

Samson: No, if they provoke me, I'll bite their thumbs.It's a disgrace to them.

Abraham and Balthazar appear

Abraham: Are you biting your thumb at us?

Samson: "I'm sure you're biting your thumb."

Abraham: Are you saying you're biting your thumb at us?

So how does this interaction convey the emotions of the characters?

Let's analyze swear words

"Bite your thumb" doesn't mean much these days, but Samson uses it as a curse.

I can understand from the fact that the other party receives it that way.

This is where we begin to see animosity even between those who serve the two Houses.

If you don't want to pick a fight, you usually don't do anything to the other person, and that's exactly what this situation is.

Moreover, at the time the play was written, biting your thumb was like "raising the middle finger" today.

There's a pretty strong emotion involved with that, and you can start to feel the tension in this scene.

Later, in this scene, Tybalt of House Capulet yells at Benvolio of House Montague.

Tybalt: "What do you have behind you, side by side with the cowards?

Benvolio, turn around and see your death."

Benvolio: "I don't like fighting. Put down your sword, or try to separate me from them."

Tybalt: "Why are you telling me to back off and talk to you!

Like Hell, the Montagues, and you, I don't like to talk.

Take the sword, you coward! ”

Now about "heartless hinds"

I know it doesn't make sense here either.

Houses hate each other this is like adding fuel to the fire

But how strong is this sarcasm?

"heartless hinds" means "cowards" In front of people on your side and enemies

Tybalt provoked Benvolio, and in order to keep his honor, Benvolio must take the fight.

This conversation gives us a good understanding of the personalities of these two characters.

Tybalt sees the Montagues as nothing more than cowardly bastards, and has no respect for them at all.

Again, it adds dramatic tension to the scene.

I'll give you a little insight here.

Tybalt's wrath and his bitter hatred of the Montagues lead to his downfall in what literature calls a "tragic flaw."

that's right

He will fall at the hands of Romeo

So when you watch a Shakespearean play, pay attention to the words, because they're really trying to say something.

(music) Is a dozen eggs singular? Or multiple?

In elementary school, my teacher gave me a long lecture about credits, and I didn't understand it on the spot.

One day, when I was going to buy an apple at the supermarket,

It was only sold by the bag, so I bought one bag.

I took one out at home and cut it up.

And I ate one piece 1 bag 1 piece 1 piece Which one is the real "1"?

1 bag 1 piece 1 slice Which one is the real "1"? Of course that's all, that's what my teacher taught me

This is behind integer fractions fractions

It's an important idea. Numerology consists of changing the contents of the number 1.

The number system consists of switching units.

There are two ways to change units: composition and division.

When composing units

Collect a lot of things and put them into a big blob Collect a lot of things and put them into a big blob Put 12 eggs into one

That group is called a dozen, and a dozen eggs are building blocks.

there are other examples

A deck of cards, a pair of shoes, a jazz quartet, a couple of Barbie and Ken, and a loaf of bread?

A loaf is not a "building block"

Because you can't make a whole loaf of bread by putting it all together.

First, there is a loaf of bread, and what you cut into pieces is bread.

A chocolate bar, a slice of orange, a slice of pizza, and so on.

This means that it can be treated in the same way as the original unit.

You can compose a composition unit or you can split a division unit

Think of biscuits, two in a pack.

Four more packs are put together to make one box.

When you buy a box of biscuits, are you buying one thing? Or four? Eight?

it depends on the unit

1 box 4 packs 8 sheets

Even if you share a slice of pizza, you have to cut it into two slices.

A box of biscuits is made up of units, and when you divide a slice of pizza, you divide the units.

What does this have to do with mathematics? everything is clear in mathematics

2+2 is 4 1 is 1

But that's actually not the case.

1 is not always 1

The reason is this -- you start at one and count up to nine -- 1, 2, 3, 4, 5, 6, 7, 8, 9 and you get to 10. 10 is 1 and 0. 1 means there's one chunk.

The presence of 0 tells us that it is not 1, but 1 lump, but 10 is also

It's a unit, like one, a dozen eggs, or an egg. Ten 10s is 100.

looks like a biscuit box

Is 100 one thing or 10 things? Or 100 pieces? the answer is what 1 is

Depends on what the units are. Watch out for the '1' in math.

What is the position of 1? How many groups does 1 represent? What is "1"?

Have you ever wondered what animals feel and think?

Let's start with one question: "Does my dog ​​really like me, or does he just want a treat?"

It's easy to see that our dog really likes us.It's easy to see what's going on in that little fluffy head.

what's going on?

something is happening

But why do we always ask, "Do you love us?"

Why is it always "we"?

Why are we so narcissistic?

I found another question to ask animals

"Who are you?"

We tend to think that there are qualities that are unique to the human mind.

Is it really so?

What are other creatures doing with their brains?

what do you feel what do you think

Is there any way of knowing that?

If you're just getting started

I think there are some

Look at evolution, look at the brain, look at behavior.

The first thing to remember is that our brains are inherited.

Nerve cells first came from jellyfish.

Chordates emerge from jellyfish

Vertebrates emerged from chordates

Vertebrates came out of the sea and onto land, and here we are.

But neurons look the same in crayfish, birds, and humans.

From that, about the heart of the crayfish

What do you know?

In fact, it's been shown that if you give a crayfish a mild electrical stimulus each time it tries to leave its burrow, it will become anxious.

If you give a crayfish a drug used to treat anxiety, it will feel safer to come out of its burrow and explore.

How do we heal crayfish anxiety?

usually boiled

(Laughter) Octopuses, like many monkeys, use tools to identify human faces.

How do we celebrate the monkey-like intelligence of this invertebrate?

usually boiled

When a grouper drives a fish into a crevice in a coral reef, it sometimes goes to a moray eel's roost and signals, "Come with me," and the moray understands that signal.

Moray eels can crawl into crevices and catch fish, and fish can pop out and groupers can catch them.

This ancient partnership was discovered only recently.

How do we celebrate this ancient partnership?

usually fried

When patterns are found, they teach us more about humans than they do about animals.

Sea otters use tools, and we take the time to show them how to do it, and this is what we call education.

chimpanzees don't teach

The killer whale teaches and shares the food with everyone.

Evolution is when you create something new, you use what already exists.

Our brains have been built over the years.

If you compare a human brain to a chimpanzee brain, you'll find that what we have is an enlarged chimpanzee brain.

It was fortunate that we were bigger, because I'm already worried

(Laughter) But there are also dolphins, which have larger, wrinkled brains than humans.

You might think, "We can see the brain, but what does that tell us about the mind?"

The workings of the mind can be seen in the logic of action.

You can tell right away that these elephants are resting.

Finding shade under a palm tree, putting the children to sleep, and dozing off guarded themselves.

I totally understand this figure, and I understand what they're doing, for living under the same sun, on the same plains, and hearing the same roars of danger, each one became one.

we've been neighbors for a long time

You wouldn't expect these elephants to feel at home.

I know you're worried about something

What are you worried about?

If you record the voices of tourists and play them through speakers hidden in bushes, the elephants will ignore them, because the tourists won't bother them.

But when the recording is the voice of a spear-wielding goat herder, who sometimes tortures elephants by scrambled for water, the elephants run in droves and out of the hidden speaker.

Elephants not only recognize humans, they know that some humans are okay and others are dangerous.

Elephants have seen humans longer than humans have seen elephants.

Elephants know humans better than humans know elephants

We all have the same mission: take care of our children, find food, try to live.

Whether it's better suited for walking the hills of Africa or swimming in the ocean, the basics are the same.

If you peel the skin off, we're alike

Elephant skeletons and killer whale skeletons are similar to humans.

help those in need

children are curious

There are ties between families

you can see the love

Courtship behavior is also common

People ask, "Are animals conscious?"

When you get general anesthesia, you lose consciousness and you don't feel anything.

Consciousness is simply the ability to feel something.

If you can see, hear, feel, or notice something, whether you are a human or an animal, you have consciousness.

Some people say that there are things that make humans human, and one of them is empathy.

Empathy is the ability to match your emotions with the person you're with.

it's very useful

If my friends start moving fast, I think I have to speed up my steps too.

everyone is in a hurry

The oldest form of empathy is fear propagation.

When all my friends flew away in surprise, if I stayed alone and wondered, "Why did they all go away?"

(Laughter) Empathy is ancient, but like many things in the world, there are different levels.

Basic empathy is, "When you're sad, I'm sad too.

When you are happy, I am happy too."

And then there's the more distant thing called sympathy, "I'm sorry to hear that your grandmother passed away.

I don't feel the same sadness, but I know how you feel and I'm worried about you."

And when the feeling arises to act on compassion, it's called compassion.

Empathy is far from what makes us human, and human empathy is woefully imperfect.

Humans collect, kill, and eat creatures with empathy.

You might say it's the case with a different kind of creature.

Humans are carnivores and that's just predation

But humans don't treat their kindred so well.

Some people say that the only thing about animal behavior is that we shouldn't extrapolate human thoughts and feelings to other creatures.

I think it's silly, because the extrapolation of human thoughts and emotions to other species is the first clue to how that creature feels and behaves, because our brains are basically the same.

have the same structure

The same hormones that give rise to mood and drive in humans work similarly in the brains of other animals.

To see you hunting and say you're hungry, or to see your tongue hanging out and say you're tired, but on the other hand to see you playing with children and having fun, and say you don't know what their experience is like.

not scientific

A journalist asked me, "But how do you know other animals can feel and think?"

I started reviewing the hundreds of scientific references I referenced in my book and realized the answer was right in my room.

When my dog ​​gets up off the rug and comes to me -- not to the couch, but to "me" -- and turns on his back and shows his belly, he's thinking, "I want you to pet my belly."

If I go to Carl, he'll know what I want him to do.

I can trust him in my family

I'll do my part properly and I'll feel better."

(Laughter) My dog ​​feels and thinks, it's not that hard.

But you might point to other animals and say, "I don't think of killer whales and wolves and elephants that way."

L41 is a male with a remarkably high dorsal fin.

I'm 38 years old

The female to the immediate left is L22.

I am 44 years old

The two have known each other for decades

they know each other well

who are you friends with

i know who i'm competing with

they have been living together

they always know where they are

This is an elephant named Philo

it's a young male

This is what it looks like 4 days later

Humans not only feel sadness, they also create a lot of sadness.

Humans want elephant tusks

Why can't we wait until they die?

Elephants could once be seen from the Mediterranean coast all the way to the Cape of Good Hope.

In 1980, there was a vast territory inhabited by elephants in Central and East Africa.

now only small dots

Here's a map of how humans are driving the largest brethren on earth to extinction.

Of course, in America, wildlife will always be cherished.

Humans killed wolves in Yellowstone National Park

We actually killed all the wolves south of the Canadian border.

In Yellowstone, park managers did so in the 1920s, and 60 years later, they had to bring the wolves back because the deer were overpopulated.

Then people started coming

Thousands of people have come to see the wolves, making it one of the best places in the world to see wolves.

I went to see one amazing pack of wolves

Wolves form family packs

Some adults giving birth and some younger generations.

We've seen some of the most stable and well-known herds in Yellowstone National Park.

The herd wandered off the park's borders and killed two adult animals, one of which was a mother called Alpha Female.

The rest of the family began to fight among their brothers.

The females kicked out the other sisters.

The female in the picture on the left tried for days to get back into the herd,

I was jealous and couldn't let you in

Because this female caught the attention of two new males, and this female is precocious.

The other females couldn't stand it.

This female also wandered out of the park and was shot dead.

Alpha Male was also kicked out of his flock.

As winter approached, this male lost his territory, his hunting companions, his family and his wife.

we are causing them so much pain

The wonder is, why don't they hurt people more?

This killer whale has just finished eating a gray whale that he and his mates killed.

Those in the boat have nothing to fear

This killer whale's name is T20

I just cut the seal into thirds with my two companions.

The seals weighed as much as the people on the boat,

they don't have to be afraid

killer whale eats seal

Why don't you eat humans?

Why do we feel safe with killer whales around our children?

Why did the killer whale guide the researchers lost in the thick fog for miles until the fog cleared and brought them very close to their house on the shore?

That sort of thing happens all the time

In the Bahamas, a woman named Denise Herzing was researching spotted dolphins, and the dolphins knew her.

She also knew each of the dolphins very well.

The dolphins know her ship

Everyone was happy when she showed up

But one day, when she showed up, the dolphins didn't come near the boat, which was weird.

I was wondering, but then I found out that a member of the ship had died while he was asleep in his bunk.

How did the dolphins know that the human heart on the ship had stopped?

why did you care?

why were you scared of that?

These strange phenomena give us hints about what's going on in the minds of the creatures that live on our planet that humans seldom think about.

In an aquarium in South Africa, there was a baby bottlenose dolphin named Dolly who was still suckling.

One time, the zookeeper was taking a break and smoking a cigarette while looking out the window at the aquarium.

Dolly came in and when she saw him, she went over to her mom and sucked for a minute or two and then came back to the window and made a smokey cloud of milk over her head.

Somehow, this baby dolphin came up with the idea of ​​using milk to represent smoke.

When a person uses something to represent another thing, it's called art.

(Laughter) It's not what we think we are that makes us human.

What makes humans human is that certain things that animals have in common are extremely developed in humans.

Humans are the most compassionate, the most ferocious, the most creative, the most destructive animals that have ever appeared on the planet.

But love isn't what makes us human.

because it is not unique to humans

Caring for one's spouse is not unique to humans.

Caring for children is not unique to humans.

Albatrosses can travel 10,000 to 16,000 kilometers for weeks to bring one large meal back to their chicks.

Albatrosses build nests on isolated islands in the ocean, nests like this.

It is the chain of existence that carries life from one generation to the next.

When it breaks, it disappears

If there's anything sacred in this world, it's this one.In this sacred relationship, there's plastic trash.

All these birds have plastic in their bodies.

This is a six-month-old albatross chick about to grow feathers, but it died after being choke on several red lighters.

This is not how we should relate to other living beings.

Humans have named themselves by their intellect, but have failed to think about the consequences.

When new human life is born, we welcome it along with other creatures.

paint a picture of an animal on the wall

I don't draw pictures of mobile phones

I won't draw a picture of a workplace with partitions.

To show that we are not alone in the world, we are all in company

draw animals

All the animals in Noah's Ark picture, all the animals that were deemed worthy of salvation, are now in danger of survival, and for them the Flood is us.

We started with the question, "Do animals like us?"

let's ask another question

“Can we use our strengths to show that we care enough to keep animals alive?”

thank you

(applause)

(music) This is Harriet the chemist.

I just wish the chemical reaction would go faster.

There are a few things that can help speed up the reaction, and she knows five of them, and she's trying to remember them.

She found a dance partner One day in high school, Harriet was studying between classes in high school.

I lost track of time and was almost late for class

Little does she know that Harold will be late there, too.

They ran into class and accidentally bumped into each other.

It's not a little bit of a bump

It hit me so hard that I even dropped the book I was holding in my hand. "Sorry, I'll pick it up," he said.

Harold helped pick up her belongings and kindly escorted her to class Who do you think went with you to that year's dance party?

yes those two

As you can see from this example, to find someone to dance with, all you have to do is bump into someone and make them drop a book.

Thankfully, we need a collision that satisfies two conditions.

The first is that we are on the right track, and the second is that we have enough energy in the immediate aftermath of this incident.

Harriet told me, my chemistry teacher, everything.

Her story and chemical reaction kinetics were similar, and this was exactly what she was studying in the hallway, and we worked out two strategies together.

Harriet wanted to help chemistry students and chemists learn how to accelerate chemical reactions, and I decided to create an educational environment where good people would cause more book-dropping conflicts, and where future chemists would have a better chance of finding someone to dance with.

To promote efficient dance partnering, I proposed five changes to schools, modeled after Harriet's five ways to speed up chemical reactions.

narrow the corridor

That makes it less easy to navigate safely down a hallway, and more likely to cause collisions than a wide hallway.

The more collisions you have, the more likely you are to have a collision with the right direction and enough energy to connect with your dance partner. Now, chemically speaking, this is

It's about reducing the volume of the reactor, the volume of the solvent, so that the individual molecules are closer together.

more collisions happen the more collisions

Collisions with the right energy and placement are much more likely to occur.

Second, I would suggest increasing the number of students in schools.

More students means more collisions, by increasing the number of molecules that can collide.

It creates an environment in which more conflict can occur. Third, we shorten the breaks between classes.

Let's cut it in half. This forces students to move to the next class more quickly.

This increases speed

A collision will have enough energy to cause the book to fall, which will change the temperature of the reaction liquid.

is the same as elevating

The higher the temperature, the faster the molecules move

The faster the molecules move, the more energy they have and the more likely they are to react when they collide.

By traveling in groups, students outside the group

It protects the students inside in the event of a collision, and by tearing it apart, more students are exposed.

You're more likely to be hit by a passing student.

When molecules move in groups, the surface area is so small that only the outer molecules undergo collisions.

But by breaking the mass into individual molecules, the overall surface area is increased, and each molecule exposes a surface on which a reaction can occur.

Crashing and dropping a book is a bit rough? An easy way to find someone with less energy?

That's where matchmaking matchmakers come in.

Matchmakers make it easier for couples to come together, and in chemistry matchmakers are catalysts.

Catalyst lowers activation energy

So it lowers the energy needed to start the reaction.

The catalyst holds the two molecules together and places them in the correct position in space, so the molecules come together in the correct orientation and the reaction takes place.

So, in summary, if a future chemist wants to find someone to dance with, all he has to do is bump into someone and make them drop a book.

Molecules must face in the right direction and collide with the right energy.

The five methods I've described can speed up both.

Suppose you're on the beach and you see sand in your eye.

do you know why it caught your eye

You can't see the sand, of course, but the average healthy person feels it and perceives extreme discomfort as pain.

Pain motivates action.In this case, rinse your eyes until the sand is gone.

So how do we know the sand is gone?

yes because the pain is gone

There are people who say they don't feel pain.

It may sound nice, but it's not.

If you don't feel pain, you may never know if you hurt yourself or hurt yourself.

Pain is the body's early warning system

Protect yourself from others as well as protect yourself

As we grow, we develop pain receptors in most parts of our body.

These specialized nerve cells, called nociceptors, extend from the spinal cord to the skin, muscles, joints, teeth and internal organs.

Like nerve cells, they carry electrical signals, sending information from different parts of the body to the brain.

Unlike other nerve cells, nociceptors fire only when they are likely to or are doing damage.

If you gently touch the tip of the needle

You'll feel the metal, this is normal nerve cell activity.

i feel no pain

But the harder you push the needle, the closer you get to the nociceptor threshold.

If you press harder, the threshold is crossed and the nociceptors fire, telling your body to stop what's going on.

But pain thresholds aren't static.

Certain substances can lower the pain threshold.

When a cell is injured, that cell and its surrounding cells furiously produce threshold-lowering substances that lower the threshold of nociceptors to the point where even the slightest touch is painful.

This is where over-the-counter pain relievers come in.

Aspirin and ibuprofen inhibit the production of a class of regulators called prostaglandins.

so let's see

When cells are damaged, they release a chemical called arachidonic acid.

Two enzymes, called COX-1 and COX-2, convert arachidonic acid to prostaglandin H2, which in turn is transformed into other substances that act in a variety of ways, including raising body temperature, causing inflammation, and lowering the pain threshold.

All enzymes have an active site

This is where the enzyme reacts.

Arachidonic acid fits snugly into the active site of COX-1 and COX-2.

As you can see there is no gap

Aspirin and ibuprofen act at this active site.

do another job

Aspirin acts like a porcupine's needle

After entering the active site, the folded half remains inside, completely inhibiting the binding of arachidonic acid to the active site.

Permanently inactivates COX-1 and COX-2

Ibuprofen, on the other hand, enters the active site but does not partially break down or alter the enzyme.

COX-1 and COX-2 are free to release ibuprofen, but while ibuprofen is present, the enzyme cannot bind to arachidonic acid and undergo its normal reaction.

So how do aspirin and ibuprofen recognize the location of pain?

I don't really recognize

Once the drug enters the bloodstream, it is carried throughout the body by the blood, distributing it to painful and normal areas alike.

This is how aspirin and ibuprofen work.

Pain has other characteristics

An example is neuropathic pain, where damage to the nervous system itself causes pain, so there is no external injury.

Scientists have also discovered that our response to pain signals is also controlled by the brain.

For example, how much pain you feel can be influenced by whether you pay attention to the pain or even your mood.

Pain is an area of ​​active research.

If we have a better understanding of pain, it will help us better manage it.

It's a basic question: is there life outside of Earth?

Scientists called astrobiologists are trying to find life right now.

Most astrobiologists are looking for microorganisms in the frozen subsurface oceans of Mars and Jupiter's moon Europa, and the hydrocarbon lakes found on Saturn's moon Titan.

But one group of astrobiologists is working on SETI.

SETI is the Search for Extraterrestrial Intelligence, and SETI researchers are trying to find traces of intelligent beings somewhere out there that have created some kind of transmitter.

But what are the chances of finding such a signal?

When it comes to SETI, there's no guaranteed certainty, but there's something called Drake's Equation, named after Frank Drake, that can help you formulate an idea of ​​what it takes to make a successful detection.

If you've ever worked with equations, you might expect, you might expect, that equations have solutions.

Drake's equation is not like that, because there are many unknowns.

there is no correct answer

As we learned more about the universe and where we are in it, we began to understand what we didn't know, and we were able to improve our predictions a little bit.

But until SETI succeeds, or proves that Earthlings are the only intelligent life in the universe, we won't have a definitive answer to Drake's equation.

For the time being, it helps to think about the unknowns.

Drake's equation attempts to estimate the number of technological civilizations that humans might encounter in the galaxy, and let that number be N, and that N is: where N is R\* multiplied by fp multiplied by ne multiplied by fl multiplied by fi multiplied by fc multiplied by L.

Multiplying all of these numbers together helps us estimate the number of technological civilizations we might be able to detect right now.

R\* is the rate at which new stars have been born in our galaxy over the past billion years, which is the number of stars born each year.

Our galaxy is 10 billion years old, but for some time after its birth, stars were forming at a different pace than they are now.

All f numbers are percentages

each number less than or equal to 1

fp is the fraction of the star that has a planetary system

ne is the average number of planets in the entire planetary system that have environments in which life can survive

fl is the rate at which life actually occurs, and fi is the rate at which such life evolves into intelligent life.

fc is the rate at which civilizations are created whose intelligent life forms will use some form of communication technology.

And the last L is the lifespan factor.

How long, on average, can a civilization that can communicate continue to communicate?

Now, astronomers are almost at the point where they can find the product of the first three terms.

We're finding extrasolar planets everywhere.

So many experts have speculated about the origin of life, intelligent life, and the proportions of technological civilization, but no one is sure.

So far, as far as we know, Earth is the only place in the universe where life exists.

In the next 20 to 30 years, if humans explore Mars, Europa, Titan, etc., and if we find any life there, then there will be a lot of life in the galaxy.

If multiple life forms occur within a single solar system, that means that life could have easily arisen, given a similar environment, and life does.

That's why the number 2 means so much.

Scientists, including SETI researchers, admit that there are many uncertainties in their estimates, but they often make very rough estimates to advance their research.

From what we know, both R\* and ne are considered closer to 10 than to 1, and all f-factor values ​​are less than 1.

Some of them will be much smaller than 1.

But the most uncertain of all these unknowns is L, and the most practical representation of Drake's equation is simply that N and L are approximately the same.

What this equation says is very clear

N stays small as long as L doesn't grow

But you can also think the other way around.

If, in the near future, SETI is able to detect a signal as a result of studying a very small area of ​​our galaxy, we can conclude that the value of L is, on average, large.

Because otherwise humans wouldn't be able to succeed in detection so easily.

A physicist named Philip Morrison put it succinctly, "SETI is the archeology of the future."

The implication is that because the speed of light is finite, signals from distant technological civilizations tell us about their past by the time they reach us.

But because L has to be large for detection to be successful, we're also learning about the future of humanity, especially if civilization can endure for a long time.

Humans have developed technologies that can send signals out into space and can deliver humans to the moon, but they also have technologies that can destroy the environment and that can wage wars with weapons and biological weapons.

Will science and technology stabilize the environment and population of the earth in the future?

Or, in a cosmic timeline, will a moment's existence destroy our world and all life?

I want you to think deeply about the unknowns in this equation.

Why don't you make your own guesses for the unknowns and figure out what N would be?

Compare that to the estimates of Frank Drake, Carl Sagan, and other scientists and people around you.

Remember that there is no right answer

for now

sea ​​turtles are miraculous animals

First appeared in the late Jurassic period, about 150 million years ago.

Sea turtles are a family of dinosaurs that have endured hardships and survived for a long time, and have survived to the present day while many other species have gone extinct.

Second, for centuries to this day, all adult sea turtles have triumphed, surviving as a result of luck, skill and talent.

Here's a rundown of the challenges sea turtles face in their lifetime: 50 to 200 leathery, ping-pong-ball-like eggs are laid in nests that the mother turtle digs high on the beach. About 20% of them never hatch.

After about a month and a half of spawning, the surviving eggs hatch and give birth to tiny, palm-sized baby turtles that writhe to the surface and all at once break out of the sand and dash frantically toward the sea.

50% of sea turtles that escape from the sand on their way to the ocean die due to junk, pitfalls, crabs, gulls, raccoons and other threats.

For the hatchlings that actually make it to the ocean, it's a hurdle and a hurdle again. The first thing they face is the repulsive force of the waves, and then they find themselves in a whole new mass of predators, including a wide variety of fish, dolphins, sharks, and seabirds that prey on young sea turtles that rise to the surface to breathe.

Surviving through many hardships in its first few days, the vulnerable sea turtle swims forward in haste.

Eventually, they often try to settle on flotsam, especially drifting algae.

Over the next few months, they will escape predators, learn which creatures are predators, and avoid being swept away by bad weather or untimely currents.

About 50% of sea turtles that reach the ocean die at this stage.

Ultimately, after a few years, the surviving sea turtles get bigger, or at least leatherback turtles, which go from being the size of a platter at one year old to the size of a table at 10 years old.

As the size increases, so does the defense.

Our only natural predators today are the larger sharks: bull sharks, tiger sharks, great white sharks, and sometimes even killer whales.

At about 20 years of age, surviving sea turtles are able to reproduce and continue the cycle that is the very symbol of life.

Fewer than 10% of eggs laid on remote sandy beaches survive, at least that's the survival rate before they're heavily affected by humans.

Over the past century, especially over the last few decades, from sandy beach development to plastic litter, smuggling, longline fishing, net fishing, and toxic chemicals like oil have jeopardized the survival of sea turtles, reducing their survival rate from each spawning cycle to about 1 percent or less.

All eight species of sea turtles have become endangered due to this human activity.

Despite overcoming many challenges and evolving, sea turtles have been overwhelmed by the rapid challenges and scale of recent years.

A quick review of the cycle of difficulty

Using egg-laying theory, female sea turtles lay eggs multiple times a year, so for the sake of simplicity, let's say 1,000 eggs.

1000 eggs

800 will hatch

400 reach the sea

200 will grow

Twenty survive to breeding age, and that's without human intervention.

Only two survive to breeding season under the influence of humans.

So adult sea turtles in the breeding season are a real gamble.

the exception and not the norm

It's a big hit

It's a miracle in the truest sense

It was April 8, 2003

I was in Baghdad as a reporter on the Iraq war.

The day the American tanks began to reach Baghdad

The flames of war were approaching outside the windows of the few journalists left in the Palestine Hotel The flames of war were approaching outside the windows

Baghdad covered in black smoke and petroleum, smells terrible

My vision was blocked, but I could see what was going on.

As usual, I was writing an article, but when it comes down to it, something big happens. I'm sitting in my room on the 16th floor, writing.

Occasionally, I watched the situation outside through the window.

Suddenly there was a loud explosion

Until then, the air raids had lasted three weeks, and missiles and bombs weighing about 1/2 ton were raining down on me, but the impact of that time echoed through my body and was very close! Right there! I felt that

trying to find out what happened

When you go down to the 15th floor

There were people yelling in the hallways -- journalists.

When I entered one of the rooms, it was exactly the room where the missile hit directly.

there was an injured person

Lying face down by the window was a photographer named Taras Protuyuk.

I used to work in a hospital, so I tried to help him.

turned him on his back

And there was an open wound from my sternum to my pubic bone.

I couldn't see anything.

And when it disappeared, I could see his scars.

We put him in the car and took him to the hospital, but he died in the car.

Spanish photographer José Kouzo, who was on the 14th floor, was also injured.

He died on the operating table, the missile detonated between the 14th and 15th floors.

When the car left, I went to my room.

I have to write the article you asked me to

In the hotel hall, where he returned with bloody hands, he was stopped by a janitor and charged with taxes that had been ten days in arrears.

I chased him away and told myself

"If you want to write an article

Forget everything else now! ”

So I went back upstairs to my room and finished writing the article.

I sent you out, but then-

Aside from the grief of losing my colleagues, something kept bothering me.

I saw that white shining thing, I don't know what it means

and the war is over

And then, "What the heck! There's no way this could have happened, never knowing what it was or what happened."

I thought so because it's not just me

Because in my 20 or 30 years of journalism, this kind of thing has happened to people many times.

I also had an incident that affected me

For example, I met a man in Lebanon, a 25-year-old veteran who had been fighting for five years, and he could move around in the dark without hesitation.

He was a great and true soldier.

One day, he said he was back, so I went to see him, and he was in the camp, playing cards, when someone came back in the next room and laid down his weapon.

The gun went off, and the sound of the gunshot made him instantly hide under the table like a child.

he was shaking and panicked

After that, he got back on his feet and never went out to fight again. Then he became a dealer in a casino in Beirut.

I asked myself, "What is it that kills people without causing injury?

Why is this happening? What is this unknown?”

too often to be a coincidence

I started researching, I know how to do it

Read a book, see a psychiatrist, go to a museum or library.

I finally tracked down people who knew about this, military psychiatrists, and it was a phenomenon called trauma.

In the United States, it is called PTSD or trauma neurosis.

This was a phenomenon whose existence hadn't been told.

So what is trauma – what is it?

facing death

Have you ever experienced death? I'm not talking about a dead body, or a grandfather who died in a hospital room, or someone who was in a car accident.

It's about the void of death

something no one should see

As the old saying goes, "Don't stare at the sun or at death."

People shouldn't stare at death when they lose everything

Once you experience it, time passes as if nothing happened, days, weeks, months, sometimes years.

And then all of a sudden, it explodes, and it's already in your head. There's that image in front of the window of your mind, and that image that's in your head is taking over your mind.

Men and women suddenly can't sleep anymore

It's an attack of distress and a panic attack. It's a panic attack. It's not a little anxiety.

All of a sudden I can't sleep because every night I go to bed, I have the same nightmare.

I'm tormented by the same image What kind of image is it?

For example, when a soldier breaks into a building, another soldier waiting for him turns his gun on him.

he stares at that muzzle

Then the muzzle suddenly becomes huge and changes shape

Become hairy and swallow everything

He said, "I've seen death, I'm dead."

From that moment on, he knew he was dead.

It wasn't just a feeling, he was sure he was dead.

Actually someone came in and the enemy soldier either fled or didn't shoot, and he wasn't shot, but he died in that moment.

For example, the smell of mass graves, I saw a lot in Rwanda.

For example, a voice calling out to a friend, a voice about to kill me, but I can't do anything

I hear that voice every night, and I wake up in the middle of the night for weeks and months, and I'm in a childlike trance, panicked and terrified.

See that image in your head

You see the image of fear, the image of the void of death, and you cry.

I just can't resist

I can't work anymore, I can't even have the feeling of admiring anything

When I get home, I don't know anyone's face, I don't even know my own face

stay at home in hiding, shut up, get sick

Some even set up coin can traps outside in case someone broke in.

And suddenly they want to die, they want to kill people, they want to hide, they want to run away.

hate even though i want to be loved

I'm trapped in that feeling day and night, and I suffer terribly

no one can understand that

Everyone said, "But it doesn't matter! You look fine.

They weren't injured, they just went to war and came back." These people suffer so much that some even commit suicide.

For them, even taking their own life is like updating their notebook.

Some take their lives, others drink and go to live under bridges.

We all remember the story of a grandfather or an uncle -- or a neighbor who was always drinking, was silent, was always grumpy, raised his hand to his wife, got drunk, and eventually passed away.

why don't we talk about it? Why are you keeping your mouth shut?

The reason is that it's a taboo word for the emptiness of death.

Not just don't talk because you can't find

I don't talk about it because people don't want to hear it.

When I came back from my post, people said, "Hey, you're back!"

A sumptuous dinner was arranged White napkins Candles Guests

"Now tell me." So I told my experience.

After about 20 minutes, everyone started to look at me with bitter eyes, and the mistress of the house felt heavy and fell down.

I realized that I spoiled the atmosphere of the dinner party.

That's why I don't talk about it anymore because people aren't ready to hear it.

"Please stop!"

Is this a rare case? No it's very common!

A third of the soldiers who went to war in Iraq suffered from PTSD.

In 1939, 200,000 World War I soldiers were being treated in British psychiatric hospitals.

54,000 American soldiers dead in Vietnam

In 1987, the U.S. government announced the suicide of 102,000 veterans -- about twice as many -- as veterans.

That's twice the number of soldiers killed in action in Vietnam.

Now you can see that not only modern warfare, but ancient warfare is being told as it is written in the books.

why don't we talk about this?

Why do you keep your mouth shut?

If you don't talk about it, doom awaits.There's only one cure.

Fortunately, it's a curable disease, but remember Munch's Scream, Goya, etc. And it's treatable!

Trauma The only way to recover from this confrontation with death that overwhelms you, paralyzes you and ultimately kills you is to find a way to express that experience.

An old man said, "Only words are what bind us together."

Without language, we would not be human.

Words make us human

After encountering these images of horror reigning in the wordless void, the only way out is to speak human language.

they feel cut off from humanity

no one wants to get involved no one wants to get involved with them

they feel dirty and ashamed

Someone said, "Doctor, I'm not taking the subway anymore because people around me will see the fear in my eyes.

It scares me." Another thought he had a terrible skin disease, so he went from one dermatologist to another for six months.

I was told I should go to a psychiatrist.

On his second visit, he told the psychiatrist, "I have a terrible skin disease from the top of my head to my toes."

The doctor asked, "Why do you think that happened?"

The man says to the doctor, "I'm dead, so my body is rotting, so I think that's why."

you will feel something that has a profound effect on you

To recover from this, we have to talk about fear.

We have to put fear into human language, put it in order, and say more.

I'll look straight into the fear

If you can do that, if you can talk about it, you can slowly put it into words and regain your humanity.

This is important! Silence kills us!

What does that mean? this is definitely after trauma

We lose the unbearable lightness of being, we lose the sense that we exist forever. It's a false sense that we can stay here forever, but without it we're at a loss.

Trauma survivors lose this sense of eternity

They lose their lightness, but they can also make new discoveries.

If you're faced with death, don't hide or stay silent and face it. My friends did that. Michael of Rwanda, Carol of Iraq, Philip of Congo. Soju Sharondon, now a great writer, stopped writing battlefield reports after trauma.

Five of my friends committed suicide because they didn't survive the trauma.

If we all have a finite life, and if we face death, if we can make this experience meaningful by understanding that we are human and that our lives are finite, by facing death and realizing that it's the most mysterious place no one has ever seen, then we will die, survive, come back, and come out stronger than ever before.

thank you

(applause)

One day when I was in fourth grade, my teacher said, "There are as many even numbers as there are natural numbers."

I thought, "Really?" It's true that there are an infinite number of natural numbers and even numbers, and you could say that there are an equal number of them.

But on the other hand, the even numbers are only part of the whole set of natural numbers, and there are other odd numbers, so there must be more of the whole set of natural numbers than even numbers.

To understand what you're trying to say, let's first think about what it means for two sets to have the same size.

What does it mean when we say that we have the same number of fingers on our right hand and left hand?

Of course, each hand has five fingers, but it's actually easier to show.

You don't have to count, just put your hands together and stack them one by one.

In fact, it's thought that ancient peoples who had wordless languages ​​for numbers greater than three used this trick, for example, when they let sheep out of their pens to graze.

By keeping a stone for each sheep that comes out, and putting the stone back when it comes back, you can know how many sheep are outside, and if there are any sheep that haven't returned, without having to count them.

Here's another example where matching is more essential than counting. If I'm speaking in a full auditorium, and the seats are all taken, and no one is standing, I don't know how many people there are, but I know there are as many people in the audience as there are seats.

So to say that two sets are the same size means that the elements of each set are in some way related to each other.

My fourth-grade teacher put the natural numbers in a row and doubled them underneath.

As you can see, the bottom row contains all the even numbers, with a one-to-one correspondence.

So there are as many even numbers as there are natural numbers.

But the fact that the even numbers are only part of the natural numbers still haunts me.

But does that mean that the number of fingers on the right hand and left hand are different?

Of course not.

There's nothing to say from that, but if we could find a way to map the elements of the two sets together.

We can say that the number of elements in the two sets is equal.

Can you list all the fractions? It can be difficult, after all, there are a lot of fractions!

What should I list first? How do I know if they are all listed?

Actually, there's a neat way to enumerate all the fractions.

It was invented by Georg Cantor in the late 19th century.

First, put all the fractions in a grid, and you'll see they're all there, let's say 117/243.

Found at line 117, column 223

Then we start at the top left and work diagonally back and forth to make a list, skipping the same number that came up earlier, like 2/2.

And that gives us a list of all the fractions, and even though there should be more fractions than natural numbers, we still have a one-to-one correspondence between all the natural numbers and all the fractions.

Here's where it gets really interesting

As you may know, not all real numbers, or numbers on the number line, are fractions.

Examples are the square root of 2 and pi.

Such numbers are called irrational numbers.

Fractions are called rational numbers because they are ratios of integers.

Irrational numbers are represented by non-repeating decimals

Is it possible to have a one-to-one correspondence between the set of natural numbers and the set of decimal numbers, both rational and irrational? Is it possible to enumerate all decimals?

Cantor proved it's impossible, not just that he doesn't know how, it's impossible.

Let's say we enumerate all the decimals, and now by making the decimals that aren't in that list,

indicates that the list is incomplete

I will make the decimal of the problem one digit at a time

To determine the 1 decimal place, look at the 1 decimal place of the first number in the list

If the number is 1 then choose 2 else choose 1

To determine the second decimal place, look at the second decimal place of the second number.

Again, if the number is 1, choose 2, otherwise choose 1.

Do you know what will happen? The decimals thus created cannot exist in this list.

I wonder why? Could that number be, say, the 143rd number? no the 143rd decimal place in this decimal is

It's not like the 143rd decimal place in the list.

The list was incomplete. It didn't include the decimal we just made up.

No matter what list you are given, you can use the same operation to create decimal numbers not in that list.

So we're faced with the astonishing fact that decimals are not enumerable, that the set of decimals is an infinity greater than the infinity of the set of natural numbers.

There are only a few irrational numbers that we are familiar with, such as the square root of 2 and pi, but the infinity of all irrational numbers is greater than the infinity of fractions.

Someone once said that rational numbers (fractions) are like stars in the night sky.

Irrational numbers are like the black part of the night sky

Cantor also showed that for any infinite set, constructing a set from all subsets of that set yields a higher infinity than the original set.

By making a set of all the subsets, we get a larger set, and if we do the same operation on the result,

You get a larger set, and you can iterate over it any number of times.

There are infinitely many different sizes of infinity.

If this idea doesn't convince you, you're not alone, among the great mathematicians of Cantor's time.

Some people were horrified by this, and they thought that mathematics could be done without this concept.

I tried to make the infinite difference irrelevant.

Cantor was personally slandered and suffered from severe depression, spending half his life in and out of mental hospitals.

But in the end his idea won out, and today it's considered a radical and great achievement.

Every mathematics researcher embraced this idea, every mathematics student learned it, and I explained the idea in minutes.

one day it may become common knowledge

Continuing the story, I pointed out that the set of all decimals (real numbers) is a higher infinity than the set of all natural numbers.

Cantor wondered if there were infinities of different sizes between these two infinities.

He thought he wouldn't, but he couldn't prove it.

Cantor's conjecture became known as the "Continuum Hypothesis."

In 1900, the great mathematician David Hilbert identified the continuum hypothesis as one of the most important unsolved problems in mathematics.

During the 20th century, the problem was solved, but the results were completely unexpected and radically disruptive.

In the 1920s, Kurt Gödel showed that it was impossible to prove the continuum hypothesis false.

In the 1960s, Paul J. Cohen showed that proving the continuum hypothesis to be true is also impossible.

Taken together, there are questions that mathematics cannot answer.

A really surprising conclusion

Mathematics is thought to be the pinnacle of human wisdom, but it turns out that even mathematics is limited in our understanding.

But there is something really wonderful about mathematics that we should think about.

For most of the 20th century, architecture was bound by one famous principle.

"Form follows function" was both an ambitious mantra of modernism and a pernicious straitjacket, liberating architecture from ornamentation and confining it to rigid utilitarianism and limited purpose.

Architecture, of course, is about function, but I would like to reflect on how Bernard Tschumi rewrote that motto and propose a completely different value.

If form follows fiction, then we can think of architecture and buildings as spaces in which stories take place -- the stories of the people who live there, the stories of the people who work there.

And then you can imagine what kind of experience your building will create.

In that sense, the story that interests me is not the improbable story, but the story of reality for the people who live and interact with the building.

Our buildings represent an idea of ​​what the spaces where people live and work can look like, what the spaces for culture and media can look like today.

Our buildings are real and constructed.

It's a tangible combination of physical reality and conceptual possibility.

I see our architecture as an "organizational structure."

At its core is systemic, structural thinking: how can we organize things, both functionally and experientially?

How can we create a structure that creates a series of relationships and stories?

How is it possible that the story of the inhabitants and users spins the architecture, and at the same time, the architecture spins the story?

This is where the second key word comes in: compound narrative, the structure of multiple concurrent narratives that revolve around the buildings we create.

We can think of architecture as a complex system of relationships, programmatically, functionally, experientially, emotionally, socially.

This is the headquarters building of China Central Television (CCTV), designed in collaboration with OMA's Rem Koolhaas.

When I went to Beijing for the first time in 2002, a city planner showed me this picture: the central commercial district was lined with hundreds of skyscrapers, but at the time there were only a handful of them.

So I had to design almost nothing, and the only vector that was clear was the vertical.

Skyscrapers, of course, are vertical, very hierarchical structures by nature, and it always seems that the top floor is the highest, the bottom floor is the lowest, and the higher the better.

We asked ourselves, could we give the building a completely different character?

Can't we get rid of hierarchies and create a system for collaboration instead of division?

So I bent this arrow back to the starting point, creating a loop of engaging activities.

Our idea is to bring all aspects of television production into one structure: reporting, programming, broadcasting, research, training, management, all in a circle of interconnected activities where people meet in interactions and collaborations.

I still love this drawing

It reminds me of my biology time in school, when the human body has different organs and a circulatory system.

And architecture suddenly becomes visible not just as a physical object being built, but as an organic organization, like a living organism.

As we dissect this organic organization, we can identify a series of key practical elements: Program Production Broadcast Center Press.

And then there's the social element intertwined: the boardroom, the canteen, the common room, the informal place where people meet and talk.

So the organizational structure of this building is hybrid: practical and social, human and business.

And we're using the building's looping structure as a circulatory system to tie everything together so that employees and visitors alike can experience all functions in greater unity.

With a floor area of ​​473,000 square meters, it is one of the largest buildings ever built.

It houses more than 10,000 people, which is in many ways beyond comprehension and beyond the scale of typical architecture.

So we paused and glued 10,000 stick puppets onto an architectural model, just to get a grip on what this amount really means.

Of course, it's not the numbers that matter, it's the community, the people who live in this building, and in order to understand that and then weave the building together, we hypothetically imagined five different types of people, and followed them through the day they would spend in the building, where would they meet and what would they experience?

So this was a process of designing and spinning the building, but it was also a process of communicating the experience of building.

This is an exhibition at the Museum of Modern Art in New York and Beijing.

This is the main broadcast control room, but it's a very large facility that can broadcast 200 channels simultaneously.

This is what a building in Beijing looks like now.

The first live coverage was at the 2012 London Olympics, and the exterior was completed by the 2008 Beijing Olympics.

You'll see three small circles at the end of a 75-meter high cantilever.

It's part of a public walkway that circles the building.

The floor there is made of glass, and you can see the slowly moving city from above.

This building has become part of everyday life in Beijing.

always there

Very popular as a backdrop for wedding photos

(Laughter) But perhaps the most important moment was this one.

"That's Beijing" is like Time Out, a magazine that tells you about what's happening in the city this week, but suddenly this building isn't being portrayed as an object, but as one of the characters that make up the city's life.

Architecture suddenly came to be seen as a living being, a storyteller, a storyteller.

This is what we believe to be one of the main significances of buildings.

Of course, there are other stories in this building as well.

It's the story of the people who built it, under my leadership of 400 engineers and architects, who worked together for nearly a decade to spin this building, imagine what it would look like, and finally build it in China.

This is a large housing complex in Singapore.

What we see in Singapore, like in Asia and a growing number of other parts of the world, is an architectural typology dominated by skyscrapers that creates isolation rather than connection.

How can we create a communal space where sharing is as good as owning?

We had to design 1,040 apartments, and the typical answer to this is 12 24-story buildings, the maximum allowed by the Department of Planning, with nothing in between. It's very formal, and the buildings are separated from each other, but they're so close together that there's no privacy, and the quality of life there is questionable.

So I suggested laying the building on its side and stacking it up. From the side, it looks messy, but from the top down, the organizational structure is a hexagonal lattice. The horizontal building is stacked to create a large courtyard, and it's the center of the community, with a variety of facilities and functions.

The courtyard is not a closed space

open and passable, connected to each other

We named this project "Interlace" because of our idea of ​​interweaving and connecting people and spaces.

And every detail of the building was designed to bring the space to life and serve its inhabitants.

As a whole, more private spaces are built up on top of shared spaces.

The spectrum that connects collective and personal space is expanding.

It's a simple calculation, but if you take the green area of ​​this land, remove the base area of ​​the building, and add the green area on the terrace, the green area is 112 percent, which is more green than it would have been without the building.

What this calculation shows is that we're multiplying the available space for the people who live here.

This is the terrace on the 13th floor

Creating new ground for social action

We paid a lot of attention to sustainability.

In the tropics, the sun is the one we pay most attention to, and we're thinking about how to protect ourselves from the sun.

First, we made sure that every room had enough sunlight year-round.

We then optimized the sheen of the walls to minimize the building's energy consumption.

But most importantly, the shape of the building provided enough shade for the courtyard so that it could be used all year round.

It also places water along the wind path to create an evaporative cooling microclimate that enhances the space available to residents.

And this gives residents the freedom to choose, the freedom to choose where they want to be, or where they want to escape, to the complex complexes in which they live.

Let's move from Asia to Europe, a Berlin-based building for a German media company that is moving away from traditional print media to digital media.

The CEO posed the crux of the question: How can it be attractive to go to the office and work in an age where work can be done anywhere?

How can a company's digital identity be embodied in a building?

We didn't just create an object, we created a large space at the center of it, a space for communal experiences, experiences of cooperation and togetherness.

At the center of the building is a "collaboration cloud," a space for communication and interaction, surrounded by regular offices.

It takes you just a few steps away from your usual quiet seat to participate in a colossal co-operative experience at its center.

And finally, London, a project commissioned by the London Legacy Development Corporation, led by the Mayor of London.

We were commissioned to look into the potential use of the Olympic Park in Stratford.

Just like Prince Albert built "Albertopolis" in the 19th century

Mayor Boris Johnson wanted to build an "Olympicopolis."

The idea is to bring together the best British and international institutions here and create a new system of synergy.

When Prince Albert built Albertopolis in the 19th century, he wanted art and science juxtaposed to showcase all of humanity's greatest achievements.

And then we built an exhibition road that connects all the institutions together.

But today's society has changed

We live in a world where nothing can be clearly delineated or separated anymore.

The boundaries between different domains are blurring, and cooperation and interaction are much more important than maintaining their independence.

So we wanted to create a giant machine that creates culture, a building that integrates and animates different realms, allowing them to interact and collaborate.

It's basically a very simple ring module.

It represents functions such as corridors, sunlight and ventilation.

They can fit together to create a large space for exhibitions and performances.

Modules are stacked so that any function can be placed on any module as time changes.

Each facility can be small, because the future of culture is largely unpredictable.

This is where the building will fit, next to the Aquatics Center, across from the Olympic Stadium.

You can see how the building's overhangs intersect with the public spaces and how the courtyards bring the interior to life.

The idea here is to create a complex system in which each institution can maintain its own identity without being swallowed by the whole.

This is a size comparison with the Pompidou Center in Paris.

Both show their great scale and potential, but there are also differences. Here, heterogeneous structures are stacked on top of each other, allowing different departments to interact without losing their individual identities.

The idea is to create an organizational structure that allows multiple narratives to be spun. Some are educational narratives that create and reflect on culture, others represent visual arts and dance, and everyone is free to follow their own path and interpret those stories and experiences in their own way.

I'm going to end with a very small project of a different type: a floating cinema in Thailand.

A friend of mine is running a film festival, and it made me think, if you're thinking about the stories and stories of movies, you should be thinking about the stories of the people who watch them.

We designed a small floating dock module inspired by how local fishermen build fish and shrimp farms.

Built in partnership with the local community and using their own materials, we've seen films like 1903's "Alice in Wonderland" from the British Film Institute archives as we swayed on this amazing floating pier.

Here, the audience's most primal experience is mixed with the story of the film.

I believe that architecture is more than just physical and environmental realms, it's about how we want to live and how we tell stories about ourselves and the people around us.

thank you

(applause)

Today we will talk about moles

You know moles? "A little furry animal that digs into the ground and ruins your garden"?

Some people think of a hairy mole that grows on the face of an aunt.

But here, mole is a concept used in chemistry to count very small molecules and atoms.

Have you ever wondered how many atoms there are in the entire universe?

how many in your body? How many in a handful of sand?

Scientists wanted to answer that question, but how do you count something as small as an atom?

In 1811, someone thought that at constant temperature and pressure, given the same volume, gases would contain the same number of molecules.

His name is Lorenzo Romano Amedeo Carlo Avogadro

It must have taken you a while to sign your name.

Unfortunately for Avogadro, the concept of the atom was not accepted by scientists, and there was no way to prove it correct.

Atoms and molecules were also not clearly distinguished.

Many scientists saw Avogadro's work as hypothetical, so it wasn't taken seriously.

But it turns out he was right! By the late 1860s, Avogadro had been proven right and his work had helped lay the foundations of atomic theory, but Avogadro died in 1856.

Now, the number of molecules in a tiny sample is enormous. For example, at 0 degrees Celsius and 1 atmosphere of pressure, one balloon [22.4 liters] contains exactly 6,020 gas molecules.

It contains a gas molecule with a 6 followed by 23 zeros.

In scientific notation it is expressed as 6.02 x (10 to the 23rd power)

A common misconception is that the molecules of a gas occupy a lot of space due to their high kinetic energy, which makes us think that atoms are larger than they actually are.

But if we consider the water molecule

If you pour 18.01 grams of water into a glass, it's 18.01 milliliters, which is about three and a half teaspoons, but there are still 6,020 water molecules in it.

Lorenzo Romano... Avogadro was the first to come up with the constant 6.02x (10 to the 23rd power), and scientists named him after him.

It's called Avogadro's number

I'm back to moles, but not moles.

That's right, this mole.

It's a mole. Chemists use the word mole as a unit to denote the number 6.02x (10 to the 23rd power).

known as the number of moles

Atoms and molecules are so small that chemists put them together in units called moles.

Moles are hard for students to understand, because it's hard to imagine how big a mole is, or the number 6,020.

It's too big to comprehend

Remember 18.01 milliliters of water

this is 1 mole of water

how many is this?

How to accurately understand 6,020 垓?

What do you think of this

Replace water molecules with donuts

One mole of donuts covering the entire globe would be 8 kilometers or 5 miles thick.

I need plenty of coffee to drink with you

One mole of basketball would create a new Earth-sized planet.

If you were given one mole of one-yen coin on the day you were born, and if you continued to use it at 100 million yen per second until you died at the age of 100, 99.99% of it would still remain in your bank account.

Now I have some idea of ​​how big a mole is.

How do we use it?

It might surprise you to learn that chemists use moles, just as they use grams to buy grapes, side dishes, and eggs.

I think I'd buy salami by the gram at the ready-to-eat section of the grocery store instead of saying, "Give me 43 pieces of salami."

When you buy eggs, you buy them in packs of a dozen.

When I think of a dozen, I think of the number 12.

Also, a pair is two, a baker's dozen is thirteen, one gross is 144, and what about a strip of paper? who knows?

1 row is 500 sheets

moles are the same

The mole reminds chemists of 6.02x (10 to the 23rd power), and it's not a small furry animal. The only difference is that the latter is better known.

I hope you got it. Mole's Story - Avogadro's Number, Basketball and How to Buy Salami at a Deli

we may speak using direct expressions

"I'm going shopping. I'll be back in five minutes."

But it can also magically bring a little spectacle into place.

"It's raining cats and dogs outside (it's pouring)" or "I was waiting for the other shoe to fall off (I was anxiously waiting)".

A metaphor is a representation of one thing in terms of something else.

It seems like a long way around, but it's not.

Seeing, hearing and tasting is the first time we understand things.

According to philosopher William James, the world is "a buzzing mess" for newborns.

Abstract concepts are vague compared to bees and flowers.

Metaphor requires imagination and feeling

The chili inside it explodes in your mouth and in your mind.

The metaphor is also accurate

I don't think of raindrops as big as a real cat or dog, but if you think about it, it's pretty clear that the dog is small, like a Cocker Spaniel or a Dachshund, but not a Labrador or a Newfoundland.

Metaphors cannot be questioned in the usual sense of the word.

Metaphor is an art, not a science, but you can feel its truth.

Bad Metaphors Confuse

I know what you mean by "I feel like a square wheel (getting stuck)", but "I'm tired like a whale" doesn't quite make sense.

Metaphors Contain Paradoxes

They say things that are almost always not true.

When I say, "There's an elephant in the room (everyone pretends not to see it)," I don't mean there's a real elephant looking for a plate of peanuts on the desk.

A metaphor is something that goes beyond logical thinking and is directly felt.

Moreover, we are accustomed to thinking visually.

Every night I see dreams that can't be real

I still remember it when I woke up

We take off our dream shoes, put on our clothes and step into our normal lives.

Some metaphors include the words "like" or "like"

"Sweet as honey" or "Strong as a tree"

these are called similes

A simile is a type of metaphor that acknowledges that you are making a comparison.

simile makes you think

Metaphor makes you feel directly

Let's take a look at Shakespeare's famous metaphor, saying that "the world is like a stage" compared to "the world is a stage."

It's flimsy and boring. Metaphors can be found in verbs as well.

Emily Dickinson's poem begins, "The lost sky is stitched together." If the sky were stitched together like a fabric -- we can immediately imagine.

Metaphors are also found in adjectives

The expression "a quiet river runs deep" refers to a quiet and thoughtful person.

Depth is as important as calmness, just as water is.

A great place to find good metaphors is poetry

Consider the following haiku by 18th-century Japanese haiku poet Issa Kobayashi

"Crying insects ride floating trees, I guess."

When you come across a metaphor, the first thing you should do is look at the world from that point of view: singing bugs, riding on twigs, floating in the middle of the river.

Even as I picture that scene, somewhere in my heart I know that it's a sketch of what's alive in a world that moves with the flow of time.Like little crickets, people's destinies will eventually perish—and yet we live and sing like these insects.

Poetry sometimes incorporates metaphors to construct the same idea in different ways to develop the scene of the poem.

Here's the beginning of Langston Hughes' famous poem, "From Mother to Son."

"Hey son, let me tell you, my life wasn't a crystal staircase.

There were nails sticking out, dangerous pieces scattered about, thorns sticking out of the planks, and there wasn't a single rug on the floor."

Langston Hughes uses a metaphor to liken the harsh life to the hovel he's forced to live in.

The thorns and the deadly pieces feel so real that they hurt the reader's feet and mind.

Hunger, cold, hard labor, and poverty are represented as thorns.

Metaphors aren't just about people's lives and emotions.

Chicago poet Carl Sandberg wrote, "A little cat's paws come the fog. Sit back and look out over the harbor and the town, and quietly walk away."

This contrast is simple

Fog is described as a cat

But a good metaphor isn't a puzzle or something that conveys hidden meaning, it's a way to make something feel and inform you in a different way.

After hearing this poem, no one will ever forget it

When the fog came into view, there was already a little gray cat nearby.

Metaphors allow words to extend far beyond their original meaning.

It's the door handle that leads to the world we know and the world we can imagine.

Each door leads to a new home, to a new world that only the handle can open.

And what's so great about this is that by making one handle, you can create one world.

What if I could describe a story that you could remember with your whole body, not just your mind?

In my life as a journalist, I've always had to come up with stories that can make a difference and inspire people.

publishing industry, documentary industry

After that I worked in the broadcasting industry.

Until I got involved with virtual reality, I hadn't seen that kind of eye-opening, intense, genuine human reaction.

And what's really special about it is that it uses VR, virtual reality, to let people participate in the scenes in the middle of the story.

With the goggles on, wherever you look, you get a full-body sensation as if you were really there.

Five years ago, I embarked on a new adventure to combine virtual reality with journalism.

I wanted to do something about hunger

American homes are starving, food banks are overwhelmed, and food is frequently in short supply.

Now, I can't make people feel hungry, but maybe I can come up with a way to physically make them feel something.

Again, five years ago, doing journalism and virtual reality at the same time was seen as worse than a half-baked idea, and there was no funding for it.

I used to be laughed at by a lot of my colleagues

But we had an amazing female intern named Mikaela Kobsamark.

We went to the food bank together and started recording audio and photos.

Until the day she just came back to the office crying

She was in a long queue that was being led by a woman who was being pushed to her mental limit and said, "Too many people! Too many people!"

was shouting

A man with diabetes was unable to find food and his blood sugar dropped so low that he fell into a coma.

As soon as I heard that audio, I knew immediately that this could be the kind of emotional trigger that could really paint a picture of what's going on in food banks.

Now, here's the actual line. You know how long it is, right?

Again, we didn't have a lot of money, so we used the donation of virtual humans and the generosity of others to recreate the model as accurately as possible.

And we tried to tell you as accurately as possible what happened that day.

(Video) Audio: "Too many people! Too many people!"

Audio: "Okay he's having a seizure"

Spoken: "I need to call an ambulance"

Peña: The man on the right - he's walking around the side of the fallen man.

he is in the same room as him

It's as if the man is at your feet

And even through the sight of the device, he feels like he's there with the people behind the device, even though he should know he's in the lab and not actually on the street.

He's walking carefully so as not to step on this man who isn't in the real world, right?

The film premiered at the 2012 Sundance Film Festival, and amazingly enough, it was essentially the first virtual reality film ever made.

I was really scared when I went to the site

Because I had no idea how people would react or what would happen.

We brought these homemade goggles with us.

(Video) "Well, you're crying, aren't you, Jina?"

You can tell from my voice that I'm surprised, right?

And this kind of reaction resulted in a kind of reaction that we've seen time and time again, where people kneel on the ground to try to comfort someone who's having a seizure, and they know they can't do anything about it, but they try to softly say something and offer a helping hand.

And a lot of people said, "Oh my god, I was so frustrated that I didn't help them."

After this film was made, the dean of the School of Cinematic Arts at the University of Southern California had "Hunger in LA" tested by the president of the World Economic Forum.

I really wanted to do something for the Syrian refugee children who are in the worst of the civil war in Syria.

We sent a team to the Iraqi border to record material in refugee camps, and that's where ISIS operates, and I would never send a team there today.

Now, we recreated the street scene where the bomb exploded while the girl was singing.

You're in the middle of the scene, you're hearing all these sounds, there's injured people all around you, it's incredibly scary, it's a real feeling.

And according to people who've actually seen the explosion, the footage evokes similar horrors.

[The civil war in Syria may be someone else's problem] [Until you experience it yourself] (girl's song) (explosion) [Syria project] [virtual reality experience] Peña: I was invited to exhibit this work at the Victoria and Albert Museum in London.

Not for promotional purposes

Installed in the exhibition hall of this tapestry

We hadn't announced anything, so that day, by chance, everyone who came to see the tapestry at the museum saw us surrounded by lightning.

I'm sure they wanted to see the origins of the tapestry.

Faced with our virtual reality camera.

But over five days, many people tried it, and the guestbook had 54 pages of comments.

For example, "It's so real." "I can believe it." Of course, I got excited by comments like, "It's a real feeling, like you're in the midst of what you usually see on the TV news."

So it's a success, right? this was successful

And it doesn't matter where you're from or how old you are -- it's really inspiring.

But don't get me wrong, I'm not saying that when you're in the video, you forget you're here.

But you can feel like you're in two places at once.

And I think you can get what you call dual existence, and that's what allows you to tap into these feelings of empathy.

That's right?

What that means, of course, is that I have to be extremely careful in creating these works.

Adhering to the best of journalism, we must make it clear that these powerful stories are built with integrity.

If you can't get your hands on the material, you have to be very thorough about the provenance, where it came from, and whether it's authentic.

Let me give you an example

In the case of Trayvon Martin, at the age of 17, he was shot and killed by vigilante George Zimmerman after buying soda and candy at the store.

To create that work, I obtained blueprints for the entire residential area, and based on those blueprints, I thoroughly recreated the site at that time.

All actions were justified by actual recorded police calls.

And, interestingly enough, they put out some news about this story.

The forensics team that recreated the audio and the audio-visual company said George Zimmerman testified that when he got out of the car, he pulled the trigger before chasing Martin.

You know the basic tenets of journalism, you know, they haven't changed anything about this situation.

We still and always will follow the same principles.

Whether you're witnessing a man dying of hunger or feeling like you're in the middle of an explosion, the difference is the feeling of being there.

This is the kind of thing that pushes me forward with my work and makes me think about how I create them.

We're going to make this more accessible than a headset.

We're also making a mobile version, like Trayvon Martin's work.

And these events had a strong impact

Some Americans donated money directly from their bank accounts to Syrian refugee children.

And the "Hunger in LA" project is pushing for a new form of journalism that will eventually find its way into existing platforms.

thank you

(applause)

Why do gas stations often stand side by side?

When I thought there were no coffee shops at all, why are there so many in one place?

Why do supermarkets, restaurants, and auto repair shops all seem to be in the same place instead of being separated?

There are many points to consider when choosing a place to open a store, but what explains why similar stores gather in one place is the "hotelling location competition model." For example, you.

like selling ice cream on the beach

Let's assume the beach is 1000m long and has no competitors.

Where should I put the cart to sell more?

it's in the middle

500m from both ends of the beach It's a bit far for people on the ends, but it should attract the most customers

One day I went to the beach and my cousin Ted was there selling ice cream just like you.

They decided to rub half the beach

We both decided to put our carts in the middle of their respective territories so that our customers wouldn't have to walk too much, and you in the middle of the south half.

Ted moved the cart to the middle of the northern half.

People south of your cart come to your cart

People north of Ted's cart will go to Ted's cart, and people in between will go to the nearby one to buy, so no one will walk more than 250m.

You've split the customer in half.

In game theory, this is called a "social optimum."

All customers have to walk the minimum distance to buy ice cream.

The next day, when I came to the beach, Ted was selling ice cream in the middle of the beach.

You went to the same south 1/4 as yesterday, 25% of the south's customers come to you.

Ted got all the customers in the northern half, plus a portion of the 25% of the customers between the two of them.

On the third day of the Ice War, you arrived at the beach first, and decided to put your cart in the middle of Ted's territory, thinking you'd have 75% of the South's customers and Ted's North would have only 25%.

But Ted, who came later, put his cart just south of you, so he took all the south customers, leaving only the north part.

I moved 10 steps south of Ted to try to get the customer back.

During your lunch break, Ted took another 10 steps south of you, so he took another customer to the south.

So they decided to move south and south, trying to get more customers for the day, and they ended up sitting back to back in the middle of the beach, splitting the customers in half.

This is what game theory calls the "Nash Equilibrium".

Put the cart 250m from the center The first strategy was not a Nash equilibrium so it didn't last long

If you want to sell more ice cream, just move closer to the other person.

Both of them will end up in the middle of the beach.If they move to the farther customers,there will be fewer customers.

But this isn't the social optimum, people on the edge of the beach have to walk a long way to buy ice cream.

Think of fast food restaurants in shopping centers, clothing stores, mobile phone stores.

It would be convenient if the shops were evenly distributed in the area, but under fierce competition, the shops would be at a disadvantage.

In reality, customers come from all directions, and stores can freely compete by differentiating their products, selling them at lower prices, or changing their strategies.

Caves are interesting things. A dark hole in a limestone cliff invites you in.

Passing through the doorway between light and darkness, you enter an underground world, a land of eternal darkness, the smell of earth, and silence.

The ancients, who were in Europe long ago, also went into these underground worlds.

Evidence of this is the enigmatic carvings and paintings of the ancients in the passageway.This is the wall of Hoyo Guarena cave in Spain, with people, triangles and zigzags.

You're walking the same road that ancient artists walked.

It's something that makes you imagine being in this surreal otherworld, hearing the faint sound of leather shoes stomping on the soft earth, and feeling the flames of a torch flickering over the next corner.

When I'm in a cave, I often wonder what drives these people to go so far, to venture down dangerous narrow passages, to leave footprints.

We shot inside the cave, about 500 meters underground in the Cudong Cave in Spain, and we explored an untouched area and found a series of red paintings on the ceiling.

We crouched forward military-style as the low ceiling got lower and lower until we finally got to the point where the ceiling was so low that my husband, Dylan, the photographer on the project, couldn't focus his DSLR.

While he was filming me, I followed the trail of the red painting with the one light I had on hand just in case, and an autofocus camera.

500 meters underground

serious talk

What were you doing in a place like that with a torch or a stone lamp in your hand?

(Laughter) Because you know I'm going?

But this is the question that I'm trying to clarify in my research.

I'm investigating the oldest art in the world.

The authors are ancient European artists, 10,000 to 40,000 years old.

But we don't just study it because it's beautiful, and yes, some things are beautiful.

I'm interested in what it means to be human, how the modern human mind has evolved, how creativity, imagination and abstract thinking have evolved.

All species communicate in some way, but only humans have taken communication one step further.

The human desire and ability to share and collaborate greatly contributes to our success stories.

The modern world is based on a global network of information exchanges, made possible primarily by our ability to communicate, especially through graphics and written communication.

The problem is that we've relied on the spiritual feats of our predecessors for so long that it's easy to forget that we have abilities that didn't exist yet.

And that's what I find most fascinating about studying the deep history of humanity.

The ancients didn't have the achievements of their predecessors to build on.

they themselves were pioneers

It's amazing how many important inventions were made long ago in their time, but what I want to talk to you about today is the invention of graphical communication.

There are three main types of communication: verbal communication, gestural communication like sign language, and graphic communication.

Speech and gestures are inherently ephemeral

In order to transmit and receive messages, we need contact.

And it disappears the moment the transmission ends.

Graphical communication, on the other hand, is fine from a distance.

With this invention, for the first time, messages are no longer fleeting, but can be transmitted and stored across time and space.

Europe is a place where early traces of figures have been found repeatedly in caves, rock dwellings and some surviving open-air sites.

But it's a different Europe than it is today.

It's a world covered in towering ice sheets three to four meters high, a world of vast grasslands and frozen tundra.

It's the ice age

In the last hundred years or so, more than 350 Ice Age rock arts have been found across continental Europe, featuring animals, abstract figures, and even humans, like this one from the Adaura Cave in Sicily.

A rare glimpse into the creative world and imagination of ancient artists.

Since these discoveries, animals have been the subject of major research, such as this black horse from the Curralvera cave in Spain, and this rare purple buffalo from the La Pasiega cave.

But what fascinated me was the abstract form, and my fascination with this thing called geometric symbols started my research.

The funny thing is that at most sites, geometric symbols are much more common than depictions of animals or humans.

But when I started my research in 2007, there was no reliable documentation of how many different forms there were, nor was it clear whether the same thing would appear across time and place.

Before I even embarked on my own research project, I decided to compile a database of the geometric symbols found in all the sites with petroglyphs.

There was a problem. While the ones that were depicted with the most beautiful animals were relatively well documented, there were quite a few that were vaguely depicted, not very descriptive and not very detailed.

There were things that no one had seen for over 500 years.

That was the subject of my fieldwork

Over the course of two years, my faithful husband, Dylan, and I each spent over 300 hours underground, walking, crawling, and moving around 52 archaeological sites in France, Spain, Portugal, and Sicily.

It was very rewarding

75% of the sites visited have found new unrecorded geometric symbols.

I knew I needed this level of precision if I wanted to clarify the bigger question.

let's move on to the answer

After removing a handful of outliers, there are only 32 geometric symbols left.

Only 32, that's all there is in continental Europe over a period of 30,000 years.

this is very few

If this were sloppy doodles and decorations, there should be more variety, but instead, what we found are symbols that are repeated across time and space.

Some symbols were popular in the early days and then faded and disappeared, while others were invented later.

But 65 percent of all the symbols have been in use for 30,000 years: lines, rectangles, triangles, ovals, circles.

Some symbols span thousands of kilometers, but others have a more limited distribution pattern.

By the way, the ancient petroglyphs are surprisingly similar, extending from France and Spain to Indonesia and Australia.

Given that many of the same symbols in such a wide area were drawn, especially in the span of 30,000 to 40,000 years ago, it makes me wonder if this invention could be traced back to a common origin in Africa.

I'll tell you about it some other time

let's get back on track

There's no doubt that these symbols were meaningful to their creators, and this bas-relief sculpture is 25,000 years old and is on the rock of Venasque in France.

It's hard for us, but I'm sure people at the time knew what it meant.

The repetition of the same symbol over so many monuments over time shows that it was a deliberate choice by the artists of the time.

If geometric shapes have a specific, culturally accepted meaning, it's very likely that it's the world's oldest systematic form of communication.

We're not even talking about the written word

At this point, there aren't enough letters to represent all the words in spoken language, without which the system of written language would be incomplete.

Also, although there is a regularity in the repetition of symbols, we don't know if they can be called letters.

But there's also quite a bit of material that piques my curiosity. This is the wall of La Pasiega cave in Spain, known as the "Stele of Symbols."

Some of the world's oldest graphical systems of communication include Sumerian cuneiform, Egyptian hieroglyphs, and ancient Chinese script, all of which are four or five thousand years old.

So the painting of the bird must have represented the very animal that is the bird.

It was only in later years that these pictographs became more stylized, until the original pictures became unrecognizable, and more symbols were invented to represent pronouns, adverbs, and adjectives that could not be represented in the language.

All of this makes it hard to believe that the geometric symbols used in Ice Age Europe were entirely abstract notations.

Rather, it is probable that ancient artists also created counting symbols, like this line of lines in the Cave of Zaminica in Sicily, or they may have created stylized representations of things in the world around them.

Are there symbols for weapons and housing?

What about celestial bodies such as constellations?

Others may represent landscape features such as rivers, mountains, trees, etc. A good example is this black feather and the strange bell-shaped symbols around it from the ruins of El Castillo in Spain.

The word "penniform" comes from Latin, and I think it's a description of a plant or a tree.

While some researchers are beginning to answer questions about the symbols found at these particular sites, I think it's time to revisit this whole taxonomy.

After all, the irony is that now that we've carefully sorted all the symbols into one category, it's likely that the next task will be to sort them out again, because depending on the type of image, some are the same and some are different.

Don't get me wrong, the later creation of the written language in its entirety was an impressive feat in itself.

But it's important to note that these writing systems didn't just fall into place.

As early as 5,000 years ago, people were already relying on something even older. Its origins can be traced back tens of thousands of years to the geometric symbols of Ice Age Europe, and then to the depths of common human history: when someone first set out to mark a shape, and it fundamentally changed the way humans communicated.

thank you

(applause)

Humans subconsciously attach meaning to things in their brains.

Let's take Professor Argyris' "inference ladder" model.

Every time I meet someone and experience something

The experience instantly climbs the ladder to the top.

People climb ladders thousands of times a day without realizing it.

Let's pay attention to each of the crossbars

The first stage takes the "raw" data into the brain.

It's like watching a video recording of the experience.

The second stage separates the specific information from the rest.

It sorts information based on interests, concerns.

in the third stage

make sense of the information

start interpreting the information

Step 4 is very important

We make inferences based on the previous steps. Facts and assumptions begin to mix.

Step 5 draws conclusions

Emotional reactions are also generated.

In the sixth step, we adjust the "world view" including the people who were involved in the experience at that time.

And finally, in the seventh step, act on your thoughts.

Are you following the story? That's good!

Let's climb the ladder using a real-life example.

Have you ever been interrupted in a parking lot? Even though I turned on the turn signal lights and started to turn the steering wheel, I suddenly braked at the last moment.

Empirical data has climbed the first rung of the ladder.

The second stage filters the information.

I don't care about the weather or the voice of the birds

Cheap signboards are meaningless

What's important is the feeling of the steering wheel being gripped tightly The rise in blood pressure The squeak of the brakes The expression on the driver's face when he cuts in He turned away

It's the third stage

I was trained by my parents to stand in line and wait my turn.

The rule should be that the person who came first is in order.

But the place was stolen, it's unreasonable

It's the 4th stage

Ideas are born and take the place of facts.

"That bastard, what did your parents teach you?

Didn't you see the direction lights? He's careless!

I think I'm the greatest."

Step five, I'll come to the conclusion that you're a selfish, insane man-

Angry, frustrated, resentful and resentful

In the sixth step, we adjust our worldview based on our experience.

"Don't give up again! If you're about to get in the way again

Even if it's forced, I'll park it for you."

It's the final stage.

honk the horn, open the window and taunt

Then the other person apologized and walked over

His pregnant wife called to say she was in labor and wanted to rush him to the hospital.

You are surprised and apologize to him and wish him luck as he leaves.

why did you change your mind?

Because the other person's ladder has cut off the assumptions that arise from your own ladder.

"My wife's labor pains I need to go quickly There's a space available Yay!

Ah, I interrupted. I think you should apologize."

But what if you could stop your beliefs on your own?

What if you could take the lead yourself?

You can actually do it!

because humans have free will

Look at your "ladder" before reacting to things.

what are you thinking about now

What data did you choose and why?

Are the inferences based on facts?

Wouldn't a different reasoning lead to better results?

People have different ladders

Watch out for other people's ladders as well as your own

It's not even the West that has the most important walls in Western history.

It surrounds the modern city of Istanbul, which the Romans called Constantinople.

For 1000 years the fate of Europe hung on its walls.

Constantinople was designed as the center of the world.

In the 4th century, when the frontier rule of the Roman Empire began to weaken, the capital was moved to the cultural, rich and still stable east.

Emperor Constantine built the city on a key trade route in the ancient world where Asia and Europe crossed.

It was a city of libraries and universities, 20 times larger than London or Paris.

The city held the precious wisdom of an ancient world that was fading in Western Rome.

To protect their great wisdom from many enemies, Constantine's heirs built defensive fortresses of the greatest sophistication.

The front line of defense consisted of an 18-meter-wide, 7-meter-deep moat extending 6 kilometers from coast to coast.

On sight of the enemy, the moat could be filled with water from pipes running from within the city, and archers, protected by low palisades, would set fire to enemy soldiers as they tried to swim across the moat.

Even if you're lucky enough to cross the moat, you'll still have to face a constant barrage of fire from the eight-meter-high outer wall.

Arrows, spears, and worse, Greek gunpowder, ancient incendiary bombs that ignite on contact with water and cannot be extinguished by water.

Roman garrisons would carry portable flamethrowers and set fire to enemy soldiers as they tried to climb up the moat.

Frightened victims jump back, only to find that they continue to burn underwater.

At times, the Roman army would equip ramparts with siphons and catapult fire clay bullets filled with Greek gunpowder against the invading army.

The front line was engulfed in flames, and it looked like the whole earth was on fire.

Even if some miracle happens and the outer wall is captured, the attacking side will hit the inner wall, which is the last line of defense.

This rampart was thick enough for four people to stand side by side, and the soldiers could be placed where they were needed.

Attila the Huns, a destroyer of civilizations and a self-proclaimed "God's Whip," took one look at these walls and turned back.

The Avars ran out of stones in their trebuchet after vainly challenging the walls.

The Turks tried to dig tunnels under the walls, but the foundations were too strong.

The Arab army tried to force them into submission with a starvation raid, but they ran out of food and were forced into cannibalism.

It took a number of modern firearms to finally bring down the walls.

In 1453, the Turks brought out an absolute weapon, a super-giant cannon that fired 680 kg of rock with a reach of over a mile.

With more than 100 small guns, they continued to fire constantly day and night.

Some of the old ramparts had collapsed, but even the terminally ill ramparts were formidable.

Because the rubble absorbed the impact of the shell better than the intact wall.

But after a month and a half of bombardment, there was finally a breakthrough.

The last Roman emperor, Constantine XI, drew his sword and plunged into the gap to stop the invading hordes before disappearing into history.

Cities fell and finally the Roman Empire disappeared.

But the crumbling walls had one last gift.

As survivors fled their destroyed cities, they also carried valuable books and ancient traditions with them.

It reintroduced Greek language and knowledge to Western Italy and sparked the Renaissance.

Thanks to the long impenetrable walls of Constantinople of brick and marble, we can still learn about its ancient history.

(Zombie noise) (Doctor 1) How did this happen?

(Doctor 2) In my opinion, I think it has something to do with the large bite mark on the shoulder.

(Doctor 1) Thank you. What causes the behavioral disorder?

(Doctor 2) Everything you do comes from your brain.

(Doctor 1) Thank you for your clear explanation.

let's be more specific

What's going on in your brain that makes you do this?

(Doctor 2) Well, that's right.

The first thing I noticed was the movement

Stiff legs, long strides, awkward walking, very slow and clumsy

Similar to Parkinson's disease

Is there a problem with the basal ganglia?

It's a series of parts deep in the brain that control movement through a neurotransmitter called dopamine.

Many people think of dopamine as the "happiness" brain chemical, but in Parkinson's disease, dopamine neurons in the basal ganglia die, causing the disease.

It's making it harder and harder to take action.

(Doctor 1) Huh? See how you move again

Stiff legs, long strides, this is not Parkinson's movement Parkinson's sufferers shuffle with short strides and their posture is completely different

It seems like a symptom that occurs when the cerebellum is damaged.

The cerebellum is a small, deep, cauliflower-shaped region, but don't be fooled by its size.

This tiny cerebellum houses half the neurons in the entire brain.

People with degeneration of the cerebellum, such as spinocerebellar degeneration, have poor coordination, stiff legs, and a jerky gait with long strides.

I bet it's the cerebellum

(Doctor 2) I'm sorry. The mystery of movement disorders has been solved.

You're always moaning, but what if you can't speak well?

Doctor 1: Well, sounds like Broca's aphasia (expressive aphasia), a disease that makes it hard to put into words.

It is caused by damage to the inferior frontal gyrus or the anterior insula, both on the left side of the head behind the temple.

(Doctor 2) But that's not all, it's true that zombies can't talk.

I don't think I understand

Look at this "Hey Walker! Your dad smells like elderberries!"

(laughs) Right? will not react

Are you not a Monty Python fan or do you not understand

Fluent Wernicke's aphasia, which is damage to the junction of the two lobes of the brain, the temporal and parietal, generally on the left side of the brain.

This region is physically connected to the region of Proca, which I mentioned earlier, by a large bundle of nerve fibers called the arcuate fasciculus.

I'm hypothesizing that this massive bunch is completely destroyed in zombies.

It's like the highway between two cities is destroyed

The city that makes the product and the other city that ships it to the world

Without highways, product distribution would be disrupted.

(Doctor 1) It's basically a problem to tell zombies what to say, because they can't understand it, and they can't answer it.

(Doctor 2) (Laughter) I wouldn't stop trying, but I'm fine with this side of the glass.

March 17, 73 AD

We're in ancient Rome to see the Liberaria, an annual festival celebrating Roman civil liberties.

A peek into the life of a 17-year-old named Lucius Podius Secundus

He didn't come from a poor family, but he lives in Suburra, a relatively poor neighborhood near Rome, but not far from the city centre.

(gongs) The residents of these apartments are crammed together (whooshing) and are in considerable danger.

Fires are frequent, and it's common to smell ash and smoke in the morning.

Lucius wakes up at dawn to do his family duties for the day.

(cheers) My brother, who is 15 years old, is coming of age.

This is a particularly important milestone, because half of all children in ancient Rome died before they reached adulthood.

Lucius sees his brother in his new toga standing before the altar of the guardian deity.

Bora has worked, it's been protecting him.

Unlike many other children, he survived to adulthood.

At 17, Lucius has nearly completed his education.

I've learned how to speak and publicize, and I've learned to read and write in Latin and Greek.

His father also taught him things he couldn't learn in a classroom: how to run, how to swim, how to fight.

At the age of 17, Lucius became a high-ranking military officer and could even command troops on the borders of the Roman Empire.

But in other ways, Lucius is still a child.

He is not considered a reliable partner in business dealings.

Until he turns 25, his father will take care of him.

My father intends to arrange a marriage between Lucius and a girl ten years his junior.

That's why I'm looking at families with seven-year-old daughters.

back to liberaria

By the time Lucius leaves home, the shops open as people start to move.

The streets are full of hawkers selling little trinkets and people rushing to and fro.

The big wagons can't enter the city until nine o'clock, but the roads are still congested.

Fathers and uncles take their children to the Forum of Augustus to show them statues of famous Roman warriors, like Aeneas, who led the Trojans to Italy, the ancestors of the Roman Empire.

Romulus, the founder of the Roman Empire

And then there are the great generals who lived in the Republic of Rome over a hundred years ago.

I can imagine fathers and guardians lovingly recalling the glorious stories of Rome with their now-grown children, retelling the good deeds and words of past greats, teaching us how to live well and overcome the foolishness of youth.

There was a sense of history in this place that was relevant to their time.

The Romans expanded their empire without the limits of time and space.

(guzzling) Rome was destined to be at war forever.

War was part of life, even in 73 AD.

North of England, Scotland north of the Danube, Romania, east to the Syrian-Iraqi border.

Now it's eight o'clock, it's time to go to the bath

Lucius and his family make their way from the main thoroughfare, Via Lata, to the Campus Martius and the great Agrippa Baths.

The family leaves the clientes (protected persons) and the freedmen outside and enters the bathhouse with their companions.

The bathhouse changed from a dark, steamy room to a bright room.

The Romans had perfected window glass.

People go from a cold bath to a lukewarm bath to a very hot bath.

(Male voice) Over there!

After more than an hour, the bather leaves the bath to receive a massage and oil treatment (whistling sound) and use a skin scraper to scrape off any remaining dirt.

Ninth Hour Seven hours after leaving the house, the men come home for a celebratory meal.

Meals are served privately, with nine people leaning back around a low table.

One by one, the slaves respond to diners' gestures for more food or wine.

In the evening, you can hear the wagon rattling outside.

Clientes and freedmen eat a nutritious meal, no matter how good it is, take a dip in the already lukewarm bath, and then return to their apartments.

Let's go back to Lucius' house. The party will continue until midnight.

Lucius and his brother-in-law aren't feeling very well.

A slave is on hand in case one of you is about to throw up.

With hindsight, we know Lucius' future.

Twenty years later, Domitian, the youngest son of Emperor Vespasian, becomes emperor and leads a reign of terror.

Will Lucius survive?

(drum sound)

(Video) Moderator: 10 seconds

５、４、３、２、１

top

Plus 1, 2, 3, 4, 5 6, 7, 8, 9, 10

Guillaume Néry, France

Constant weight, 123m 3:25

Record-breaking challenge

70 meters

[123 meters] (Applause) (Video) Referee: White card Guillaume Néry! A new French record!

Guillaume Néry: Thank you

thank you for your warm applause

What you've just seen is a journey between two inspirations.

Journey set out between two inspirations - the breath just before departure and during the first breath after returning to the surface.

This dive is a journey to the limits of human possibility, a journey into the unknown.

And it's also, above all, an inward journey, where everything happens, both psychologically and physically.

I would like to take you on this journey today.

Take your last breath

(Inhalation) (Exhalation) In this way, the last inspiration is

It's slow, deep, and powerful, and it ends with a special technique called "Carp", which allows me to squeeze an extra liter or two of air into my lungs.

When I leave the surface, my lungs hold about 10 liters of air.

As soon as you start diving, the first mechanism kicks in, the diving reflex.

This first causes your heart rate to plummet.

It goes down from 60-70 beats per minute to 30-40 beats per minute, and it happens in a matter of seconds -- almost instantly.

What happens next is peripheral vasoconstriction, which is basically blood leaving the extremities of the body and concentrating in the organs where it plays the most important role: the lungs, the heart and the brain.

This mechanism is innate

happens naturally

This same mechanism works if you're diving for the first time, even if it's your first time.

All humans have this trait

Incredibly, this same mechanism is also present in marine mammals -- all marine mammals -- dolphins, whales, sea lions, you name it.

When these creatures hold their breath and dive deep into the ocean, this mechanism works, but more powerfully.

Of course it works much more efficiently

it's really amazing

As soon as you leave the surface, you can safely dive into the depths thanks to the forces of nature.

As I dive into the blue sea, the water pressure slowly squeezes my lungs.

Because I'm floating on the air in my lungs, I'm going down further and the pressure on my lungs is getting stronger.

When you dive 35-40 meters, you don't even have to consciously swim anymore.

My body is heavy and dense enough to go into a state called freefall where I can freely descend to great depths.

Freefall is the best part of diving

This is why I keep diving

For the feeling of being drawn to the bottom of the sea without doing anything

You can dive from 35m to 123m without moving a fingertip.

I feel like I'm flying underwater as I'm drawn to the bottom of the ocean.

This is an incredible feeling, a special feeling of freedom.

I continue to slide slowly to the bottom of the sea

At 40 meters, 50 meters and between 50 and 60 meters comes a second physical change.

My lung volume has reached "residual capacity," and theoretically it shouldn't compress any more.

This second phenomenon is called the blood shift phenomenon, which in French is called pulmonary protuberance.

I prefer "Bloodshift"

I call it "Le Bloodshift." How does it work?

Prevents the capillaries in the lungs from becoming congested due to suction, the capillaries in the lungs becoming congested due to suction, the lungs becoming stiff, and the entire thoracic cavity collapsing.

It prevents the two walls of the lung from collapsing, sticking together, and atelectasis.

This physiology, just like any marine mammal, keeps me underwater.

60 meters, 70 meters, the water pressure keeps pressing on my body, so I keep speeding up and continuing to descend.

Beyond 80 meters, the water pressure gets stronger and you start to feel it in your body.

I'm starting to feel really suffocated

As you can see, it's not very pretty.

My diaphragm is completely depressed, my ribcage is squeezed inward, and many things are happening mentally.

You might think, "I don't feel so good

What should I do? ”

If it's just a reflection on the ground -- what do you do when you meet some obstacle on the ground?

When there is something you want to avoid? to fight, to resist, to resist

it doesn't work in water

If you try to do this underwater, your lungs will burst, you'll vomit blood, you'll develop edema, and you may not be able to dive for a while.

So I tell myself, the water is much stronger than I am

And let the water swallow you

accept water pressure

Let it be done, and in that moment I give my body this information and my lungs unwind.

I let go of all control

It's totally relaxing. The water pressure starts to overwhelm me, but it's not uncomfortable at all.

I even feel like I'm a cocoon

Protected and the dive continues

80m, 85m, 90m 100m

100 meters this is a mysterious number

In any sport, this is the mysterious number.

It's the same for swimming, gymnastics and diving, it's a dream number for freedivers.

Everyone dreams of one day reaching a depth of 100 meters.

This figure is symbolic for us, because in the 1970s, doctors and physiologists concluded that 100 meters was probably the maximum depth that the human body could withstand.

If you go deeper than that, your body will implode

And then the Frenchman Jacques Mayol, who you all know, the hero of the movie "The Grand Bleu," appeared and dived to a depth of 100 meters.

further up to 105 meters

At the time, his event was "No Limit".

To dive faster, we used weights and balloons to surface, just like in the movies.

I can dive 200 meters today with no limits.

I can go up to 123 meters with muscle power alone.

And it's all partly due to him, because with a flick of his arm he took the known and accepted concept of what was theoretically believed, banished the limits imposed by man's mind.

He showed us that the human body's adaptability knows no bounds.

so i keep diving

105、110、115

the seabed is approaching

120 meters 123 meters

arrive at the bottom of the sea

Now let's all have a little help

Imagine that you became me and close your eyes

And imagine reaching a depth of 123 meters.

The surface of the water is very, very far

you are the only one

almost no light

The water is cold, freezing cold

The water pressure completely crushes you, 13 times the pressure on the surface of the water.

You're probably thinking, "Horrible!"

"Why are you looking at me like this?"

"He's a total idiot"

but no

That's not what I think when I dive in

I feel good when I reach the bottom of the sea

I feel wonderfully satisfied

Maybe it's because I let go of all the tension and became free

I feel fine and have no desire to breathe.

But it's certainly disturbing

I feel like a tiny dot A drop in the water Floating in the ocean

Every time I think of the same image

This "Pale Blue Dot" Small light blue dot The small dot that this arrow is pointing to

do you know what this is?

this is the earth

This is an image from 4 billion kilometers away, taken by the Voyager spacecraft.

It shows us that our planet is a tiny dot floating in empty space.

This is what I feel when I dive to a depth of 123 meters.

I am a tiny dot, a dot of dust, a stardust, floating in the middle of the galaxy, in nothingness, in vastness.

It's an amazing feeling, you can look around 360 degrees and it's deep blue forever.

You can't look around anywhere on earth and you'll never get the same feeling of looking around and being surrounded by the exact same scenery.

it's a wonderful feeling

And in that moment, every time, I get the same feeling: humility.

When I look at this picture, I feel humbled, and when I'm in the deep sea like this, I'm nothing.

Still a completely mesmerizing experience

It's not my world, so I'll soon leave for the surface

My world is far above, at the surface of the water

start to float

As soon as you start to ascend, you feel a big shock.

To get myself off the bottom of the ocean first

It takes a tremendous amount of force.The bottom of the sea pulled me in as I descended.When I want to surface, I have the same gravitational pull.

So you have to swim twice as hard

Then the next thing happens: the coma.

Do you know this symptom?

Nitrogen poisoning

This can happen not only with scuba divers, but also during freediving.

It's the nitrogen in your blood that causes a clouding of your consciousness.

Various thoughts cross my consciousness, spinning left and right

I can't control it anymore.

You can't control anything. The more you try, the harder it gets to move.

And then a third thing happens, and you want to breathe.

This breathing desire reminds me that I'm not a merman, I'm just a human being.

And then, at around 60 or 70 meters deep, the desire to breathe appears, and this is how it all happens.

It's very easy to lose your balance and panic.

At that moment, this crosses my mind

"Where's the surface? I just want to surface and breathe."

but don't

Even if you look up at the surface of the water, don't even try to find it

Never bring your feelings to the surface

stay in the present moment

I see the rope in front of me, the rope that takes me to the surface.

I will continue to focus on the moment

If you think about the surface of the water, you'll panic.

If you panic, it's the end of the first volume

suddenly time speeds up

When you reach 30 meters, it's finally time to be rescued. You're no longer alone.

Rescue team, my guardian angels are here to help.

They pick me up in 30 meters of water and escort me the rest of the way, so there can still be problems.

Every time I see them, I feel, "Thanks to all of you."

It's all thanks to you that I can go back there.

It's time to be humble for the second time

Everyone who helps me - without them, the journey to the bottom of the sea would be impossible.

A trip to the bottom of the ocean is a team effort.

So I'm happy to end this journey with them, because they're the reason I'm back.

Twenty meters, ten meters my lungs slowly return to normal size

Buoyancy lifts the body to the surface of the water

When you're 5 meters from the surface, you start exhaling, just like you can inhale as soon as you're on the surface.

and reach the surface

(breathe in) Air flows into the lungs

It's like a resurrection experience and a rescue

yeah i feel so good

This trip is extraordinary I have oxygen filling my lungs

It feels great when you don't feel it energizing your body, but sometimes this can be traumatic.

This is a shock to the body.

Imagine going from darkness to sunshine From almost silent silence to hustle and bustle

As for the feel, the smooth, velvety soft touch of water replaces that of the air hitting your face.

When it comes to taste and smell, air flows into the lungs.

and the lungs inflate

90 seconds ago it was completely depressed, but it's widening again.

There are various influences like this

It takes me a few seconds to bring myself back to the present.

But I have to hurry.The referee is watching and judging my performance.I have to prove that I'm in good physical condition.

It's called an exit protocol.

Within 15 seconds of being out of the water, you can remove the nose clip, hand-sign and say (in English), "I'm OK."

Also required to be bilingual

(Laughter) I'm going to have to do something after this.

At the end of the protocol, the referee gives me a white card, and there's an explosion of joy.

Finally, I can rejoice in the success of my skin diving.

The trip I just told you about is an extreme example of freediving.

Freediving is more than that

For the past three years, I've been presenting the other side of freediving, where the media only talks about competitiveness and records.

But freediving is another

It's also about being free in the water

It's an extremely beautiful, poetic, artistic experience.

My wife and I decided to capture it on film, to show you this other side and invite you to dive into the ocean.

I'm going to show you a little bit of footage, and I'll wrap up the story.

A patchwork of beautiful underwater images

(music) Someday, you'll find that if you try to hold your breath, your thoughts will also stop.

peace of mind will come

In the 21st century, our minds are under tremendous pressure.

We're constantly overworked, 10,000 miles an hour, and we're under constant stress.

Freediving relaxes the mind even for a moment

When you hold your breath underwater, you can feel gravity.

Float in the water and fully release your body

Total release of tension. This is our 21st century predicament. Your back, your shoulders, it hurts here and there because you're stressed and tense all the time.

But in the water, I let my body float, just like I was in outer space.

completely surrender

the feeling is wonderful

Finally, face your body, your mind, your spirit

everything will be calm

Learning to freedive is also learning how to breathe properly.

We start breathing when we are born and it continues until our last breath.

Breathing is the rhythm of life

Learning to breathe better is learning to live better

Hold your breath underwater, don't say 100 meters, but 2-3 meters with goggles and fins, to see another world, to see another completely fantastical dimension.

There are little fish, seaweeds, flora and fauna, you can watch them quietly, glide through the water, look around and come back to the surface, leaving no trace.

Being at one with nature in this way is an incredible feeling.

And the last thing I'd like to add is that going underwater and meeting the world of the sea means connecting with yourself.

As I showed you in my presentation, I talked a lot about bodily memories that go back hundreds of millions of years, when we were sea creatures.

When you dive into the ocean and hold your breath for a few seconds, you'll encounter this origin again.

I promise it feels like magic

Please try it yourself

thank you

(applause)

I'm sure many of you have heard of the Electoral College in the year of the US presidential election.

So what is the Electoral College?

In a nutshell, the nominees from each state formally elect the President and Vice President of the United States.

To understand how this system began and how it came to be today, let's look at Article II, Section 1, Section 2 of the U.S. Constitution.

It defines how many electoral votes are allocated to each state.

There have been 538 electors in each presidential election since 1964.

How did you decide on 538?

The number of electors equals the number of eligible members of the United States Congress

435 members of the House of Representatives, 100 senators, 3 electors from the District of Columbia.

Essentially, Democrats and Republicans are trying to win the presidential election by rallying the electoral colleges of each state to more than 270 votes -- or a majority of 538.

So how do states get electoral votes?

Each state is assigned a number of electors according to its population.

The census happens once every 10 years, so each time a state's electoral vote count can increase or decrease slightly.

Suppose you're a California voter with 55 electoral votes.

If your candidate wins, you get all 55 electoral votes.

If you lose, you get zero votes

This is why many presidential candidates want to win Texas Florida New York

The combined electoral votes of these three states are now 96.

If a candidate wins eight states (North Dakota, South Dakota Montana, Wyoming Vermont, New Hampshire Connecticut, and West Virginia), they get just 31 votes.

here's where it gets tricky

On rare occasions, like the 2000 election, you won the popular vote but didn't get 270 electoral votes.

That's when the winner wins by a small margin, collects the electoral votes, and wins the required number of states with the required electoral votes, while the loser receives a large number of votes in the remaining states.

In these cases, the loser can win the majority of the votes in other states and more than 50% of the popular vote nationally.

So the losers got 50% of the popular vote but didn't get 270 electoral votes.

Some critics say that the system unfairly favors states with more electoral votes.

please think about it

A candidate can become president by winning the popular vote in 11 of the following 12 states: California, New York, Texas, Florida, Pennsylvania, Illinois, Ohio, Michigan, New Jersey, North Carolina, Georgia, Virginia, without getting a single vote in 39 states or the District of Columbia.

That's why Democrats and Republicans are looking at these states.

Others argue that the Electoral College protects small states like Rhode Island, Vermont and New Hampshire, as well as large but sparsely populated states like Alaska, Wyoming North and South Dakota.

The reason a candidate can't completely ignore a small state like this is that when elections get close, every single electoral vote counts.

Some states have traditionally voted for a particular party.

We call those states "safe states"

In the last four elections in 1996, 2000, 2004 and 2008, Democrats have counted on Oregon, Maryland, Michigan and Massachusetts, while Republicans have counted on Mississippi, Alabama, Kansas and Idaho.

States that go either way are called "swing states."

In the last four elections, Ohio and Florida have endorsed Democrats twice and Republicans twice.

Think Is Your State a "Safe State"?

If so, are you a Democrat or a Republican?

Is your state a "swing state"?

Is the neighboring state 'swing' or 'safe'?

Is your state's population increasing or decreasing?

On election night every four years, when you're watching the election results and you see a big map of the United States on TV, remember that the magic number is 270, and start adding up.

There are about 100 billion galaxies in the universe

Each galaxy contains about 100 billion stars

Most of the stars have orbiting planets.

How can we find other life forms among this vast number of planets?

It's like looking for a needle in a haystack

Humans like to explore planets where life forms like ourselves can live, and we call such places "habitable worlds."

what kind of planet would that be?

There are no hints out there to answer

Look where we are, it's the earth

Because Earth is the only planet in space where we can be sure that life is viable.

When you look at the earth from space, you can see a blue world full of water.

It's no coincidence that three-quarters of the surface is covered by ocean.

Because water, with its unique chemical and physical properties, is essential to life as we know it.

So I'm obsessed with finding a world where water is abundant.

Fortunately, water is a very common substance in the universe.

But life needs water in a liquid state, not ice or steam, which is not so commonplace.

There are three things that are important for the existence of liquid water on the surface of a planet.

First, the planet must be large enough that its gravity does not allow water to escape into space.

Mars, for example, is smaller than Earth and has weaker gravity, which is a major reason why its atmosphere is so thin that it can't have oceans on its surface.

Second, planets need atmospheres. Why?

No atmosphere means the planet is a vacuum, and liquid water isn't stable in a vacuum.

For example, the moon has no atmosphere, so when water is spilled, it either boils and evaporates or solidifies into ice.

Liquid water cannot exist without atmospheric pressure.

Third, the planet needs just the right distance from the star.

If it's too close, the surface temperature will reach the boiling point of water, and the ocean will turn into steam.

If you go too far, the surface temperature drops below freezing and the ocean freezes.

Both fire and ice are bad for life as we know it.

You'll find that there are suitable zones around stars where water exists as a liquid.

This is called the habitable zone

So in our search for habitable worlds, we look for planets in habitable regions around stars.

To find planets like Earth, it's wise to look for regions like this.

Habitable regions are a fast track to the search for life, but there are some complications.

First, even habitable regions don't make the planet habitable.

Think Venus in the Solar System

Alien astronomers would think Venus would be the perfect place to live.

It's just the right size, it has an atmosphere, it's in the habitable region of the Sun.

To alien astronomers, Venus looks like Earth's twin.

But Venus, at least on its surface, can't have life.

too hot for life as we know it

Venus' atmosphere is rich in carbon dioxide, a greenhouse gas.

In fact, its atmosphere is mostly carbon dioxide, and it's 100 times thicker than Earth's atmosphere.

As a result, the temperature on Venus is hot enough to melt lead, and the planet is blisteringly dry.

Planets with just the right size and distance from the star only cleared the first condition.

We also need to know what that atmosphere is made of.

The second condition can be seen if we look a little closer at the planet Earth.

In the last 30 years, we've found microbes in every extreme environment.

It exists in rock crevices many miles deep, in the boiling waters of the ocean floor, in the acidic waters of hot springs, and in the droplets of clouds miles above us.

Organisms called extremophiles are not uncommon.

Some scientists estimate that the total mass of microbes living deep underground is about the same as the total mass of all surface life on Earth.

Underground microbes don't need seawater or the sun.

This finding suggests that astrobiologically terrestrial planets are just the tip of the iceberg.

There may be life in the water beneath the surface of Mars.

On Jupiter's moon Europa, microbes may thrive in the liquid water that probably exists beneath the surface of the ice.

The ocean beneath Saturn's moon Enceladus is the source of geysers that erupt into space.

Could this geyser contain microbes?

Can you fly over and find out?

Life we ​​don't know What about life in liquids other than water?

Maybe we ourselves are strange lifeforms living in anomalous extreme environments.

The real habitable area may be much larger, with billions of needles in a trillion haystacks.

In the big picture, Earth may be just another example of a viable world.

The only way to uncover this is to go out and explore.

The literary critic Northrop Fry once said that the heroes of literature used to be close to the gods, and as civilization grew, they descended from the mountain of gods and became more human, flawed and less heroic.

From near-god heroes like Hercules, a little further down the mountain, to miraculous but mortal heroes like Beowulf, to great leaders like King Arthur, to great but flawed heroes like Macbeth and Othello.

Further down you'll find Harry Potter, unexpected heroes like Luke Skywalker and Hiccup, and if you get to the bottom, you'll find anti-heroes.

Contrary to what they say, antiheroes are neither villains nor adversaries.

In fact, antiheroes are the main characters in some contemporary literature.

Guy Montag in "Fahrenheit 451," Winston Smith in "1984," they unwittingly end up confronting those in power -- those who abuse their power and brainwash the public into thinking the evils of society have been eliminated.

Ideally, those who defy the establishment should be smart, confident, brave, powerful, and charismatic enough to inspire their followers.

But antiheroes, at best, aren't perfect in their traits, and at worst, they're downright clumsy.

An antihero story usually goes something like this:

At first, docile and ignorant, they accept preconceived notions and are unsuspecting, typical brainwashed members of the community.

Antiheroes struggle to comply and begin to dissent, sometimes finding outsiders to question with them, innocently and foolishly sharing their doubts with those in power.

Antiheroes openly challenge society and fight the lies and tricks used to subjugate the populace.

This stage rarely results in brave, wise and heroic resistance.

As antiheroes fight and overthrow oppressive governments, it's all thanks to an incredible stroke of luck.

I might run away to fight another day.

Antiheroes are often killed or brainwashed into resubmission to the group.

No heroic victories, no valiant resistance to the inhuman institutions of modern society, no rousing others to fight, no smart outsmarting and defeating evil empires.

To allay our fears of powerlessness, the tales of our ancestors featured Hercules and other heroes who were powerful enough to defeat the demons and monsters that might lurk in the darkness beyond the campfire.

But eventually we realized that the monster wasn't out there, it was inside us.

Death was Beowulf's greatest enemy

Othello's enemy is jealousy

Hiccup's enemy was self-doubt

And in the tales of Guy Montag and Winston Smith, tales of helpless antiheroes, lurking a modern writer's caveat that appeals to primal fear: we're not strong enough to defeat monsters.

Only this time, it wasn't the fire that drove the monster away, it was the monster that kindled the fire in the first place.

Justin's favorite girl is in front of me

As I got closer, I got nervous. The pimples gradually grew to cover my face.

Justin fidgeting, she notices a big pimple and starts laughing

Justin is disappointed and trudges home

Stress is nasty to everyone, regardless of age.

How do you get pimples?

Let's go back to before I had acne, or before Justin fell in love.

As Justin barely slips into the classroom, the teacher says, "It's a surprise test."

Justin, who didn't do his homework, feels more trapped than when soldiers in World War II were in ambush, which is also the subject of the assignment.

My whole body panics, my hands start to sweat, my mind gets cloudy, my heart rate goes up.

When I left the class in a daze, I suddenly encountered the biggest unrequited lover of my life, and my stress level skyrocketed.

Stress is the body's natural reaction to danger.

Cavemen say that when you encounter a hungry saber-toothed tiger, you either fight for your life or you run for your life, stress is what causes this.

Special chemicals called stress hormones rush through your body, telling you to get more oxygen and more energy in order to escape or fight danger.

But when you don't fight or flee, you're in trouble.

Taking final exams, being stuck in traffic, thinking about environmental pollution can be stressful.

The starting point is the brain

The hypothalamus, the hormone-regulating organ, secretes something called adrenocorticotropic hormone-releasing hormone.

This stimulates the soybean-sized pituitary gland below the brain to release adrenocorticotropic hormone, which in turn stimulates the adrenal glands at the top of the kidneys to release cortisol, a major stress hormone.

These hormones are great when you need to summon the courage you don't normally have, or when you need a quick escape, but if you just sit around, these stress hormones build up in your body and harm your health.

Stress hormones increase inflammation in the body, weakening the immune system and making it less able to fight acne-causing bacteria, and they also cause the skin to produce more oil.

This bodily agitation creates the perfect conditions for pimples to form.

The stress hormone cortisol increases the secretion of oil from sebaceous glands within skin cells.

But when the lipid called sebum is overproduced, it bloats and clogs the inflamed pores, trapping the acne-causing bacteria, thus allowing the bacteria to thrive.

And when you're even more nervous, your nervous system releases neuropeptides that cause inflammation, leading to pimples.

To make matters worse, Justin is a boy, so he has more testosterone than a girl.

Testosterone is also a hormone that increases sebum production.

If you have oily skin with more sebum, and stress exacerbates the inflammation, it's the perfect environment for bacteria, which will continue to grow and lead to larger pimples.

How did I avoid this pimple?

stress is inevitable

But you should be able to reduce your stress by changing your approach.

If I'd approached her with confidence, the big pimple might not have been noticed, or maybe it wouldn't have popped at all.

Dialogue adds color to the story—it makes it interesting, it moves the story forward.

(Romeo) Are you going to leave me unsatisfied?

(Juliet) Do you have anything to fill your heart with tonight?

(Romeo) In exchange for mine, a sincere vow of your love

Without Dialogue—What would it take to write an effective dialogue?

There are social skills: making friends, resolving conflicts, being pleasant and polite.

I don't use that anymore

Instead, they use "antisocial skills."

If you're a writer, you probably already have

First is eavesdropping

If you hear an interesting conversation on the bus, write it down.

Of course, when you're writing fiction, you don't just use real people, you create characters.

But sometimes an overheard conversation can give us clues.

1 person says "I'm not doing it"

Another person says, "Because I saw it."

Who will say that line?

Maybe the boy thinks they were classmates and the girl pushed him.

Or maybe they were a couple, but the woman was a vampire, and they witnessed the man cheating on them, and it was also a zombie.

isn't that

Or it could be that the teen and his mother were both vegetarians and the mother was scolding them for eating a burger.

Now let's assume that the person has been decided.

The second antisocial skill is pretending that fictional characters are real.

how are they Where are you from? what kind of music are you listening to?

let's spend time with them

If you're on the bus, think about what those people are doing there.

Make a call Listen to music Draw a picture Sleep

What to say depends on the person

Older people speak differently than younger people

Southerners may speak differently than Northerners.

When you know a person, you also know how he speaks.

At this stage, a third antisocial skill comes in handy: talking to yourself.

When I speak a character's lines, I can see if they sound natural and correct them if necessary.

Remember that many people use informal language when they speak

use simple expressions and abbreviations

"Please don't lie" sounds more natural than "Please don't lie"

then shorten

It's normal to speak short, rather than speaking like a speech.

And let's use dialogue effectively

Think about whether you really need that modifier

For example, "The woman said threateningly, 'If you're afraid of your life, don't pay for it.'"

This "threateningly" is redundant, so you can take it.

But when modifiers and actions don't match, modifiers have an effect.

"The woman cutely said, 'If you're afraid of life, don't pay for it.'"

In summary, the first is eavesdropping, and the second is making a fictional character seem real.

Third, try talking to yourself, and write it all down.

you already have everything you need

This is the conversation in the novel, or "how to hear the voices in your head."

The periodic table of elements can be seen at a glance

Not only are they found in chemistry labs around the world, but they're also found on things like T-shirts, mugs, and shower curtains.

But the periodic table isn't just a trendy symbol.

It is a heavy board on which the wisdom of mankind is written, standing shoulder-to-shoulder with the Taj Mahal, the Mona Lisa, and ice cream sandwiches. The inventor of the table, Dmitri Mendeleev, is a true scientist worthy of being inducted into the Hall of Fame.

But what makes him and the table he devised so great?

Is it because they made a comprehensive list of known elements?

No, just making a list doesn't get you into the Science Hall of Fame.

And Mendeleev was far from the first person to make the list.

Is it because Mendeleev arranged the elements with similar properties?

no that was already done

So where is the best?

Let's take a look at the first edition of the periodic table, circa 1870.

Elements assigned two-letter symbols are listed in a table.

Let's look at the elements in the 5th row of the 3rd row

there is a dash

Mendeleev's genius is demonstrated in this ordinary way of finding a place.

This dash is science

By putting the dash, Dmitri was making a bold statement.

Here we hear him say, "We haven't found this element yet, but let's just give it a name.

It's one step below aluminum, so let's call it Eka aluminum, and 'Eka' means one in Sanskrit."

No one has discovered Ekaaluminum, so what do we know?

No, you can tell just by looking at the table

First of all, ekaaluminum has an atomic mass of 68, which is about 68 times the mass of a hydrogen atom.

If you isolate ekaaluminum, you'll find that it's a solid metal at room temperature.

It's shiny, it has high thermal conductivity, it can be rolled into sheets, it can be rolled into lines, but it has a low melting point, yes, surprisingly low.

We also know that the mass is 6 grams per cubic centimeter.

Mendeleev was able to predict the properties of the blank element from his knowledge of the position of the blank and the behavior of the elements around it.

A few years after the prophecy, Frenchman Paul Boisbaudrin discovered a new element in a sample and named it gallium after the old French name Gallia.

Gallium is one step below aluminum on the periodic table.

Ekaaluminum So, was Mendeleev's prediction correct?

Gallium has an atomic weight of 69.72

1 cubic centimeter has a mass of 5.9 grams

It's a solid metal at room temperature, but its melting point is only 30 degrees Celsius, or 85 degrees Fahrenheit.

Melts in your mouth or in the palm of your hand

Not only did Mendeleev hit on the properties of gallium, but he also made predictions about scandium, germanium, and rhenium, which were unknown at the time.

The element he called ekamanganese is now called technetium.

Because of its rarity, it could not be isolated, but it was synthesized in a cyclotron in 1937, about 70 years after Dmitri predicted its existence, and 30 years after his death.

He died in 1907 without receiving a Nobel Prize, but with much higher honors.

In 1955, the University of California, Berkeley, created 17 previously undiscovered atoms.

This element filled in the blank for element number 101 on the periodic table and was officially named mendelevium in 1963.

So far, more than 800 Nobel Prize winners have been named after only 15 of them.

The next time you stare at the periodic table on the wall of your college classroom or in your five-dollar coffee cup, I'm sure Dmitri Mendeleev, the creator of the periodic table, will be staring back at you.

Chris Anderson: First, I would like to introduce you to your country.

There are three big dots drawn on the globe.

Each one is about the size of the state of California.

Please tell us about Kiribati

Anote Tong: First of all, I would like to express my sincere gratitude for giving me the opportunity to speak to those who are interested.

I've talked to many people so far, but they didn't listen to me seriously.

Kiribati is made up of three islands, the Gilbert Islands in the west, the Phoenix Islands in the center, and the Line Islands in the east.

To put it bluntly, Kiribati is probably the only country that touches the corners of the world's four major territories, straddling the northern and southern hemispheres, while also straddling the east and west of the International Date Line.

These islands are all made up of coral atolls, with an average elevation of about two meters above sea level.

This is the characteristic of our country

Most of the islands are less than two kilometers wide.

Occasionally, I'm told, "If it's dangerous, why don't you stay away from the coast?"

they don't understand

I have no idea what that means

If the sea level rises and you are told, "Why don't you step back?"

I answer

"If you retreat, you'll fall into the Pacific Ocean on the other side."

you don't understand this

Chris: You can see the vulnerability in this very picture.

When did you first realize that this country was in danger?

ANOTE: Climate change has been discussed for decades.

Since I became president in 2003, I've spoken to the United Nations General Assembly about climate change, but it's been a slow debate, because there's still conflicting views among scientists about whether climate change is a result of human activity, and whether climate change is real.

However, the IPCC (Intergovernmental Panel on Climate Change) issued its Fourth Assessment Report in 2007, which affirmatively stated that climate change is real and man-made.

This made me take the situation seriously.

I've talked about this issue in the past.

I was worried

This became a real problem when the 2007 forecast was released.

CA: According to these projections, I think by 2100, sea level will probably rise about one meter.

There could have been scenarios where the rise was even higher. "One meter?

The height of the land is 2 meters

What did you mean by that? ”

ANOTE: Most of the land is low elevation, so you can understand that a small rise in sea level will result in the loss of a lot of land.

But not only that, but it's always in danger of big waves.

Even 60 cm is dangerous

In the first place, people are wrong in thinking that climate change is likely to happen in the future.

We are in the most sensitive position to be affected.

already affected

Some communities have already moved

Every time there was a debate in parliament, other communities complained about building seawalls, or doing something about the freshwater lens (which floats steadily on salt water) that was destroying it.When I visited different islands, I found that each community did indeed have a problem: reduced crop yields, or turbidity in the freshwater lens. must be

Chris: You also suffered from the first cyclone of the year. Is this also related to climate change? What happened here?

ANOTE: Our country is on the equator, and many people think that the equator means no wind.

I created a cyclone and sent it north and south.

(Laughter) I don't usually come back here.

Earlier this year, for the first time, Cyclone Pam devastated Vanuatu, and in its path also touched the two southernmost islands of our country, Pam hit, flooding the entirety of Tuvalu.

On our two southernmost islands, high waves hit more than half the land like never before.

this is my first experience

When I rushed over from my constituency, the beautiful trees I had seen for decades had been completely knocked down.

This is what is happening, but when we talk about sea level rise, we tend to think of it as a gradual process.

It can manifest itself in the form of winds and waves, and its effects can be magnified. We are now beginning to witness changes in climate patterns. Sea level rise is imminent and will require more immediate action.

Chris: Your country is already affected.

Looking to the future, what options do countries have?

Anote: I say this every year.

I have traveled many times to countries around the world, trying to make people understand.

we have a plan i think we have

One time, in Geneva, on a similar occasion, I was interviewed by someone, and when I said, "I have an idea for an island in the ocean," he was skeptical.

I haven't given up on the floating island concept

The Japanese have expressed interest in building floating islands.

We have a promise as a nation that we will do our best to keep our country alive, no matter what happens.

It's very hard, it's very essential.

It's like living on an island in the ocean, or raising the islands so that they don't get submerged when sea levels rise or storms get more intense.

But it's very difficult to raise the necessary funding to make it happen.

Chris: So the only recourse is forced relocation.

Anote: I'm thinking about that too, because we have to be prepared for situations where the countries of the world don't do anything, so we're preparing so that we won't be swayed by Europe's circumstances.

I don't want them to suddenly migrate en masse at some point.

We want to give our citizens a choice now, and let those who want to emigrate.

We don't want sudden, unprepared forced migrations.

Of course, our culture and society are very unique. They're different from the environments and cultures we're migrating to, and they require a lot of adaptation.

Chris: Your country has had forced migrations in the past, and this week, yesterday or the day before yesterday, you visited them.

What happened there? what was said?

ANOTE: Yes, unfortunately, some people questioned why I secretly visited.

There's a good reason to visit: there's a community of Kiribati people in that part of the Solomon Islands, who were displaced from the Phoenix Islands in the 1960s.

A severe drought made it impossible for us to live on the island, so we ended up living in the Solomon Islands.

It was very interesting to meet these people yesterday.

They never heard of me

Some of you found out later, and I think they were very happy to meet you.

He expressed his desire to offer formal hospitality on another occasion.

I was very happy to meet our people.

You talk to them in their own language, they respond in the same language, but they're forgetting the Kiribati language, and the accent is different from the original.

Here's a lady with red teeth

She is chewing betel nut, a custom not found in Kiribati.

we don't chew betel nuts

I've also met the families of locals who have married, and this is what's happening.

When you enter a different community, change inevitably happens.

Some degree of loss of identity is inevitable, and we have to anticipate what will happen when we migrate in the future.

Chris: Today was very emotional, maybe because of the question of identity, the joy of meeting someone like you, and the emphasis on the weight of what our people have lost.

I find it very inspiring to hear that you will fight to the end to keep the country where it is.

Anote: That's our wish

No one wants to leave our home, which is why it's such a difficult decision for me.

No other leader would make plans to abandon their homes and leave their islands, so people often ask me, "How do you feel?"

i don't feel good at all

I get very emotional, but I've tried to keep it in check. I know people are accusing me of not trying to solve the problem.

can only be solved in a holistic way

Climate change is a global phenomenon, and one that I always advocate -- unfortunately, on the occasion of the United Nations General Assembly, I will be meeting and discussing with the countries of the Pacific Islands Forum, of which Australia and New Zealand are also members.

There's some talk about reducing [greenhouse gas] emissions, but the impact on industry is something they're unlikely to be able to do.

And then I say, "I heard you, I understand what you're saying, but I want you to understand what I'm saying. If you don't cut your emissions, we're in danger.

It's up to you to weigh your convenience against your morals."

It's a question of national survival versus industry.

Chris: I asked you yesterday what made you angry, and you said, "I'm not mad," but you were at a loss for words.

Is this the reason for your anger

ANOTE: I spoke at the United Nations.

I was so angry and frustrated and depressed

Because it felt futile, I was fighting a hopeless battle.

I had to change my approach

I thought I should be more rational, and I thought people wouldn't listen to me if I wasn't reasonable, but I'm still radically rational.

(Laughter) Chris: Well, fishing is an important business in your country.

Most of the people are involved in some form of fishing.

ANOTE: We eat fish day in and day out. Fish consumption is definitely the highest in the world.

We don't have many livestock, and we rely on fish for food.

Chris: You depend on fish, not only for your diet, but also for the national income you get from the international tuna fishing industry.

talk about this

This is what happened here in the Phoenix Islands.

ANOTE: As background, I would like to talk about what fish mean to us.

We have the largest existing tuna fishery in the world.

I think they make up about 60 percent of the remaining tuna fisheries in the Pacific, some tuna species are doing well, some are not.

Kiribati is one of the three major owners of tuna resources.

Income from access fees and license fees currently accounts for 80-90% of our income.

Chris: You mean the national income.

ANOTE: It's the national income, which allows the government to run things like hospitals and schools.

But the decision to close the tuna fishery was a very difficult decision.

It's not going to be easy politically or for people's livelihoods, but I was convinced that it was a necessary step to make the fisheries sustainable.

There are indications that some species, especially the bigeye, are in danger of extinction.

Yellowfin tuna was also overfished

bonito is still ok

So we needed some kind of protection, so we decided to stop the capture.

And there's another reason. We've been begging the nations of the world to take action on climate change.

Since we are asking the international community to make sacrifices, we thought that we must also make sacrifices.

So I decided to make a sacrifice

If you refrain from commercial fishing in the protected areas of the Phoenix Islands, you will lose your income.

We're still assessing the impact of the loss, but we stopped commercial fishing earlier this year, so by the end of the year, we'll know the impact of the lost revenue.

Chris: There's a lot going into this.

On the one hand, it may promote healthy fisheries.

It's about how much more income can be generated by increasing fishing fees in the remaining waters.

ANOTE: We're having tough negotiations, but we've been able to raise the price per boat.

All fishing boats entering the area were charged a fishing fee of about 700,000 to 1,000,000 yen per day, but this was raised from about 1,200,000 yen to 1,500,000 yen.

It's quite a price increase

But on the other hand, I have to say that in the past, these boats were probably catching about 10 tons of fish a day, but now they're so much more efficient that they're catching about 100 tons of fish a day.

So there is also a corresponding

Technology is so advanced that we have to be careful

There was a time when Brazilian fishing boats moved from the Atlantic to the Pacific.

they couldn't mass-catch

We just started an experiment to see if we could catch a large number of fish.

Now we've succeeded in doing that, and it's been very efficient.

Chris: Can you tell us a little bit about how the negotiations went?

You're actually at the forefront of multi-million dollar price negotiations.

How do you lead negotiations to your advantage?

Could you give some advice to other leaders going into negotiations with the same fishing companies about how you negotiate to maximize the country's revenue from fishing?

What advice do you have?

People are too obsessed with cutting license costs to increase profit margins, because license costs are about 10 percent of the catch at landing, not the retail price at the store.

we only get about 10%

What we've been trying to do over the last few years is to get more involved in this industry, to fish it, to process it, and ultimately, maybe even market it.

It's not easy to get into this industry, but we're working to make it happen, and I'm sure it will work.

We have to be more involved in order to increase our profit margins.

We are taking action, we have to rebuild this industry.

The message to give them is that the world has changed.

I want to handle fish with my own hands.

Chris: On the other hand, local fishermen can continue to fish, but what does this business mean to them?

Is it harder than it is now? Depletion of marine resources?

Or can it be managed sustainably?

ANOTE: In artisanal fishing, apart from supplying the domestic market, there is no commercial fishing activity involved.

The tuna fishery is completely destined for the foreign market, most of it going to the United States, Europe and Japan.

I'm a fisherman too, so I used to catch yellowfin tuna.

But now, yellowfin tuna is rarely caught because purse seine boats have landed it by the hundreds of tons.

Chris: Here are some pretty girls from your country.

What message would you like to give to them and to the world for their future?

ANOTE: I've been telling the world that we have to do something about climate change, which is happening right now, and it's for the future of these kids.

I have at least 12 grandchildren

I think 12, but my wife knows exactly.

(Laughter) I have eight children.

about their future

Every day, I see my grandchildren who are about the same age as these girls, and it worries me a lot, and in truth, sometimes I get angry.

what will happen to their future

The message we have to deliver is them. It's not about national interests. The issue of climate change is unfortunately, unfortunately, seen in many countries as a matter of national interest.

I recently discussed this with our partners in Australia and New Zealand, because they said, "We can't cut it any further."

One of them, an Australian leader, said, "We've done our share, we're cutting back."

I replied, "What about the rest of the cut? If you don't let it out

If you say you can keep the portion that cannot be reduced within the country, I won't say anything.

Eject as much as you like

But, unfortunately, emissions also concern us and affect the future of our children."

This is at the heart of the climate change problem we have today.

We have a meeting in Paris at the end of this year. It continues to affect other countries until it is recognized that it is a problem that is caused by individual countries but needs to be addressed globally.

Chris: People are really desensitized to what the graphs and numbers tell them. They just turn a blind eye.

However, there are times when I care just a little bit.

It must be because countries like yours, which are in great danger, are warning you with very visual and strong messages.

On behalf of all of you, I want to thank you for your leadership and for being here.

Mr. President, thank you very much.

Anote: Thank you very much.

(applause)

I'll give you a little task first.

I'm going to show you two sentences.

Part 1 (English: Hearty Welcome) "I was warmly welcomed" (English: Hearty Welcome)

Who warmly welcomed you?

What are you wearing?

What are you drinking?

Next, the second (English: Cordial Reception) "I received a sincere reception" (English: Cordial Reception)

How do you stand?

what kind of expression?

What are you wearing? What are you drinking?

Try to write down what you have in mind in a short sentence.

I will come back to this article later

Here's a little history

The year was 400 AD and the Celts lived

Britain today will be conquered by the Romans.

But the Celts also had an advantage: they were protected from the Anglo-Saxons coming from northern Europe.

But when the Roman Empire began to crumble, the Romans withdrew from England.

The Romans were followed by other Germanic peoples, the Angles, the Saxons, the Jutes, and the Frisians, who drove the Celts out and established kingdoms in the British Isles.

For several centuries they lived in England, where the Anglo-Saxon and Germanic languages ​​came together and became widely spoken, called Old English.

Old English may sound like a different language to modern English speakers, but if you read and listen carefully, you'll notice that there are many similar words.

This is the Lord's Prayer in Old English

At first glance, it looks like an unknown word, but if you play around with the spelling a little, you'll see many English words in use today.

Old English was used on British soil for centuries, but in the 700s, Viking invasions began, and later a treaty was signed that divided Britain into two halves.

one was ruled by the Saxons

The other was ruled by Danes who spoke a language called Old Norse.

The Saxons fell in love with, and began to marry, the pretty Danes, and as a result, the boundaries faded. Thus Old Norse and Old English came together. Freckle, leg, root, skin, and want, which we see in English today, are Old Norse words.

About 300 years later, in 1066, the Normans invaded the British Isles.

The Normans were Vikings who lived in France.

The Normans abandoned the Viking language and culture in favor of the French way of life, but they didn't stop fighting.

Normans sat on the English throne, and for the next three centuries French was spoken in the English royal court.

English society was divided into two classes, the French-speaking aristocrats and the Old English-speaking farmers.

Latin also came in as the Normans brought in Catholic clergy.

Thousands of loanwords flowed into Old English, enriching its vocabulary Old English was enriched with thousands of loanwords, most of which were related to administration, law, and nobility.

council, marriage, sovereign, govern, damage, parliament, etc.

As the number of words grows, English speakers quickly find ways to be sophisticated. English speakers quickly find ways to be sophisticated.

Anglo-Saxon words have the simple impression of being spoken by farmers.

So let's go back to the first two sentences I asked you to think about.

When you hear the words, "We were warmly welcomed," do you think of the simple scene of relatives embracing and talking?

were you drinking beer?

Were you wearing jeans with a checkered shirt?

How about "I received a sincere reception"?

You would have imagined more fashionable and sophisticated people.

Wearing a blazer and a shirt, maybe wine or caviar

Why?

Why do words that are synonymous in dictionaries give us such different images and impressions?

Hearty and welcome are both Saxon words.

Cordial and reception are French in origin

Words of French origin retain nuances of nobility and power.

The Saxon words, on the other hand, are entrenched in images of farmers, the masses, and farmers, the masses, and the salt of the earth.

I think that even people who have never heard of this story have different impressions depending on the word without knowing it.

You could say that you already know this story, whether we realize it or not. Whether we realize it or not, the words we use every day have a history.

All humans start as a single cell

This divides, and the cell divides into two, then into four, then into eight, then into four, then into eight.

Cells become tissues, tissues become organs, and organs become people.

A single cell divides into 100 trillion cells, and this is called growth.

Growth seems simple. When we think of growth, we think of it as growing taller or getting bigger as we age. But for cells, it's not so simple.

Division is a chemical process that resembles a complex dance of cells, singly or collectively.

In this 100 trillion cells, things can go wrong.

DNA, the programming language of the cell, can be misspelled. DNA, the programming language of the cell, can be misspelled. This is a mutation.

Usually when the cell detects an error or is discovered by the system, the troublemaker is removed, the troublemaker is removed.

But when a certain number of mutations slip through the safeguards, the cell continues to divide.

"Rogue" cells divide from one to two, then four, then eight, then four, then eight.

At each stage of division, faulty codes are passed on to new cells.

In time, what should have been just one transformed "villain" cell would be found as a lump in the breast.

A problem with the toilet may be due to the intestine prostate bladder It may be due to the intestine prostate bladder It may be due to the intestine prostate bladder

If you had regular blood tests, problems would show up in the form of spikes in white blood cells and liver enzymes.

And I have "bad news" from my doctor: it's cancer.

After that, your strategy will change depending on where the cancer is and how advanced it is.

If it's slow-growing and just in one place, you'll probably just need surgery.

If the disease progresses rapidly and the surrounding tissues are also affected, your doctor may recommend radiation therapy or a combination of surgery and radiation therapy.

If the cancer has metastasized, or has spread throughout the body from the beginning, like leukemia, chemotherapy or chemotherapy and radiation may be recommended.

Radiation therapy and most chemotherapy work by physically disrupting a cell's DNA and inhibiting its ability to divide.

But radiation therapy and chemotherapy can't just target cancer cells.

Radiation affects all areas it's exposed to, and chemotherapy delivers anticancer drugs throughout the body through the bloodstream.

What happens to non-cancer cells?

I'm going to look at healthy liver cells, hair cells, and cancer cells.

Healthy liver cells divide only when stressed, whereas hair cells divide frequently, and cancer cells, for example, continue to divide frequently and indefinitely.

When you receive chemotherapy, every cell is affected.

Chemotherapy basically stops cells from dividing.

So every time it divides, it's under attack, and thus, the more often it divides, the more likely it is to be killed by the cancer drugs.

remember hair cells

Fragments frequently but harmlessly

There are other cells that divide frequently, such as skin cells, intestinal cells, and blood cells.

When these cells are affected, unwanted side effects of cancer treatments occur: hair loss, skin rashes, nausea, vomiting, fatigue, weight loss and pain.

They're the cells most hit by chemotherapy, so it's no wonder they have side effects.

It all comes down to growth

Cancer hijacks the cell's ability to divide, forcing the gas pedal on and triggering rapid, unrestricted proliferation.

But with chemotherapy, we can take advantage of this reckless nature and turn cancer strength into weakness.

Imagine, you're watching a sitcom with a friend, with a cheeky sidekick carrying a four-tiered wedding cake.

Fall down, fall down, dive from the face into the cake

Your friend laughs and says, "That's stupid! It's so ironic!"

Well now what do you do?

Laughing together and overlooking this sadly wrong use of "sarcasm"?

Or do you want to take the risk and explain what "sarcasm" really means?

i would choose the latter

Unfortunately, the word sarcasm is completely misunderstood.

The word sarcasm is often misused for funny situations, coincidences.

Of course, sarcasm is often humorous, but that's not what makes it sarcasm.

Irony only works when the exact opposite of what was expected happens.

It's ironic if you expect result A and result B happens.

Let's go back to the slapstick drama from earlier.

If someone falls while carefully balancing and carrying something that one person can't carry alone, it's chaos.

In fact, you didn't expect a single person carrying a giant cake to fall over, did you?

So this is not ironic, because even if you fall, the expectation is the same as the outcome.

But what if this supporting character wore around his neck the gold medal he won in the cake-driving event at the 1996 Atlanta Olympics?

What if you were a professional cake hauler?

That way, even if you're carrying a giant cake, you might have a reasonable expectation that this guy can do it.

Now, when this rational expectation is subverted, that is, when he falls, this is the irony.

Let me give you another example

An old man is texting and blogging.

Many images come to mind when you hear the word "elderly," don't you think? Many images come to mind when you say "elderly," don't you think? Are you ignorant or uninterested in technology?

So you can't use the internet, you can't have anything to do with technology, you can't do texting, you can't blog.

So when a grandma pulls out her phone and uploads dentures and photos of her grandchildren, they're betraying rational expectations.

Now the sarcasm is done

this is the irony

It may not be ironic to drop the cake, but there are situations where irony can happen all around.

Looking for real irony in action?

Your company has started recruiting for vacant posts.

Applications started coming in, and we found some qualified candidates.

It's time to start the selection process

Mr. A graduated from a prestigious university with excellent grades, a perfect resume, and many excellent letters of recommendation.

Impeccable

Ms. B graduated from a second-rate university, has many career changes, and has a strange career like a cashier and a "singing waitress."

But remember that both are eligible

So let me ask you, which one would you choose?

In our department, we have official names for this contrasting type of candidate.

Mr. A is a "silver spoon," someone with a clear edge and a promise of success.

Mr. B is a "fighter," a person who has fought through extremely difficult conditions in order to reach the same point.

Ladies and gentlemen, you've just heard that the director of human resources is giving a candidate an outrageous name -- (Laughter) -- it's certainly not politically correct, and it might sound a little too pretentious.

Before my HR credentials are taken away — (Laughter) let me explain.

A resume tells a person's story

Over the years, I've learned about people who have histories like patchwork quilts, and instead of throwing them out right away, I stop and think about them.

A streak of erratic tasks may indicate inconsistency, lack of concentration, and fickleness.

On the other hand, it may indicate that you've been battling some kind of obstacle.

"Warrior" is at least worth an interview.

Let me be clear, I have no complaints about the "silver spoon." It takes a lot of sacrifice and hard work to pass and graduate from a prestigious university.

But if you've lived your life based entirely on success, how do you deal with challenges?

One of the people I hired thought that there were some jobs that he wasn't suited for because he was a top-tier employee, and that he would be forced to temporarily do tedious manual work to understand the process.

he has quit

What if, on the other hand, someone who was destined for the life of a loser was successful?

I highly recommend that you interview such a "fighter".

I know them well because I am a fighter myself.

Before I was born, my father was diagnosed with paranoid schizophrenia.

Sometimes our lives were like "One Flew Over the Cuckoo's Nest", sometimes "Leonard's Morning", sometimes "A Beautiful Mind".

(Laughter) I was the fourth of five children, raised by a single mother, in a rough neighborhood in Brooklyn, New York City.

We didn't own a home, we didn't own a car, we didn't have a washing machine, and throughout our childhood we didn't even have a phone in our house.

So I was very curious about the relationship between professional success and the "warrior," because my life could have been very different.

As I've met successful business people and read biographies of great leaders, I've noticed what they have in common.

Many of them went through periods of hardship at a young age: poverty, parental neglect, childhood bereavement, learning disabilities, alcoholism, violence.

Traditional thinking has focused on trauma as a consequence of suffering later in life, and the resulting impairment.

But as research into dysfunction progressed, survey data revealed something unexpected: that even in the worst of circumstances, people can grow and change.

This counterintuitive phenomenon is what scientists have dubbed post-traumatic growth.

In one study that looked at the impact of adversity on at-risk children, more than a third of the 698 children who experienced the most extreme experiences had a healthy, successful and productive adult life.

Despite all the difficulties and the very bad conditions, they are succeeding.

1/3 of the people are

Let's take a look at a resume

This person was put up for adoption by his parents.

dropped out of college

He's been in India for a year, changing jobs, and on top of that, he's dyslexic.

Would you hire someone like that?

his name is steve jobs

A study of the world's most successful entrepreneurs found that they were significantly more likely to have dyslexia.

35% of US entrepreneurs surveyed

I was dyslexic. And what's surprising is that some of these entrepreneurs who have experienced post-traumatic growth think that their learning disabilities are their strengths, their "desired deficiencies," because they've made them better listeners and more attentive to details.

They don't think they've been successful in spite of adversity. They think adversity made them who they are.

They accept trauma and hardship as a major part of who they are and understand that without such experiences, they might not have the strength and grit to succeed.

One of my colleagues had his life completely turned upside down by China's Cultural Revolution in 1966.

When I was 13, my parents were sent to a rural area, my school was closed, and I was left alone in Beijing until I got a job in a garment factory at 16, forcing me to fend for myself.

But instead of accepting his fate, he vowed to one day return to school.

Eleven years later, when the political landscape changed, he heard about the highly competitive college admissions process.

In order to pass, you must master the middle and high school curriculum in three months.

Every day, he would come home from the factory, take a nap, study until 4 a.m., and then go back to work, repeating the cycle every day for three months.

he did it and passed

His determination to educate never wavered and he never lost hope.

He graduated from graduate school with a master's degree, and his two daughters graduated from Cornell and Harvard, respectively.

Fighters are driven by the belief that they are the only ones in complete control.

When things go wrong, they ask themselves, "How can we change the way we do things better?"

Fighters have a certain sense of purpose, and they're not easily discouraged. They've survived poverty, crazy fathers, and repeated encounters with robbers.

It's nothing like that. Leave it to me."

(Laughter) And that reminds me of a sense of humor.

Fighters know that humor can get them through hard times, and that laughter can change the way they see things.

And finally, there's the human relationship.

People who overcome adversity don't do it alone.

Somewhere along the road to success, they meet someone who brings out their strengths and invests in their success.

In order to overcome adversity, it is necessary to have someone you can always rely on.

i was lucky

When I graduated from college and started working, I didn't have a car, and I was carpooling with a woman who was the president's assistant.

She saw the way I worked and encouraged me to focus on the future and not dwell on the past.

I've met many people in my life who have genuinely given me their opinions, their advice, their guidance.

They didn't care that I used to be a singing waitress to pay my school fees.

(Laughter) Finally, I'd like to share with you an important tip.

Companies committed to diversity and inclusive practices tend to support the 'fighter' type and outperform.

A DiversityInc study found that the 50 most diverse companies outperformed the S&P 500 by 25% in profit margins.

back to the first question

Which one would you bet on? "Silver Spoon" or "Warrior"?

I would say that we should pick the underrated candidates, who have hidden weapons of passion and purpose.

Hire a "fighter"

(applause)

It's often said that the English word "doubt" is spelled strangely because of the letter "b".

Everyone wonders why there is an unpronounced "b"

But, contrary to what we learn in school, sounds are never an important part of English word spelling.

The meaning and history of words are important

"doubt" as a verb means "to ask", "to hesitate", "to hesitate"

As a noun, it means "uncertainty" or "confusion."

Today's English word "doubt" comes from the Latin word "dubitare"

First of all, when it was passed from Latin to French, both the "b" sound and the letter were lost.

And in the 13th century, it entered the English language.

Another 100 years later, scribes who also knew Latin began inserting the "b" again when writing English, but the pronunciation remained the same.

I wonder why?

Why would a clever person spell the unpronounced "b" back?

The scribe knew Latin, so he knew that "doubt" had a "b" in it.

As time went by, less people knew the Latin word, but the "b" remained to indicate a deep connection with other related words, such as "dubious" and "indubitably," which were later borrowed into English, from the same Latin word "dubitare."

Understanding this historical connection will help you spell "doubt" correctly, as well as understand the meaning of more sophisticated related words.

but the story still continues

Dig deeper and you'll see a lot more about the "b" behind this vague background.

There are only two root words in English that contain the spelling "d-o-u-b", one is "doubt" and the other is "double".

You can make a lot of words out of those two words, starting with "doubtful," starting with "doubtless," starting with "doubtful," then "doubtless," then "doublet," "redouble," and even "doubloon."

If we look at the history of these words, we can see that they share a common Latin root.

The number "2" represented by "double" also has the meaning of "doubt" in the number "2" represented by "double"

For example, when you have doubts or hesitations, you say "second guess."

We also describe the state of doubting, questioning, or being confused as "two minds."

Historically, before the introduction of French into the English language, historically before the introduction of French into the English language, there was a word for "doubt."

That's the Old English word "tweogan." Looking at the spelling, it's clear that it's related to "two."

From now on, whenever you have doubts about the spelling of an English word, do a "second look."

"double take" - you might find something surprising

It's really wonderful that there is color in this world.

To understand the properties of color, it's helpful to think of light as a wave.

But first, let's talk briefly about waves.

Imagine being on a boat watching a cork bobbing and sinking on the surface of the sea.

The first thing you notice is that this movement is repeated.

The cork repeats the same trajectory, ups and downs, ups and downs.

This cyclical, repetitive behavior is characteristic of waves.

You can also see that

A stopwatch is used to time the cork from the top of the track, through the valley, back to the top.

let's say it took 2 seconds

In physics, what we measure here is called the "cycle" of the wave that the cork floats on.

is the time it takes for a series of motions of a wave

We can also express this relationship in terms of the "frequency" of the waves.

Literally means number of cycles, or frequency of cycles.

how many times the wave repeats in one second

If I knew how many seconds each wave would take, I could calculate how many times the wave would repeat in one second.

In this case, one wave takes two seconds, so the frequency is 0.5 waves per second.

So much for cork, let's get back to light and color.

If light is also a wave, it must have a frequency.

yes there is

In fact, the frequencies of light that our eyes can detect have names.

That is "color"

Well, color is simply the speed at which light waves vibrate.

If you have a keen eye, you might actually be able to observe this cyclical movement, much like you see a cork floating in the ocean.

But the frequency of light is so high that the waves bounce up and down 400 trillion times per second, so you can't see it, but you can tell the frequency by looking at the color of the light.

The human eye can see light with frequencies from the lowest red to the highest violet.

Between these two colors lies a range of colors, which we call the visible light spectrum.

Imagine a yellow pencil on your desk.

The light that comes from the sun contains all colors, so all colors hit the pencil.

A pencil looks yellow because it reflects yellow light more than other colors.

Where did the blue, purple, and red light go?

absorbed and turned into heat

A similar thing happens with objects of other colors

Blue objects reflect blue light and red objects reflect red light.

White objects reflect all light, while black objects absorb all frequencies.

Wearing a black T-shirt on a hot day with the sun shining makes you feel hot.

We all think we're unique, independent individuals, but we're never alone.

Our bodies are home to an enormous number of microbes, and no two bodies are the same.

Each person has a different body as a habitat for microorganisms. Dry desert-like “skin” Villages on “lips” Cities spreading out “inside the mouth”

Each "teeth" is like a unique housing complex.

And those streets are teeming with microbes like this, and food is always pouring in. Each microbe has a job.

For example, cellulolytic bacteria

Its job is to break down cellulose, which is often found in vegetables, and turn it into sugar.

These monosaccharides are then taken up by another class of respiratory bacteria and burned as fuel.

Food travels further down the digestive tract to fermenting bacteria that extract its energy, where simple sugars are converted into chemicals such as alcohol and hydrogen gas, which are then exhaled as waste.

Deeper in the gut, commensal bacteria make their living by scavenging the waste products of fermenting bacteria.

During each of these stages, energy is released and that energy is absorbed by cells in the digestive tract.

The "cities" we've seen are different for each person.

Every human being has a unique and diverse set of gut bacteria that digest food differently.

Some people can extract far fewer calories than their gut bacteria can extract.

So what determines the composition of our gut microbiota?

For example, our genetic makeup and the variety of microbes we encounter in our lifetime determine the microbial ecosystem in our bodies.

What you eat also affects the types of bacteria that live in your gut.

For example, a food with complex molecules, such as an apple, requires a wide variety of bacteria to break down.

But when it comes to foods made up of simple molecules, like candy, some bacteria lose their jobs.

Those germs are gone, they'll never come back.

An intestinal environment with just a few types of bacteria doesn't work very well.

For example, people with diseases such as diabetes and chronic enteritis typically have fewer types of gut bacteria.

We don't know the best way to manage a person's microbial community, but by making dietary changes, such as eating a varied diet with plant-based, macromolecular foods, we can rejuvenate the microbial ecosystem not just in the gut, but throughout the body.

So the human body is not just ours.

It's home to enormous numbers of microbes, and we and microbes need each other.

As we learn more about how microbes interact with our bodies and with each other, we'll also see how we can nurture the complex, invisible world of microbes that shape our personalities, our health and our well-being.

Light is a wave, and the color of an object is related to the frequency of the light waves it reflects.

Light with a high frequency looks violet, and light with a low frequency looks red. Between red and violet there are yellows and greens.

This is the physical concept of color, which describes color as a physical property of light.

different from human perception

This is not wrong, but there is more to come.

For example, have you seen this picture?

As you can see, where the red and green light overlap is yellow.

It's strange when you think about it

Because light is a wave, two waves of different frequencies should not interact. Their mere existence together should be the same as two people singing in harmony.

So here in yellow, there are two different waves of light, one with red frequencies and one with green frequencies.

There's no yellow light here

But then why does it look yellow where red and green light mix?

To understand this, let's look at how the eye works, how the eye perceives color.

Light is detected by the retina, a thin paper-like layer of cells at the back of the eyeball.

There are two types of light-sensitive cells in the retina: rods and cones.

Rods work in relatively low light, and there's only one type.

But cones are completely different.

"Red", "Green" and "Blue" Corresponding to light close to each color "Red", "Green" and "Blue" Corresponding to light close to each color

When you see a color, different cones send specific signals to your brain.

For example, let's say yellow light, true yellow light with a yellow frequency, hits your eye.

We don't have cones that detect yellow, but yellow is somehow closer to green and somehow closer to red, so both red and green cones are activated, and each cell sends a signal to the brain.

Of course, there are other ways to activate both red and green cones at the same time, as long as both red and green light are present at the same time.

So for the brain, seeing light with yellow frequencies is the same as seeing light with red and green frequencies mixed together.

That's why when you add red and green light, you see yellow.

So why can't we see colors in the dark?

In the dark, the rods in the retina do the main work.

There's only one kind of rod, so there's only one kind of signal that goes to the brain. There's only one kind of signal that goes to the brain.

You can't see colors with just one type of light sensor.

There are an infinite number of physical colors, but the human eye has only three types of cones, so the brain creates the illusion of seeing a variety of colors by skillfully combining the three colors of red, green, and blue.

This mechanism of the human eye has many applications.

For example, to make a TV

Instead of reproducing and displaying the myriad colors in the natural world, instead of reproducing and displaying the myriad colors in the natural world, you can display a combination of the three colors of "red", "green" and "blue".

here we go…

let's go back in time

It's 1974

Somewhere in the world, there's a gallery, and in the center of that space is my 23-year-old daughter.

there is a table in front of her

On top of that are 76 objects, objects that give pleasure or pain.

Among them are glasses of water, coats, shoes and roses.

On the other hand, there are knives, razor blades, hammers, guns that hold a single bullet.

The instructions say, "I am the object.

Anything on the table can be used against me

I take all the responsibility, even if it's for killing me

The time limit is 6 hours."

It was still easy when the performance started

They gave me glasses of water and gave me roses.

But soon after that, a man came up with scissors and cut my clothes, and then someone took a rose thorn and stuck it in my stomach.

Somebody took a razor blade and cut me in the neck and drank my blood and I still have the scars.

women instructing men

The reason the men didn't rape me was because it was a normal exhibition opening and it was all open to the public and I was with my wife.

The men carried me and put me on the table with a knife between my legs.

And someone took a gun and a bullet and pressed it to my temple.

Another man picked up the gun and the two started fighting.

Six hours later, I—

started walking towards the audience

i was a mess

Half-naked, full of blood, crying

everyone ran away

They couldn't face me as a normal human being.

And what happened? I went back to my hotel.

And when I looked at myself in the mirror, I saw a strand of gray hair.

Now take off the blindfold

Welcome to the world of performance

First of all, let me explain what performance is.

Different artists give different explanations, but mine is very simple.

A performance is a space created in front of an audience in a specific amount of time by a performer -- a mental and physical construct from which an exchange of energies occurs.

Audience and performer create the work together.

performance and theater are very different

In theater, knives aren't real knives, blood is just ketchup.

In performance, blood is the material, razor blades and knives are the tools.

Performance is all about being there in the moment, you can't rehearse, and in many cases this kind of thing can never happen again.

This is very important. Performance is... we're all afraid of the simplest things.

Fear of suffering Fear of pain Fear of dying

So I'm -- I'm going to stage that fear in front of an audience.

I harness your energy and use it to propel my body as far as it can go.

and free yourself from those fears

i'm a mirror for you

If I can do it for myself, so can you

I went to Amsterdam from my hometown of Belgrade.

I've been performing for 40 years now.

That's where I met Urai, someone I really loved.

we performed together for 12 years

I traded knives and guns and bullets for love and trust.

In a show like this, you have to really trust the other person, because this arrow is aimed at my heart.

So the beating of the heart, the rush of adrenaline, it's trust, total trust in another human being.

Our relationship lasted 12 years, and we've tackled so many subjects about male and female energy.

Just as all relationships end someday, so did our relationship.

But like most people, I didn't say on the phone, "It's over."

I walked the Great Wall of China to say goodbye.

I started walking from the Yellow Sea, he from the Gobi desert.

We each walked 2,500km for three months.

I had a hard time on the mountain road

There were places to climb and ruins.

The Great Wall of China spanned 12 provinces before China began its reforms and opening up in 1987.

We were able to meet at the halfway point and say goodbye.

This is the end of our relationship

This completely changed the way I perceive my audience.

One of the most important pieces I made around that time was "Balkan Baroque."

It was during the Yugoslav conflict, and I wanted to create a powerful and charismatic image, something that could be applied to any war in any era, because the Yugoslav conflict is over now, but there's always a war going on somewhere.

So here I am washing the big, bloody bones of 2,500 dead cows.

You can never wash the shame out of war, just like you can't wash the blood away.

I washed my bones six hours a day for six days, and as the war flakes off my bones, the smell is unbearable.

On the other hand, there are some things that are memorable.

The next piece I want to show you is a piece that changed my life, a performance I recently gave at the Museum of Modern Art in New York.

About this performance, I said to the curator, "I'm going to just sit in a chair and put another chair in front of me so that anyone who comes in can sit there as long as they want."

The curator replied, "No, this is New York. No one will sit there. No one has that much free time."

(Laughter) And yet I sat for three months.

Every day, eight hours, all the time the museum is open. On Fridays, when the museum is open at 10, I sat for 10 hours and didn't move.

I took the table away and I'm still sitting.

If you did this performance 10 or 15 years ago, nothing would have happened.

But people really wanted to experience something different, and the audience was no longer a group, it was a one-to-one relationship.

I was watching these people, people come in front of me and sit down, and they have to wait hours and hours to sit in this place, and then they finally sit down.

And what happened?

They're being observed, photographed, videotaped, and watched by me, so their only escape is within themselves.

this is important

I feel a lot of pain and loneliness. When you look into someone else's eyes, amazing things happen. When you look at a complete stranger without saying a word, everything happens.

Three months later, when I got up from my chair, I had changed.

And I felt a strong sense of mission to share this experience with everyone.

That's how the idea of ​​creating a disembodied facility for performance art was born.

Given its lack of substance, performance is a time-based art.

different from painting

Hang the picture on the wall and it will be there the next day.

If you miss a performance, all you're left with are your memories and stories you've heard, and in fact, you've lost everything.

you need to be there

What I want to emphasize is that when we talk about immaterial art, music is arguably the best of all arts, because music is the most immaterial.

Next comes performance, followed by other arts.

in my subjective view

This facility will be located in Hudson, upstate New York, and I'm working with Rem Koolhaas to bring the idea to life.

very simple

If you want to experience something, you need to give me time

Before you can enter the building, you have to sign a form, and you have to take an oath to spend six hours there.

This is a little old-fashioned, but I don't care if you break your vows and leave before time.

But six hours is one experience.

After you're done, you'll get a certificate, so you can go home and frame it.

(Laughter) This is the orientation hall.

The first thing people do when they enter is change into their white coats.

This is important for moving from being a spectator to being an experimenter.

Then you go to the locker and put all your digital devices and electronics like watches, iPhones, iPods, computers, etc.

For the first time in my life, I have free time for myself.

There's nothing wrong with the technology per se, but it's the wrong way of handling it.

we lose time for ourselves

This facility is for you to reclaim that time.

What we're going to do here is start by walking slowly and slowing down.

and go back to simple

After a slow walk, you'll learn how to drink water, and it's very simple. Take about 30 minutes to drink water.

Then you go to the "magnetism room," where you create a magnetic flow through your body.

Then go to the "Crystal Room"

After that, in the "staring room" and then in the next room, you lie down.

Sitting, standing, and sleeping are the three basic postures of the human body.

You can walk slowly

Next is the "Sound Room"

Once you've seen all of this, and you're mentally and physically prepared, you're ready to see something that takes a long time, like immaterial art.

It can be music, it can be opera, it can be theater, it can be film, it can be video dance.

If you feel relaxed, head to the "long chair"

You're sitting in a chair for a long time, and you're moved to a larger space, where you'll be able to see the work.

And if you do fall asleep -- it's a long day, so it's likely -- and you're going straight to the parking lot.

(Laughter) Sleep is very important.

I receive art even while I sleep.

You'll spend some time in the parking lot, but after that you can come back and see as many things as you want, and you can take your certificate and go home.

For now, this facility is a virtual one.

I'm building a facility in Brazil right now, and I'll be building one in Australia, then here in Canada, everywhere.

It's about experiencing a kind of simple way, a way of returning to a simple way of life.

There is also counting grains of rice

(Laughter) You can create a life just by counting grains of rice.

How to keep counting grains of rice for 6 hours?

this is very important

Because you never finish counting the grains of rice, you go through a series of emotions: bored, angry, frustrated.

It's very comforting when you've done enough work, or count the grains of sand in the desert.

Or if you put on headphones and you can't hear anything, creating a sound-blocking situation, you're just existing in a completely silent environment with people experiencing silence.

we always do what we like

so it doesn't change

If you always do the same thing as you go through life, nothing will happen.

My approach, on the other hand, is to work with what I'm worried about, what I'm afraid of, what I don't know, and step into territory that no one else has.

can also fail

I think failure is important, because failure is part of progress and experimentation.

If you don't step into that territory and fail, you're just repeating the same thing over and over again.

I believe that we need change in our time, and I believe that change can only happen on an individual level.

you have to change yourself

Because the only way to change consciousness and the world around us is to change ourselves first.

It's easy to criticize them for saying they're wrong. Everything in the world is wrong. Politics is corrupt. There are hungry people in the world.

But how can we, as individuals, help with that?

Can you face someone you don't know next to you and look them in the eye for two minutes?

(Noisy) Just give me two minutes. It's a short time.

Breathe slow, don't blink, don't be too self-conscious

be relaxed

Just look into the eyes of someone you don't know

(pause) Thank you for trusting me.

(Applause) (Chris Anderson) Thank you.

Thank you very much

Once upon a time, there lived six daredevil musketeers in a round magic pie kingdom.

Their names were brackets, exponents, multiplication, division, addition and subtraction.

Each of the six musketeers was well known for their symbols. Parentheses are two hands trying to catch a fly. The exponent of a small, high number. The mighty X for multiplication. The slash for division. The plus for addition.

The kingdom of Pai was not a very peaceful country, so the numbers of the kingdom needed musketeers.

The Kingdom of Pi was ruled by a number of figures that made up an anarchist commune. The Numbers were elected by vote, but one powerful figure from the Imperial Senate orchestrated a war between the robots and the Knights of the Kingdom, and took the throne of the highest emperor himself.

It's been a tough day

So the Musketeers were summoned to save the Pai Kingdom from the ravenous dragons.

I rushed and attacked the dragon on my brave horse.

First was multiplication, then parentheses, but it didn't work.

The dragon continued to eat the people

I also fought addition, but was thrown away

The exponent jumped at the dragon, but was quickly flattened.

didn't go well at all

The musketeers huddled together and planned a strategy.

We're going to attack in order, but who should go first?

While they were talking, the dragon ate a few more princesses, and the story was finally settled.

They jumped into the first little bracket inside Puff the Digit Dragon.

Parentheses indicated where to start, exponents, multiplication, division, addition, and subtraction, protecting them while they minced the dragon.

first here then over there then over here

please look! Another set!

Parentheses indicate and exponents lead

Multiplication, division Addition, subtraction followed in order Always in the same order

() n X / + - After that set, we moved on to the next set, and then on to the next.

Pon! Pon! Pon! Pon! Pon!

The Six Musketeers are here! There's one over there too!

Don't forget the parentheses within the parentheses

There is one!

That's a cunning index

What then!

The Six Musketeers made the dragon smaller and smaller until it was just a terrifying growl.

When Puff the Magic Digit Dragon disappeared, all the empire's numbers reappeared from this very tiny one, and they all lived happily ever after.

Except for the numbers who were emperors, because they threw them into the mouths of desert-dwelling monsters.

end

Look at the yellow pencil on the desk

All kinds of information is collected from the eyes to the brain. The length of the pencil, the color and shape, the length of the pencil, the color and shape, the length of the pencil.

How does this work?

The ancient Greeks were the first to think of this scientifically. The ancient Greeks were the first to think of this scientifically.

Greek philosophers such as Plato and Pythagoras believed that light emanated from the eye, and small objects emitted from the eye reached distant objects and collected information to see things.

A thousand years later, the Arabian scientist Alhazen proved that the ancient Greek logic did not make sense.

Alhazen explains that the eye simply collects the light that reaches it, rather than emitting something to gather information.

Alhazan's explanation explains the darkness that the Greeks failed to explain.

In fact, objects that emit light are not that kind of thing.

Things that emit light are limited, such as the sun, or light bulbs, such as the sun, or light bulbs, are known as light sources.

Most of the other visible things, like the pencil on the desk, just reflect the light from the light source and don't emit their own light.

When you look at a pencil, the light that enters your eye comes from the sun, travels millions of kilometers through empty space, is reflected by the pencil, and reaches your eye.

By the way, what is it that comes out of the sun? why does it look like that?

Are they particles, like atoms, or are they waves, like ripples on the surface of a pond?

Modern scientists have been searching for the answer to this question for hundreds of years.

In the early days, Newton

He believed that light was made up of tiny, atom-like particles, which he called corpuscles.

Based on this idea, I explained the properties of light.

For example, refraction, when light travels from air to water, it looks like it's bending.

But even geniuses sometimes get it wrong, which is science.

In the 19th century, long after Newton, scientists experimented and found that it was impossible for light to be a particle like an atom.

First, light coming from two directions and intersecting doesn't affect each other.

If light is a particle, a part of the particle of the ray A and the particle of the ray B will collide.

Colliding particles should fly in all directions Colliding particles should fly in many directions

but it won't

Rays pass through each other's rays, and this is easy to experiment with a laser pointer and chalk dust.This is easy to experiment with a laser pointer and chalk dust.

Also, the interference fringes of light are evidence of waves.

An interference fringe is a special pattern that occurs when two waves are in one place.

This is what you see when two objects are thrown into a pond, disrupting the calm water surface. This is what happens when you put two very small light sources close together.The same thing happens when you put two very small light sources close together.

The pattern of interference is proof that it's a wave, something that doesn't happen with particles.

What's more, because light behaves like waves, it can also explain how color works and why pencils look yellow.

So, can we assert that light is a wave?

it's not that easy

In the 20th century, scientists did more experiments and found that light behaves like a particle.

For example, when you shine light on a metal, the energy of the light is transferred to the atoms of the metal, but in chunks of discrete values ​​called quanta.

But we can't ignore properties like interference.

So this quantum is nothing like Newton's little hard round grain.

The property that light behaves like both particles and waves The property that light behaves like both particles and waves gave birth to a whole new physics, quantum mechanics.

So let's think again, "What is light?"

Light is completely different from the ordinary things we think about every day.

Sometimes it behaves like a particle, and sometimes it behaves like a wave, but it's definitely not the same.

What do horror movies and comedies have in common?

The two genres may seem very different, but the reason they're both so popular might be that they have something in common: they use theatrical irony.

Let me explain in detail.

There are three types of irony

First, the irony of the situation is that the opposite of what you expect happens.

Verbal irony is saying the opposite of what someone thinks.

And the theatrical irony is what you're seeing right now.

Theatrical irony means that the viewer understands the events, situations, and conversations happening in the scene better than the characters in the movie or drama book.

The viewer is in a situation where they know a secret that the characters are unaware of.

It's a great technique for eliciting a lot of emotion when telling a story.

think for a moment

How does it feel when you find out that a terrifying villain in a horror movie lurks behind the door in the dark room?

Eerie music plays, the lights cast sharp shadows, and bad things must happen to the hero.

But of course, the hero has to enter that room to meet the villain.

You know that someone will come out and something terrible will happen, but you feel the tension and the thrill of not knowing when it will happen.

That tension is the theatrical irony, that you're in a situation better than the characters in the movie.

Now let's look at a typical comedy.

There will probably be some kind of "misunderstanding"

As before, we know the situation better than the characters.

Two characters are planning a birthday surprise for their roommate, but their roommate in the hallway overhears the whole plan.

From there, confusion and misunderstanding arise, and tension arises.

It's a different type of tension from a horror movie, because it's so funny how the characters come to grips with the whole situation, and it's a great example of the tension and thrill that theatrical irony can bring.

In both genres, the tension or thrill drives the narrative and keeps the story going.

What viewers want, or need, is a terrifying figure coming out of the shadows, a terrifying figure coming out of the shadows, someone finally being revealed, breaking the tension and breaking the tangle.

So if you feel like you know some secret, it's the theatrical irony that proves the greatness of writers from Shakespeare to Hitchcock.

I often say that if you want to know about someone, just look in the bookshelf.

What does my bookshelf say about me?

When I asked myself that question a few years ago, I realized something terrible.

All my life, I thought I was a fairly educated, internationally-minded person.

But my bookshelf was telling me something very different.

Most of the books there were by British or North American authors, and very few were translated.

I was pretty shocked to discover this huge cultural blind spot in my reading.

I thought this was really embarrassing

I know there must be a lot of great books by authors who speak languages ​​other than English.

I was very disappointed to think that I would not be able to meet it in my own way of reading.

So what I set myself to do is an intensive course in international reading.

2012 was supposed to be an international year for Britain, because it was the year of the London Olympics.

So I decided to read novels, short stories, and autobiographies written in every country in the world during this year.

and ran

It's been really exciting, I've learned amazing things, and I've made some amazing connections with people, and that's what I want to share with you today.

But when it came time to run it, I ran into a little problem.

I couldn't decide which of the many countries in the world to use for my project, so I ended up with a country recognized by the United Nations.

Then I thought about my reading and blogging schedule, four books a week, five days a week, and I was faced with the reality that it might not be possible to get English-language books from every country in the first place.

Only about 4.5% of the literary works published each year in the UK are in translation, a figure similar to that in many English-speaking countries.

Many other countries have a much higher percentage of translated books.

4.5% is already small enough, but what's hard to see from this number is that many of these books are from countries with strong publishing networks and large numbers of industry people who can sell them to English-speaking publishers.

So, for example, in the UK, more than 100 books translated from French are published each year, mostly from countries like France and Switzerland.

On the other hand, French-speaking African countries have little prospect of publication.

After all, there are actually quite a few countries in which little or no work is available in English.

For readers of the world's largest published languages, books from those countries are virtually invisible.

But the hardest part of planning to read the world's books was not knowing where to start.

All my life, I've read almost nothing but British and North American books, so I had no idea how to go about gathering information from other parts of the world and finding and choosing books.

Also how to get information about Swaziland stories.

I didn't even know about the great Namibian novel.

There's nothing to hide, I didn't know anything, I hated foreign literature.

So how can we read all the books in the world?

i had to ask for help

So in October 2011, I started a blog called "A Year of Reading the World" (ayearofreadingtheworld.com) and posted a short request.

I introduced myself, explained how narrow my reading range was, and asked people who cared about what books I should read from other parts of the world.

I had no idea if anyone would be interested, but within hours of posting my request, I started getting calls.

first from friends and co-workers

then a friend of a friend

And then it started coming from strangers.

Four days after posting my request, I received a message from a woman named Lafida in Kuala Lumpur.

She said she was impressed with my plan, and she said, Shall we go to a local bookstore that sells English books, pick out some Malaysian books, and send them to you? I say

I welcomed him with open arms. A few weeks later, I received a parcel containing not one, but two books.

At that time, I was amazed that a stranger more than 10,000 kilometers away would go so far for a human being who I would never see again.

But I was to experience Rafida's kindness over and over again that year.

Time and time again, people have gone the extra mile to help me.

There were people who researched things for me, and there were people who took a detour to visit bookstores on their days off or on business trips.

If you want to read books from all over the world, if you want to open your heart and meet people, the whole world will help you.

People were even more hospitable in countries where little or no work was available in English.

Often unexpected places became the source of books.

For example, the Panama book came from a conversation I had with the Panama Canal on Twitter.

Yes, the Panama Canal also has a Twitter account.

When I tweeted about my plans, the Panama Canal suggested that I might like the work of the Panamanian author Juan Davi Morgan.

I found Morgan's website, sent him a message, and asked if he had any of his Spanish novels translated into English.

And he said he had none published, but he did have an unpublished translation of the novel The Golden Horse.

He emailed it to me and made me the first person to read the book in English.

Morgan wasn't the only writer to present his work in this way.

From Sweden to Palau, authors and translators have sent me their self-published books and unpublished manuscripts, books that were either not picked up by English-language publishers or are no longer in print, and have afforded me the privilege of glimpsing a wonderful imaginary world.

For example, I read about a South African king named Ngungunyane who resisted the Portuguese in the 19th century, and I read about marriage customs in a remote village on the Caspian coast of Turkmenistan.

I also met the Kuwaiti version of Bridget Jones.

(Laughter) And then I read about the treetop orgies in Angola.

But the most amazing example of people going to great lengths to help me read all over the world came near the end of my journey, when I tried to get hold of a book from Sao Tome and Principe, a small Portuguese-speaking African island nation.

After months of trying everything I could think of to find an English translation of this country's work, it seemed like the only way left was to find someone to translate it from scratch for me.

I couldn't imagine having someone take the time to help me.

But I put out a call on Twitter and Facebook for people who could speak Portuguese, and within a week, I got more people than I needed, including Margaret Jules Costa, a leading figure in the field, who translated the works of Nobel Prize winner José Saramago.

Together with nine volunteers, we managed to find a book by a São Tomé author that we could buy enough copies of on the Internet.

this is the one

I gave the book to each volunteer.

Each person worked on two short stories in the book, and they sent me the translations they promised, and in less than six weeks, I had the whole book.

In my year of reading the world's books, I've discovered so many times that, once again, being transparent about my ignorance and my limitations has led to great opportunities.

In the case of Santope and Príncipe, it was not only an opportunity to learn new things and discover new collections of stories, but it was also an opportunity to bring a group of people together to face a joint creative challenge.

My weakness became my strength in this project.

The books I read this year have opened my eyes in many ways.

As anyone who enjoys reading knows, books have an amazing ability to pull us out of ourselves and into the minds of others, allowing us to see the world in a different, if fleeting, way.

It can be uncomfortable, especially if the book is from a culture whose values ​​are very different from yours.

But there's a lot of learning potential there.

By wrestling with unfamiliar thoughts, you can clarify your thoughts.

And it also exposes blind spots in how we see the world.

When I look back at many of the English-language works I grew up with, I realize how narrow they were compared to the wealth the world had to offer.

And as the pages turned, other things began to happen.

Little by little, that long list of country names I prepared at the beginning of the year turned from a dry, bureaucratic register of place names into a living, breathing entity.

Of course, I'm not trying to say that it's possible to get a complete picture of a country just by reading one book.

But the stories I read that year have accumulated to make me more sensitive than ever to the richness, diversity and complexity of this wonderful planet.

It's as if the world's stories and the people who worked so hard for me to read them made the world more real to me.

These days, when I look at my bookshelves, or when I think about the works in my ebooks, I feel that they tell a different story.

It's a story about the power of books to unite us across political, geographical, cultural, social and religious differences.

It's a story about the possibilities of human collaboration.

And it's a testament to the wonders of the times we live in, when the Internet makes it easy for strangers to share stories, worldviews, books, even though they're on opposite sides of the globe and never meet.

I would love to read more stories like this in the future.

And I hope more people will join us

If we all read more widely, publishers would think more about translating and publishing, and that would make us all richer.

thank you

(applause)

Anyone have a robot?

2, 30 people

I'm fine

Who among you would like to have your own robot?

I want it too

why not

Why can't you say "I want a personal robot" at the convenience store or department store counter?

Let's talk about how

It's about building smart robots

Then it wouldn't be strange to have a robot.

We have Mars rovers, and we're getting scientific data to better understand the world.

industrial robots are building cars

Military robots are defusing bombs for the safety of soldiers.

But why not for personal use?

Why no robot chef? i can't cook

It's a robot that I built. It just walks. It's not smart at all.

What we need is to change the definition of robot.

How? First of all, we design the robot, and before we start assembling it, we create rules, like laws.

Code of Conduct Why? If robots were smart, they might even be able to do things we don't need to do.

so we need rules

don't hurt humans

follow me only

always protect me

Define limitations for robots and how they interact with humans before designing

then figure out how

The way to make robots smart is to imitate humans.

The human brain is complex, it does a lot of processing, and you can't open the brain, so it's hard to imitate.

The best thing to do is observe, observe what people do to understand what they are doing, what they are thinking, what they are doing and how they are feeling.

What makes robots smart is that they imitate humans, and robots that imitate behavior may do better.

there are many ways

My specialty is electronics

There's something I never thought I'd learn about child psychology and early childhood development.

Toddlers grow into children and adults, learn and interact, and that's what's important in robotics.

I never thought I'd watch videos of socializing monkeys, because they have a society, they learn from each other, and that's what helps us build smarter robots.

And neuroscience. I was interested in neuroscience, but I didn't think I needed to understand it. Why do neurons excite, how the environment affects learning, all of these things help make robots smarter.

Mirroring is just one part of what I do.

You look in the mirror and wave your hand, you recognize that you're there. You recognize yourself. That's a sign of intelligence.

We're trying to turn this robot into a health coach.

An exercise physiologist teaches a robot how to exercise

I want to become stronger

next is learning

Learning is important, children learn, adults learn, and old people learn.

One form of learning is muscle memory.

Does anyone play an instrument?

At the beginning, for example, the violin, the teacher comes and moves your hands, lifts the bow.

I touch you, let my muscles learn, now you understand

improve

The learning methodology, of course, is to move the legs without touching the motors, and use the remote control to make the muscles of the robot memorize it, and that's how you teach it to dance.

Lastly is creativity

Isn't it strange "Creativity in robots?"

"Why do we need creativity?" "Will it make us smarter?"

Creativity and Imagination Define the problem from here

create something there

The apps that you use, the tablets that you use, the iPads, the iPhones, the Androids that didn't exist 20 years ago.

It was created out of nothing, right?

This is imagination, this is creativity.

these create new

My robot is imaginative. He's a composer playing the piano. He's playing "Twinkle Twinkle Little Star."

If you put these together, the last thing is exchange.

If I had a robot, I would like to use it as a friend, a teacher, or an instructor, and interact with it.

It's cute, right?

Communication is the key It's the key to understanding How to coexist So it's very important to communicate

to communicate, to understand, to look, to pay attention

These things allow us to interact and make robots smarter.

These are just a few ways to make robots smarter.

One last word

I'm in favor of making smart robots

It's my job and I believe in it

But what is the end goal?

How far should we go?

How far, how smart should we make robots?

thank you very much

Hi, I'm Christian Rudder and we started OkCupid.

It is currently the largest dating site in the United States.

Like many of our staff, I'm a math major, and we're known for our analytical approach to love.

we call it a matching algorithm

This helps two people decide if they should date.

This is at the heart of our business

Algorithms are something cool and people talk about it like it's something amazing.

It's actually a step-by-step process of solving a problem mechanically.

Not necessarily great

In this video, I'm going to show you how our algorithm works.

Why are algorithms important?

Why does this video exist in the first place?

Notice that I said "step-by-step solution," and I'm sure you know that computers are great at step-by-step processing.

Without algorithms, computers are just expensive pickle stones.

Computers are everywhere, and that means algorithms are everywhere.

The math behind OKCupid is pretty straightforward

Addition, multiplication, and a little root

The difficulty in designing this algorithm is to break down the mysterious phenomenon of human attraction into components that can be handled by a machine.

In order to match people, the first thing we need is data for the algorithm to use.

The best way to get data quickly from people is to simply ask.

So here at OkCupid, we decided to ask our users, "Do you want kids someday?"

"How many times a day do you brush your teeth?"

"Do you like scary movies?"

And then there are big questions like, "Do you believe in God?"

Many questions are considered compatible when two people give similar answers.

For example, if two people both like scary movies, than if one likes them and the other doesn't like them,

Probably a good fit, but what if the question is, "Do you like being the center of attention?"

If you're dating two people who both want to be the center of attention, you're likely in big trouble.

So we decided to take a little more data for each question.

I decided to ask not only for answers about myself, but also for the answers I wanted from others.

This worked fine but

I needed one more element

Because some questions tell us more than others.

For example, political questions like "Which is worse, burning books or burning flags?"

It may have more significance than things like movie taste.

It's problematic to treat all questions the same, so I added another piece of data.

Every question OkCupid asks about its importance to you, from 'don't care' to 'must have'

can be specified

So, for each question, there are three things that the algorithm can use: 1. Your answer, 2. The answer you want in your partner, 2. The answer you want in your partner, 2. The answer you want in your partner, and 3. The question's importance.

Based on this information, OKCupid can judge the compatibility between two people.

Algorithm calculates answer from data

Use a specific example to find out if you and someone else, Mr. B, are compatible

Let's see how we judge

Compatibility is determined based on the questions that both of you answered.

Let's call this collection of common questions S

To keep things simple, let's assume that S consists of just two questions, and that's what we're going to use to calculate compatibility.

one of those two questions

For example, "Are you a messy person?"

Suppose the answer options were "messy," "normal," and "clean."

Let's say you're a clean person and you want your partner to be a clean person, and this issue is very important.

you are super pretty

I strongly demand not only myself but also others to be clean and tidy.

Mr. B is a little different

He himself is "clean", but he doesn't care if the other person is "normal", and he doesn't care if the other person is "normal".

So let's move on to the second question, the example question I gave earlier, "Do you like being the center of attention?"

Choices are yes or no

Let's say your answer is "no" and you hope the other person also says "no", so this question wasn't that important.

Mr. B himself said "yes"

Let's say you want the other person to say no -- because you want to be the center of attention -- and this issue is kind of important to him.

Let's calculate

First of all, because we're using computers, we need to assign numbers to concepts like "somewhat important" and "very important," because all computers work with numbers.

At OkCupid, we decided to use the following weighting: 0 points for "I don't care"

1 point for “not very important”

10 points for "somewhat important"

50 points for “very important”

"Required" is 250 points.

The algorithm then does two simple calculations.

One is how satisfied Mr. B is to you.

This is how many points Mr. B got out of the possible points.

First question, whether you're a mess or not is very important to you.

Mr. B answered correctly, so he gets 50 points.

The second question wasn't very important, so it was only worth 1 point.

B gave the wrong answer, so B's score is 50/51.

98% satisfaction, which is a pretty good score.

The next thing the algorithm looks at is how well you satisfy Mr. B.

Mr. B set 1 point for the messy question Mr. B set 1 point for the messy question and 10 points for the center question

The full score is 1 + 10 = 11 points, and you got 10 points because you were right on the second question.

Your score is 10/11 and B's satisfaction is 91%.

not bad

As a final step, we take these two percentage numbers and calculate how compatible they are.

The algorithm multiplies the two values ​​together to find the nth root, where n is the number of questions.

In this case, there were only two questions, so the compatibility is the square root of 98% times 91% — the compatibility is the square root of 98% times 91% —

94%

94% is the degree of compatibility between you and Mr. B

It's a value calculated mathematically based on data that gives you the expected happiness when you're in a relationship.

Why does this algorithm multiply the two scores to find the root instead of averaging them?

Such an expression is commonly called a geometric mean.

It's a great way to combine a wide range of values ​​with different properties.

That means it's perfect for romantic compatibility.

We have a wide range of different data, movies, politics, religion and everything else.

Intuitively, this also makes sense.

Two people who are 50% satisfied with each other are probably more compatible than two people who are 0% and 100% satisfied, because a relationship needs to be mutual.

Just make a few corrections to account for the error, and you're done.

When OkCupid brings two people together, it follows the steps just described.

First of all, we collect everyone's answers as data, and then we match their choices with their expectations in a simple mathematical way.

I believe that the ability to transform this real-world phenomenon into a form that microchips can understand is the most important skill of our time.

Just as we use sentences to tell stories to people, we use algorithms to tell computers.

Learning a language allows you to tell stories

I hope this video helps

You may think that there are many things I cannot do because I am blind.

That's the way it is for the most part

Even coming up on this stage, I needed a little help.

But there are many things you can do

This is my first attempt at rock climbing.

I love sports and I can do many sports such as swimming, skiing, skating, scuba diving, jogging, etc.

But there is one limitation: you need someone's help.

i want to be able to do it by myself

When I was 14, I lost my sight in a pool accident.

I was an active, independent kid, and suddenly I was blind.

The hardest thing for me was losing my independence.

What was once easy has become almost impossible on your own.

One of the difficulties was the textbook.

Back then, there were no computers, no internet, no smartphones.

So I had to get one of my two brothers to read the textbook to me, and I had to make my own book in Braille.

Can you imagine?

Even my brother didn't find it funny, and I noticed that he was always gone when I wanted to ask him.

(Laughter) I think you were avoiding me.

I'm not going to blame you two for that.

But I really want to be able to do it without depending on someone.

That led to my desire to innovate.

Time passed, mid 1980's

As I became familiar with the latest technology, I wondered why there was no technology to create Braille books on a computer.

With this wonderful technology, we should be able to save a handicapped person like me.

And so my journey to innovation began.

I started working on developing digital book technology Digital Braille editor Digital Braille dictionary Digital Braille library network

Today, visually impaired students can read textbooks through Braille and audio using computers and mobile devices.

This shouldn't come as a surprise, in 2015, we all have e-books on our tablets.

But Braille books went digital long before regular books, in the late 1980s, nearly 30 years ago.

The specific and strong needs of the visually impaired created the opportunity for the creation of e-books long ago.

This is nothing new. History shows that accessibility stimulates innovation.

The telephone was born in an attempt to create a means of communication for the deaf.

Certain keyboards were also originally designed for people with disabilities.

Let me give you another example in which I was involved.

In the '90s, people started talking about the internet and the web.

I remember my first exposure to the web.

I was surprised

You can read the newspaper at any time of the day

I was able to search for any information myself

I had a strong desire to make the Internet accessible to blind people, and I found a way to turn web pages into synthetic speech, which dramatically simplified the user interface.

That led to the development of "Homepage Reader" in 1997, first in Japanese and later translated into 11 languages.

When I made the homepage reader, I received messages from many people.

One thing in particular sticks out in my mind: "For me, the Internet is my little window to the world."

This was a revolutionary moment for the blind.

Now that the internet has become accessible to the disabled, the technology we developed for the blind has many more uses than we could have imagined.

Checking emails while driving, listening to recipes while cooking

We can do more by ourselves now than we used to, but it's still not enough.

For example, when I went on stage earlier, I needed help.

My goal is to be able to come here alone.

not only here

To travel and be able to do things that are nothing to you.

Let me show you the latest technology.

This is a smartphone app that we're working on.

(Electronic voice) 15 meters to the door, go straight ahead.

(Electronic voice) To get out, go through two doors. The door is on your right.

(Electronic voice) Nick is coming, he looks happy.

(Chieko) Hello Nick!

(laughs) (Chieko) Where are you going? You look happy, don't you?

(Nick) The paper was accepted.

(Chieko) Really? Good for you!

(Nick) Thank you, but how did you know it was me? Are you happy with that?

(both laugh) (man) hi

(laughs) (Chieko) Ah... Thank you.

(Electronic voice) I'm talking to the other party, not you.

(electronic voice) It's potato chips.

(Electronic voice) Dark chocolate with almonds.

(Electronic Voice) I've gained two kilos since yesterday. Let's eat apples instead of chocolates.

(Laughter) (electronic voice) I'll be there soon.

(electronic voice) Arrived

this -

(Applause) Thank you.

This app uses radio beacon signals and smartphone sensors to give you directions and allows you to get around indoors and outdoors alone.

The part that uses computer vision to tell us who's coming and how they're coming is still in development.

The ability to recognize facial expressions is very important for visually impaired people to be social.

A convergence of technologies to enable blind people to see the world.

We call this "cognitive assistance."

It understands the world around it, whispering it into your ear or vibrating your finger.

"Cognitive Assistance" compensates for missing or weakened sensory abilities.

This technology is still in its infancy, but eventually I'll be able to find a classroom on campus, window shop, or find a nice restaurant while walking down the street.

Wouldn't it be amazing if, when you met me on the street, I would notice you before you did?

This will be the best companion for me and for all of you.

So this is a worthwhile challenge.

And this challenge requires collaboration, and that's why we're trying to create an open community that accelerates research.

Just this morning, we announced that we were going to open source the underlying technology in the video you saw.

Frontier is the real world

The blind community is pioneering and exploring the frontiers of this technology.

I want to open up a new era together with you. Next time I'm on this stage, I'm sure I'll be walking alone with the power of technology and innovation.

thank you

(applause)

By now you'll know that no matter what you do in life, you need numbers.

But in some areas in particular, you need a lot of numbers instead of a few.

How do we manage these numbers?

Going back in time, back in ancient China, mathematicians came up with a way to represent large numbers in many columns at once.

Today we call that arrangement a "matrix" or "matrices" if plural.

"There are queues everywhere—

It surrounds us on all sides, even now, even in this very room."

excuse me let's get back on topic

Yet the fact is, matrices are everywhere.

It's used in business, economics, cryptography, physics, electronics, computer graphics, and more.

One of the things that makes matrices so great is that you can cram a lot of information into them, and you can take a huge collection of different problems and reduce them to just one problem.

Now, to use matrices, you have to learn how to do math.

In fact, we can treat matrices like ordinary numbers.

You can also add, subtract and multiply

Division is impossible, but the explanation is a quagmire, so I will omit it.

Adding two matrices is really easy.

All you have to do is add the elements in the same place in each matrix in order.

So add the first components together, the second value, the third, and so on.

Of course, you can only add two matrices of the same size, but it's more or less intuitive.

We can also multiply the entire matrix by a number called a scalar.

Just multiply each component by that number.

But wait, there's more!

You can multiply one matrix by another matrix.

But unlike addition, you don't multiply component by component.

It's more unique. It's very interesting if you know the trick.

Calculate like this

Let's say I have two matrices

Let's say they're both 2x2 in size, which means they're each a 2-by-2 matrix.

So let's put the first matrix on the left and the second matrix next to it, and move it up a little bit, so it's kind of like making a table.

Put the product you get when you multiply the matrices to the right

I'll also draw grid lines to make it easier to understand.

Now look at the first row of the first matrix and the first column of the second matrix.

How do the two numbers line up?

Multiply the first number in the row by the first number in the column. 1 times 2 is 2.

3 times 3 is 9

Then add them together, 2 plus 9 is 11.

Place that number in the upper left corner to match the row and column position you used in your calculations.

you see?

You can do the same with other elements

-4 plus 0 is -4

4 plus -3 is 1

-8 plus 0 is -8

so this is the answer

It's not that difficult, is it?

there's just one problem

As with addition, matrices must be appropriately sized

Look at these two matrices

2 times 8 is 16

3 times 4 is 12

Multiply by 3, oops, the second matrix has no more rows.

I've run out

So these matrices cannot be multiplied.

The number of columns in the first matrix must match the number of rows in the second matrix

It's very easy if you're careful to match the dimensions correctly.

But understanding matrix multiplication is just the beginning.

There are many things you can do with matrices.

For example, let's say you want to encrypt a secret message.

Let's call it "Math Rules"

That said, it's not a secret per se.

Represent the letters as numbers, put the numbers in a matrix, and then put the encryption key in another matrix.

Multiplication gives us a new encrypted matrix.

EnglishAnd the only way to decrypt this new matrix and read the message is to get hold of this second matrix, which is the key.

In mathematics, matrices appear frequently—there is something called linear algebra.

If you have the chance to study linear algebra, do it.

But don't forget this: if you know how to use matrices, anything is possible.

What does a working mother look like?

If you ask the internet, you'll get an answer like this

Forget what happens when you try to work on a computer with a baby on your lap.

(Laughter) But this is not a working mother.

You can see there's something about these photos, you see them a lot.

Characteristic is dazzling, natural lighting.

There are thousands of images like this out there.

Please search for "working mother" in Google image search. An image material site is also fine.

These images are all over the internet, they're even the headlines of blogs and news stories. I became obsessed with these images and the lies and reassurances they conveyed: the lies and reassurances that it's perfectly okay to work as a new mother in America.

there is actually a problem

Nationwide, America sends millions of women back to work every year after giving birth, very, kind of frighteningly early.

This is a moral issue, but the reason I want to talk to you today is why it's also an economic issue.

I've been frustrated and obsessed with the unreality of these images. They're so far removed from my life, so I recently decided to photograph myself in a parody version that I want the world to start using, depicting the awkward reality of going back to work with your baby's food source already in your body.

I will show you two

(Laughter) To see breast milk seeping in the middle of a presentation, it's almost like you've been promoted. (Laughter)

There's no baby in this picture, because that's the reality for most working mothers.

You know, it might make you sick, but every time the toilet is flushed, the contents of the bowl become a mist that's suspended in the air for hours.

Yet for many working mothers of newborns, the toilet is the only place they can produce food for their newborn during the day.

I made dozens of these photos and sent them out into the world.

I wanted you to know the truth

At the time, I didn't realize that I was opening a door, because now I get letters from complete strangers in all walks of life, telling me about their experience of returning to work days and weeks after giving birth.

I would like to share 10 of those stories with you.

These stories are real, some of them are graphic, and none of them look like this picture.

this is the first story

"I was a serving officer in a federal prison.

After giving birth by caesarean section, I returned to work after using up the eight weeks of leave allowed.

A male colleague was unhappy that I took a 'vacation', and when I was pumping, he purposely left the door open and stood in the hallway with an inmate."

Most of the stories that women who are complete strangers send me are not really about breastfeeding.

One woman wrote to me, "I gave birth to twins and returned to work after seven weeks of unpaid leave.

Mentally I was devastated

Physically, I suffered heavy bleeding and horrific lacerations during labor that left me unable to stand, sit or walk.

My employer told me not to use my paid leave because it was time to submit the budget proposal.”

I've come to believe that people can't face these situations because they're shocked, and because they're shocked they have to do something.

So we look at this image and decide to believe it.

I'm not sure what this picture is about.It's very strange and a little creepy.

(Laughter) What is this woman doing?

but i get the message

I'm telling you there's nothing wrong

Working mothers and their babies are all fine

that there's nothing to keep an eye on

And it's not even our problem because it's the woman who made the choice.

I'd like to divide this "choice" issue into two parts.

The first "choice" is that the woman chose to work.

this is not true

Women now make up 47 percent of the total workforce in the United States, and 40 percent of American households are either solely or primarily female-financed.

Women's paid work is at the heart of the American economy, and it's essential to support their families.

At the national level, paid work is not an individual choice.

The other "choice" is that she chose to have children, so the consequences of this choice should only be on her.

It's one of those things that seems right if you just listen to it.

"I didn't give birth to the baby."

"I wasn't there when I got pregnant."

But this attitude ignores a fundamental fact: at the national level, women's fertility is not an individual choice.

Many women are working, and the children they give birth to will one day enter the labor force, protect the security of the nation, and form the tax base.

At a national level, it's not a personal choice for women to have children.

these are not choices

Women need to work, and working women must be able to give birth.

We should at least be able to do these two things at the same time.

Now it's time for a quiz. What percentage of working women in America do you think don't get paid maternity leave?

88%

88% of working mothers don't get even one minute of paid maternity leave after giving birth.

So you might think about unpaid leave

FMLA exists but does not work

Because of the way the law works and the various exceptions, half of all new mothers can't afford it.

Let's see the example

"We adopted a son

The day I got the call, the day my son was born, I had to take time off from work.

I didn't have enough years of service to do FMLA, so I couldn't take unpaid leave.

I lost my job when I took time off from work to pick up my newborn baby."

There's another reality hidden in the imagery of these companies.

Of the women who can only take unpaid leave, most of them cannot afford to take unpaid leave.

A nurse told me, "My pregnancy was considered a pre-existing condition and I wasn't eligible for short-term income protection.

During my six weeks of unpaid leave, I used up half of my tax refunds and savings.

I couldn't live any longer

It was hard physically, but it was even harder mentally.

I had a hard time not being able to be with my son for months."

So the choice to return to work early is a rational financial choice that takes into account your family budget.

As one waitress told me, "When I had my first child, I went back to work five weeks after giving birth.

With my second child, I had major postpartum surgery, so it took me six weeks to get back to work.

I had a third degree laceration."

23% of working mothers of newborns in the United States return to work two weeks after giving birth.

"I was a bartender and chef and worked an average of 75 hours a week during my pregnancy.

I had to go back to work before my baby was a month old, and I worked 60 hours a week.

My colleague only had 10 days off when she gave birth."

Of course, these cases are not just a matter of financial and physical burden.

Childbirth is and will continue to be a big psychological event.

As one teacher told me, "Eight weeks after giving birth to my son, I returned to work.

I've had anxiety issues before, but the panic attacks I had before going back to work were excruciating."

Statistically speaking, the shorter a woman's postnatal leave is, the more likely she is to suffer postnatal depression symptoms, including depression and anxiety disorders. Of all the possible consequences of postpartum mental illness, suicide is the second leading cause of death among women in the first year after giving birth.

Let's move on to the next story. I've never met this woman, but it's a painful story to read.

"I am deeply saddened and angry that I was not able to spend an important and irreplaceable developmental period with my son.

Labor and delivery made me feel broken

Memories of months of crying, what we call colic.

in my heart i was drowning

Every morning I asked myself how much more I could hold out

I was allowed to go to work with my child

I closed the door to my office, so that it wouldn't become a problem, soothed my son to be quiet, and begged him to stop crying.

Every day, I hid in my office door and cried while my son cried.

I cried in the toilet while washing the milking machine

Every day, I cried on my way to work and on my way home

I promised my boss that I would do the work I couldn't finish during the day at home at night.

I thought it was my fault that I couldn't do it well."

These are mother's stories

what about the baby?

As a nation, do we care about the millions of babies born to working mothers?

I don't think so. I'm not thinking about it until I'm old enough to work, pay taxes, and be in the military.

In other words, tell him to come back in 18 years, and let him live for 18 years.

One of the reasons I say this is that babies of mothers who stay with their babies for 12 weeks or longer are more likely to be vaccinated and screened during their first year of life, and are better protected from life-threatening and disabling diseases.

These facts are hidden behind these images.

America is sending a message to working mothers and their babies.

"You're a nuisance to the American economy and to employers," he said.

This "thankfulness" trend underlies many of the stories I receive.

One woman told me, "I went back to work eight weeks after my C-section because my husband was unemployed.

Without me, my daughter wouldn't have thrived.

don't drink milk

I started to lose weight

Thankfully my boss is understanding

Allow my mother to bring my daughter, hooked up to oxygen and a monitor, four times a shift so I can take care of her."

There's a small group of countries in the world that don't give paid maternity leave to mothers of newborns as a nation.

Do you care about the members?

The first eight countries have a combined population of just eight million people.

Papua New Guinea and Suriname, then the small island nations of Micronesia, the Marshall Islands, Nauru, Niue, Palau and Tonga.

The ninth is the United States, with a population of 320 million.

There is nothing else...

That's it for the list

In other economies around the globe, we have nationally offered some degree of paid maternity leave for the babies who are the future of our nations.

Kudos to companies that say the market will one day solve the problem and give more paid time off to women who are already very well educated and earn well.

Remember the number 88%?

Those middle- and low-income women can't even participate in this.

We know the economic, financial, physical and psychological costs of this practice are staggering.

Not by chance, we "chosen" to put this burden on working mothers and their babies.

The burden is even greater for low-income women, which is disproportionately burdened on women of color.

I'm still doing it this way

This is something America should be ashamed of

But it's also a risk for America.

Because what happens when individuals who make the so-called "choice" to have a baby start making the choice not to have children?

As one woman said, "Motherhood is hard, but it shouldn't be tortured.

In my family, when it comes to expanding our family, we think about how much time we have to take care of ourselves and our babies.

If I have to do exactly the same as I did with my first child, I think I'd rather be an only child."

The fertility rate needed to keep America alive is 2.1 births per woman.

The current birth rate in America is 1.86.

We need women to give birth, and we go out of our way to discourage working women.

Workforce and innovation What about GDP? What if the working women in this country decide they can't stand doing the same thing over and over again?

There is one idea that I would like to share with you today that is worth spreading.

It's time for the most powerful nation on the planet to give paid vacation at the national level to the people who work for the future of this country and the babies who will carry that future.

procreation is in the public interest

This paid maternity leave should be subsidized by the state.

It should be done without exception, regardless of business size, tenure, or entrepreneurship.

You should be able to share the holidays between your partners.

I talked a lot about mothers today, but co-parenting is very important on many levels.

No more women going back to work with a limp and bleeding.

For a few days of rest, recuperation and bonding, don't let your family run out of bank accounts anymore.

No more vulnerable newborns sent straight from the incubator to daycare because their parents have used up their little "vacation" in the neonatal intensive care unit.

We can no longer have dual-income parents who are told it's their own problem to juggle work and parenting, both of which are necessary.

The problem is that families with newborns are overwhelmed by this, and families with newborns are often more financially challenged than ever before, so mothers of newborns can't afford to speak up for themselves.

But we can all speak up

I already had children You may have decided not to have children before you had children or after you already had children

it doesn't matter

We should stop talking about this issue as a mother's issue or as a woman's issue.

This is America's problem

We should stop believing the lies these images tell us.

Don't feel comfortable with those lies

You should wonder why people say it can't be done when it works so well in the rest of the world.

We should recognize that this reality in America is dishonorable and dangerous.

Because neither this nor this nor this is what a working mother looks like.

(applause)

When we think of "learning," we imagine students in a classroom or in a large lecture hall, with their textbooks spread out on their desks, listening intently to the teacher or professor in front of them.

But in psychology, learning means something else.

For psychologists, learning is a long-term change in behavior based on experience.

The two main types of learning are classical conditioning and operant or instrumental conditioning.

Let's talk about classical conditioning first.

In the 1890s, Russian physiologist Ivan Pavlov did a very famous experiment with dogs.

He showed the dog food and rang the bell at the same time.

After a while, the dog began to associate the bell with the food.

They learned that when the bell rings, they get food.

Eventually, just ringing the bell made the dog salivate.

The sound of the bell made me expect food.

Of course, under normal circumstances, the sight and smell of food will cause dogs to salivate.

We call this food the "unconditioned stimulus" and salivation the "unconditioned response."

If you salivate at the sight of steak, you don't need training.

But when you present an unconditioned stimulus, such as food, together with something originally neutral, such as the sound of a bell, that "neutral stimulus" becomes a "conditioned stimulus."

Thus classical conditioning was discovered.

So far we've seen how it works in animals, but what about in humans?

it's exactly the same

Let's say you go to the doctor one day to get an injection.

She says, "It's okay, it doesn't hurt at all." Then she gives me the most painful injection ever.

I'm going to the dentist in a few weeks.

He starts putting the mirror in his mouth to check, and he says, "It's okay, it doesn't hurt at all."

Even though he knows the mirror doesn't hurt, he jumps out of his chair and screams out of the room.

When you go in for an injection, the words "It doesn't hurt at all" are shown together with the pain of the injection, which is the unconditioned stimulus, which becomes a conditioned stimulus, and that statement is followed by the "conditioned response" of rushing away.

classical conditioning worked

Operant conditioning explains how outcomes lead to changes in spontaneous behavior.

So how does operant conditioning work?

Operant conditioning has two major components: reinforcement and weakening.

A reinforcer makes a behavior more likely to occur again, and a depressor makes it less likely.

Strengthening and weakening can be positive or negative, but that doesn't mean they're good or bad.

Positive means extra stimulus, like if you're done with your vegetables and you get a dessert, etc. Negative means remove stimulus, like you did well on a test and didn't have to do your homework all night.

Let's look at an example of operant conditioning

After having dinner with my family, I clear the table and wash the dishes.

And when it's done, my mother gives me a big hug and says, "Thank you for helping me."

In this situation, if she repeats the operant response of clearing the table and washing the dishes, the mother's response is positive reinforcement.

Operant conditioning is ubiquitous in everyday life.

There aren't many behaviors that are completely unaffected by operant conditioning.

Operant conditioning can also be found in special situations.

A group of scientists taught pigeons art appreciation, demonstrating the power of operant conditioning.

Using food as a positive reinforcer, scientists taught pigeons to distinguish between a Monet painting and a Picasso painting.

Scientists found a stimulus generalization in this when they saw pigeons choose Impressionists over Cubists when presented with the work of other artists.

Maybe next time we'll condition pigeons to paint their own masterpieces.

Scientists now know how traits are inherited from parents to offspring.

They can calculate their chances of having certain traits or genetic diseases based on information about their parents and family history.

But how is that possible?

To understand how traits are passed from individual to offspring, we have to go back to the 19th century, and this is Gregor Mendel.

Mendel was an Austrian monk and a biologist who loved to work with plants.

He discovered the laws of heredity by crossing peas in his monastery garden.

The most basic example is that when Mendel crossed pure-bred yellow peas with pure-bred green peas, he only got yellow beans.

He called the yellow trait "dominant," because that's how all beans were described.

And then I let these yellow peas self-pollinate.

This second generation produced both yellow and green beans, meaning that the green trait was masked by the dominant yellow color.

He called this hidden trait "recessive."

From these results, Mendel inferred that each trait was determined by a pair of factors, one from the mother and the other from the father.

These factors are now called "alleles" and are known to represent genetic diversity.

Because of this allele pattern Mendel discovered in an individual bean, when both alleles match, we call it a "homozygous" bean, and when both alleles are different, we call it a "heterozygous" bean.

This combination of alleles is known as a genotype, and the yellow or green that results from that genotype is called a phenotype.

To clearly visualize the distribution of alleles to offspring, we use a diagram called a "Punnett square."

By placing a different allele on each axis, we can derive all possible combinations.

Take Mendel's peas for example.

Write the dominant yellow allele as a capital Y and the recessive green allele as a lower case y.

Uppercase Y is always stronger than lowercase y, so it's only when you get lowercase yy that you get a green child.

In Mendel's first generation, homozygous yellow mothers pass the dominant yellow allele to all their offspring, and homozygous green fathers pass the recessive green allele.

Then all offspring will be yellow heterozygotes.

And in the second generation, when the heterozygous offspring marry each other, there is a chance that they will have offspring with three genotypes, a three-to-one ratio of the two phenotypes.

But peas also have many traits.

For example, in addition to yellow / green, there are also circles / wrinkles

So all in all, we have this combination Yellow round beans Green round beans Yellow wrinkled beans Green wrinkled beans

You can also use Pannet Square to calculate the proportions of each genotype and phenotype.

Of course, the combination in this case is a little more complicated.

A lot of things are more complicated than peas, like humans.

Scientists these days know much more about genetics.

There are many ways to determine if a trait is inherited.

But it all started with Mendel and the pea.

Very nice weather!

Great!

What an athlete!

You think it's a compliment, right?

well what do you think

Depending on the attitude and tone of voice behind these words, they may be compliments.

But it can also be sharp and aggressive words as well.

The slightest difference in attitude behind words reveals what is called verbal irony.

If someone says, "It's a beautiful day," they might really mean it, provided the sun is shining, the birds are singing, and the wind is calm.

If the weather is really bad, it's cloudy and the wind is raging like a storm, and someone says, "It's a beautiful day," he probably doesn't think so.

I really wanted to say it's bad weather, but I said the opposite.

This is the irony of language, when the speaker says the opposite of what is true.

You must be thinking-

Isn't that an innuendo?

that's right

Verbal irony is when the speaker says the opposite of what is true.

When the speaker goes one step further and says the opposite and makes fun of you with a little bit of bitterness and spite, you can say it's an innuendo.

Let's look at the second example "That's great!"

When someone achieves a lifelong dream, "Wow!"

When someone wins a sports competition, you say, "Wow!"

There's no such thing as "great" when someone hits you from behind with a car, right?

So when the rider says, "That's great!"

I'm just kidding, saying the opposite of what it really is.

This is both verbal irony and innuendo.

If I said to an Olympian, "You're a talented athlete," you'd mean it, and I don't see any irony in the language.

When a clumsy child walks into English class and stumbles and throws books and pencils all over the room, it becomes a bit of a bit of a sarcasm because he doesn't really think so.

This is the irony of words

It's about saying the opposite of what you actually think.

In addition, it is not only sarcastic, but also hateful, because there is a desire to make fun of the poor person.

but be careful

All innuendo is part of verbal irony, but not all verbal irony is innuendo.

The irony of language is that what you think is the opposite of what you say, while innuendo has a twist of attitude.

Even if there is another meaning, sometimes it doesn't sound like an innuendo

Now look for real examples of verbal irony and innuendo.

go for it!

no really good luck

No no, I really want you to do your best on this difficult task.

yeah ok good luck

You can do it!

Because there's no verbal irony here

Deep in the jungles of Vietnam, soldiers on both sides battled heat exhaustion and enemies for nearly 20 years.

The key to the communist camp's victory wasn't weapons or endurance, but the dirt road.

The Ho Chi Minh Route, a traverse that meanders through Vietnam, Laos and Cambodia, was born out of a simple network of unpaved roads. It developed during the Vietnam War and became a cornerstone of the winning North Vietnamese strategy, used to supply arms and reinforce troops, providing moral support to their compatriots in the south.

This road network was a combination of trails, dirt roads and river crossings that crossed the border from North Vietnam to the west and south along the Truong Son Mountains along the border between Vietnam and Laos.

It originally took six months to get to South Vietnam.

Through civil engineering and ingenuity, the Vietnamese expanded and improved the route.

By the end of the war, major roads had been bypassed through Laos, and South Vietnam could be reached in a week.

Let me explain how it happened

As relations between North and South Vietnam deteriorated in 1959, a transport network was constructed to smuggle soldiers, weapons and supplies into South Vietnam.

The first armies marched in single file on roads used by rural ethnic groups, often marked only by cut branches at dusty crossroads.

Initially, most of the communist cadres going down the route were South Vietnamese-born, trained in North Vietnam.

Like unarmed peasants, they wear silk "black pajamas" and plaid scarves.

They wore Ho Chi Minh sandals made from cut truck tires, stuffed rice into elephant intestines, carried it with them as food, and wrapped hemp tubes around their bodies.

It was a hostile environment, and many died from heat stroke and malaria-amoebic dysentery.

They faced constant threats of getting lost, starving to death, and the possibility of being attacked by wild tigers and bears.

The diet was always just rice and salt, and quickly ran out.

Fear, boredom, and homesickness dominated my emotions.

Soldiers spent their spare time writing letters, sketching, and drinking and smoking with the local villagers.

The army that went south first was less involved in the fighting.

Arriving in South Vietnam, after an exhausting six-month journey, was notable and was often celebrated with an abrupt song.

By 1965 it was possible to go south by truck.

Thousands of trucks supplied by China and the Soviet Union made their way through the terrifying B52 bombardment, and the truck drivers became known as ground pilots.

As traffic increased southward, so did American bombing.

To avoid air attacks, they began moving at night and early in the morning, setting up lookouts to warn of incoming enemy aircraft.

Villages along the route organized teams to secure passage and help drivers repair damage caused by enemy aircraft attacks.

Their slogan is "All for the Southern Brothers!"

"Don't care about the house until you let the trucks through."

Some families even donated doors and wooden beds to repair roads.

The Vietnamese military directed American bombers to bomb hillsides to make gravel for building and maintaining roads.

Red clay spreads to every corner

The Ho Chi Minh route's impact on the Vietnam War was enormous and was key to the success of the North Vietnamese camp.

North Vietnam's victory was decided not by battle, but by the Ho Chi Minh Route, which was the cornerstone of politics, strategy, and economy.

Americans recognize the feat, calling this route "one of the greatest feats of military engineering of the 20th century."

That route is a testament to the strength of the Vietnamese people's will, and whoever took it, male or female, became a national hero.

Why do optical illusions occur?

What I'm going to share with you today is part of my research, which is a new theory of how optical illusions work that I've proven that's different from what's in the mainstream books.

So let's look at an example of an optical illusion here.

This is just one example of the variety of optical illusions that this theory can explain.

Let's take a closer look at this example

As is often the case, the two lines should be parallel, but the middle line appears to spread outward.

At the center where the radial lines gather, it looks wider than the top and bottom It looks wider than the top and bottom

What's surprising is how simple this visual stimulus is.

Even though it's just a collection of straight lines

Why can't we interpret this simple image using perhaps the most complex organ in the world?

To clarify these questions, we need to ask, "What does this mean for the brain?"

This image is more than just a random line drawn on a piece of paper to the brain.

The human brain has evolved to process the stimuli in the world around us The human brain has evolved to process the stimuli in the world around us

So when does the brain get this kind of stimulation?

Surprisingly, we're actually bombarded with this stimulus all day long.

when you move, especially when you move forward

As we move forward, we perceive a visual flow, something that flows out of our field of vision, like the Starship Enterprise going into a warp.

All objects flow outward, leaving trajectories and blurry lines on the human retina.

it activates a series of microscopic nerve cells

So this is what happens in real life, and this is another way of looking at what happens all the time in the real world.

In fact, even cartoonists understand this.

When they use "flow lines" in cartoons, the brain perceives them as "movement."

In reality, you don't see this line of flow.

This blurring occurs in the stimuli that you feel behind your eyeballs, and this is transmitted to your brain as movement.

When you move forward, your eyes focus like a camera, like a snapshot camera.

Even when you focus, you get this weird visual blur, which tells you where you're moving.

Well, half the story is over here.

This is the role of this stimulus

So when your brain sees the first image, it thinks you're actually heading toward the center.

But that doesn't explain the two straight lines that seem to spread out.

To understand the rest of the story, we have to understand the "dullness" of our brains.

The moment the light reaches your eyes, beep! It would be nice to be able to immediately understand what you are looking at.

not going so well

It takes about 1/10th of a second for the brain to develop a perception.

A tenth of a second doesn't sound like a long time, but it's a long time in normal motion.

If you're moving at a meter per second, that's pretty slow, but in a tenth of a second, you're moving 10 centimeters.

If you don't cover this delay, even if you sense something within 10 centimeters, by the time you can recognize it, it will be after you hit it or passed it.

Of course things can get serious, for example at times like this at times like this

It's too late to recognize

I want cognition to be like this

It would be nice if an event that happened at a certain time "t" could be recognized at that time "t".

The only way the brain can receive it that way is to perceive the world as you see it when light hits your retina, instead of perceiving the world as you see it when light hits your retina, instead of perceiving the world as you see it when light hits your retina.

Even if we wait, we don't know what's going to happen the next moment, so we need to make the best predictions.

predict what will happen in tenths of a second

By the time you have that prediction in your head, by the time you have that prediction in your head, you're building that cognition, and by the time you have that prediction in your head, you're in the future, and you can use it as your present cognition.

The results of my research, and research in other fields, show that the brain has many mechanisms to compensate for its desensitization.

You can use this theory to explain all kinds of illusions, and this is just one example.

Finally, I'm going to show you how this theory can actually explain this example.

So what you have to think about is how the two parallel lines you see at the beginning will change in the next moment, if they're moving toward the center, as the background lines suggest, if they're moving toward the center, as the background lines suggest.

what will happen?

Now imagine, imagine there's a door.

here is the door

Let's make it a cathedral door for clarity Let's make it a cathedral door for clarity You'll see later

Both sides are perfectly parallel when far from the door

But what happens when you get closer

Both edges move outside the field of vision Both edges move outside the field of vision Flowing out more and more

When you're in front of the door, imagine the sides of the door here and there. If you look up at the door and put your hands like this, the sides of the door look like railroad tracks going up into the sky.

It started out as two parallel lines that bulge out at eye level and not so much at the top.

As you get closer, it looks like this picture.

It's about projective geometry, and the projection of an object can change the next moment like this.

Given this kind of stimulus, the brain has no problem accepting two parallel lines, and since there's no hint that the next moment will change, it simply processes the information.

But when you have a hint of change, among other things, you get this kind of illusion, a very strong hint of blur, and what you see in your mind is an image of what you'll see the next moment.

All cognition tries to grasp the present, but in order to perceive the present, one must actually perceive the future.

So these optical illusions are misidentifications of the future, because they're just static images on paper that don't change like the real thing.

Now let me show you one last illusion.

I can show you two if possible.

this picture is funny

Focus on the middle and shake your head against the wall like this forward.

Please try it

let's move fast

Because we added blur to the vision, the brain thinks, "Maybe it's already moving, so it's blurry."

If you shake your head, it should come towards you faster than it actually is.

I can't move that fast

Finally, I would like to end with this example.

This is information about moving objects, the sensations you get on your retina when an object is in motion.

you don't have to do anything here just watch

Raise your hand if this one isn't moving and it looks like it's moving

It's funny, isn't it?

But there's a hint, so if you think about it in your brain, from the stimulus reflected in your eyes, from the stimulus reflected in your eyes, "Ah, these things are moving."

It's like, "Make the image that's coming next." And the next moment, you think you're moving, you're moving. Thank you.

What was the toughest job you've ever had?

Work outside during the day?

Work to provide for the livelihood of a family or community?

Have you ever worked day and night to protect your life and assets?

Is it the work you do alone, or the work that has no promise of success, but that might improve people's health or save their lives?

Building something, building something, creating a work of art?

Is it a job that you are not sure if you can get enough understanding and evaluation from others?

People who do this kind of work deserve attention, love and full support in the community.

Humans aren't the only ones doing this kind of heavy lifting for their communities.

Plants, animals, even terrestrial ecosystems play a role, as do the coral reef ecosystems in the tropics that I study.

Coral reefs can be said to be farmers

Because it provides food and income -- food security -- for hundreds of millions of people around the world.

Coral reefs are security watchdogs

Its structure protects the coast from storm surges and surf, and its ecosystem purifies water and makes it a safe place for us to work and play.

coral reefs are chemists

The molecules we discover in coral reefs are becoming increasingly important in our search for new antibiotics and cancer drugs.

coral reefs are artists

The structures that coral creates are some of the most beautiful on earth.

Its beauty forms the basis of tourism in many countries that don't have many other natural resources.

For these reasons -- and their contribution to ecosystems -- economists estimate that coral reefs generate billions of dollars in value worldwide every year.

In spite of all the benefits and wealth that we're creating, all we're doing is leading to the destruction of coral reefs.

We've caught fish in the ocean, and we've dumped manure, sewage, pathogens, oil, pollution, and soil.

Boats, fins and bulldozers have caused physical damage to coral reefs, and they've changed the chemistry of the entire ocean, raising water temperatures and making storms worse.

Each of these can have a negative impact, but these threats reinforce each other, and they're intricately linked to make matters worse.

give an example

Curacao, where I live and work, was hit by a typhoon a few years ago.

At the eastern end of the island, coral reefs were intact and thriving, with little evidence of the typhoon's passing.

But near towns where corals died from overfishing and pollution, dead corals were strewn about by typhoons, and they became deadly weapons, killing even the surviving corals.

This is the coral that I was working on during my PhD, and I knew it very well.

When the storm stripped away half of the coral's tissue, it became contaminated with algae, and the algae overgrowth (inside the symbiotic coral's body), causing the coral to die.

This escalation of threats and confluence of factors is what Jeremy Jackson called "falling into sludge."

This is not a metaphor, in fact, many coral reefs are now literally bacteria, algae and sludge.

Now that you've read this far, you might think that I'm going to ask, "Let's save the coral reefs."

But to be honest, those words just drive me crazy.

Whether it's on Twitter, in a news headline, or in a nice environmental pamphlet, those words haunt me, because we environmentalists have been warning about coral death for decades.

And yet, most people I meet, no matter how educated they are, don't know what coral is and how it grows.

If protecting coral reefs around the world is an abstraction that few can comprehend, who cares?

If you don't know what corals are, how they grow, and how lovely and interesting and beautiful they are, how can you expect them to protect them?

Let's change from here

What are corals and how do they grow?

The birth of corals varies, but most commonly, individuals of a particular species lay eggs en masse on one night of the year. The eggs, produced over the course of a year, clump together with the sperm cells into the water and are released all at once.

This mass breaks apart when it reaches the surface of the ocean.

At the surface, if you're lucky -- if you're really lucky -- you'll meet eggs and sperm from other corals.

That's why reefs need so many corals, because so many eggs can be fertilized on the surface of the water.

Once fertilized, the cell divides, doubling and doubling, just like eggs in other animals.

Taking pictures like this every year with my microscope camera is my favorite and most magical moment of the year.

At the end of cell division, it becomes a larva that can swim. It's made of fat and looks like a tiny ball about the size of a poppy seed, yet it has sensory organs just like us.

It can detect color, light, surface texture, chemical composition and pH

You can also feel pressure waves, which means you can hear sounds.

They use these abilities to find coral surfaces where they can settle down and make lifelong homes.

Imagine finding a place to live the rest of your life when you're only two days old.

Once it's found the perfect spot and implanted, it begins the difficult task of building a skeleton under its body, growing mouths and tentacles, and forming a coral reef.

A single coral polyp repeats doubling many times to create a skeleton made of limestone underneath and grows in the direction of the sun's rays.

Over the course of hundreds of years, many species come together to form large limestone structures, often visible from space, with these hardworking creatures on their surface.

There are only a few hundred, if not a thousand, coral species on this planet.

But that ecosystem is home to millions of species, and it's this diversity that keeps the ecosystem stable, and where new drugs might be found.

There may be clues to finding new food.

I had the opportunity to study in Curacao, where I still see corals like this.

But this is what's left in the Caribbean and most of the rest of the world.

Scientists are looking more closely at the loss of coral reefs than ever before, and they are reporting with greater confidence the reasons for coral decline.

But my research isn't about looking back,

I'm going to Curacao with my friends to study the fate of coral reefs.

We are slightly optimistic about the outlook.

Because in some of these reefs, where you would think they would have been abandoned long ago, you can still see the survival of larval corals.

We began to wonder if juvenile corals were able to adapt to situations where adult corals couldn't adapt.

Corals may be just a little bit more adaptable on this inhabited planet.

So here in Curacao, my friends and I are trying to find out what the larval corals need, what they want, and what we can do along the way during the most critical time for their survival.

Let me give you three examples of what we did to answer these questions.

A few years ago, we used a 3D printer to study coral preferences, a simple experiment that involved different "colors" and "surface textures" to see where corals prefer to live.

It's a non-biological experiment, but what we've found is that they prefer white and pink -- healthy coral colors.

They also prefer crevices, ditches, and holes, because they're safe places where they can't be trampled or caught by predators.

So from what I've learned, I can tell you that what you need in a conservation project is to restore elements like pinks and whites, crevices and hard surfaces.

With that knowledge, you could also consider putting something under water on a breakwater or on a wharf.

You can choose materials, colors and structures to change the environment to what corals prefer.

Beyond surface properties, we study the chemical and microbial influences that attract corals to reefs.

Six years ago, I took it from a surface inhabited by coral and propagated it with bacteria.

By trying them one by one, we tried to find the bacteria that encouraged them to colonize the coral.

We now store many strains of bacteria in our refrigerators that help ensure coral colonization and colonization.

At this very moment, my colleagues in Curacao are trying to see if these bacteria help the corals in the lab grow more, and if they get a higher survival rate when they're put back in the seawater.

Not only are we testing these tools, but we're also trying to unlock the mysteries of species that are still understudied.

This is one of my all time favorites, a spiny coral called Dendrogyra cylindrus.

I like it because it's weird looking, it's funny fat tentacles, and it's a rare species.

Finding this is a reward

In fact, it's so rare that it was declared endangered last year as an endangered species.

One of the reasons is that scientists haven't seen larval coral reefs in the last 30 years of research.

I didn't know if this coral could regenerate or if it was in the process of regenerating.

Four years ago, we started doing nighttime surveys to try to determine when ovulation occurred in Curacao.

We got some good advice from a colleague in Florida who witnessed one ovulation in 2007 and one in 2008, which allowed us to decipher and observe the timing of ovulation in Curacao.

The one on the left is the female, who has eggs in her body and is about to ovulate into the ocean.

On the right is the male, where he releases his sperm.

We took it, brought it back to the lab, and fertilized it, and baby spiny corals are swimming in the lab.

Thanks to the work of senior scientists and our 10-year effort in Curacao to grow other coral species, these juvenile corals continue to grow, settle, colonize, and undergo metamorphosis.

This is the first baby coral reef I've ever seen.

(Applause) I can assure you that baby pandas can be cute, but this one is even cuter.

(Laughter) We're beginning to understand the secrets of the coral regeneration process and how we can help.

This is true globally, and scientists are trying to find new ways to manipulate and implant embryos, including ways to keep them at low temperatures, so we can preserve genetic diversity and do more research.

Still, it's not all about using advanced technology.

We have limited research space and limited manpower, so we don't have a lot of time for coffee.

Let's compare it to other crises and concerns in society.

We have advanced medical technology, defense technology, science and technology, and even advanced technology in the arts.

But protection technology is lagging behind.

Think of the hardest job you've ever had

A lot of people would say it's about becoming a parent.

My mother told me that being a parent can make your life far more wonderful and far more difficult than you can imagine.

I've been trying to help corals become parents for the last 10 years.

My heart has been filled with wonder to the core as I have seen the mysteries of nature.

But I've also seen the difficulty of parenting corals.

Two weeks ago, a coral reef spawned, and I collected them and brought them back to the lab.

You can see one embryo undergoing cell division, while 14 eggs did not hatch, they will eventually burst.

It becomes infected with bacteria and bursts, threatening even the young corals that might survive.

We don't know what flaws caused this. Was the low survival rate just a problem for the corals on this reef?

Whatever the cause, we have a lot of work to do to get the larval corals to grow and colonize and save the reef.

Let's forget for a moment that corals are worth tens of trillions of yen.

Coral reefs are made up of hardworking animals, plants, microorganisms and fungi.

They provide us with aesthetic beauty, food and medicine.

It's as if we humans have uprooted an entire generation of coral.

Despite human destruction, some have survived. Now it's our turn to thank corals for what they have done for us.

thank you very much

(applause)

Anyone who studied geometry, past or present, knows that the father of geometry is Euclid, a Greek mathematician who lived in Alexandria, Egypt, around 300 BC.

Euclid is known as the author of his extraordinary and influential "Elements."

Although there are a number of thick mathematics books

"Elements" is 13 volumes, dealing exclusively with geometry.

In "Elements," he systematically organized the research contents of the previous mathematicians and supplemented the missing contents.The predecessors were Pythagoras, Eudoxus, and Hippocrates.

Euclid constructed a logical system of proofs from a series of definitions, common concepts and five well-known postulates.

Four of the postulates are simple and intuitive, like two points determine a line.

But our story unfolds from the fifth postulate.

The fifth magical postulate is known as the parallel postulate.

Unlike the other four postulates, the fifth postulate is a very convoluted description.

Euclid wrote, "When two lines intersect with a line, if the sum of the interior angles on the same side of the line is less than two right angles, then the two lines have a point of intersection somewhere on the side of the interior angle and are therefore not parallel."

Oh that's long!

There is a much simpler and more well-known one: "Given a line in a plane and a point not on this line, there can be only one line parallel to this line and passing through this point."

Over the centuries, many mathematicians have tried to prove the parallel postulate from the other four postulates, but have failed.

In the course of the proof, they began to consider what would logically happen if the parallels postulate were not true.

Some of the greatest figures in the history of mathematics have tackled this problem: Ibn Haitham, Omar Khayyam, Nasiruddin Tusi, Giovanni Saccheri, Janos Boyai, Karl Gauss, Nikolai Lobachevsky.

They denied the parallel postulate and tried to develop a theory that simply led to a different geometry.

Collectively, these geometries are called non-Euclidean geometries.

I will leave the details of that to another material.

The main difference is the curvature of the surface that draws the straight line.

In the end, it turned out that Euclid didn't explain everything in "The Elements", but only described one way of looking at the universe.

everything depends on the context of what you're looking at

While a plane behaves in a certain way, a curved surface, whether its curvature is positive or negative, behaves quite differently.

This other kind of geometry seemed strange at first, but it soon turned out to be a good way to describe our world.

To navigate around the Earth, you need elliptical geometry, and M.C. Escher's beautiful drawing shows hyperbolic geometry.

Albert Einstein also used non-Euclidean geometry to describe how spacetime warps in the presence of matter in his general theory of relativity.

The big mystery is whether Euclid had any inkling of the existence of such a different geometry when he wrote his Elements.

No one knows, but it's hard to believe that he was completely ignorant of the nature of geometry, because he had a great intellect and a thorough understanding of the field he had established.

Perhaps he knew that the way he described his postulates left room for later intellectual exploration.

then he will be happy

These discoveries could not have been made without the gifted, forward-thinking scholars who challenged their preconceived notions and thought beyond what they were taught.

Unless we sometimes put aside our preconceived notions, let go of our own experiences, and look at the bigger picture, we run the risk of not realizing that there are other points of view.

how beautiful the universe is

There's just about everything, from big to small

It can be a little dangerous, but the basic idea of ​​scholars is that the universe is a good thing.

So we can devote all fields of research to space.

this is cosmology

Observing the universe, unraveling its story, what is happening now, what is to come, and how the universe came into being.

Edwin Hubble was the first to spot galaxies moving apart, and he realized the universe was expanding.

And I wonder if it all started with a big explosion And it all started with a big explosion So hot, so tiny

At first, people didn't believe the idea, and they teased it as "the big bang," but then the evidence piled up and the idea and the name stuck.

After the big bang, the universe cooled and the galaxies and stars we see today were born.

There are many theories about the origin of the universe.

And there's an entirely different way to figure it out: create a hot, dense state in the lab.

This is a particle physicist's experiment

For the 20th century, particle physicists have studied matter and force in hot, energetic environments.

First with cosmic rays, then with a device called a particle accelerator that bombards substances smaller than atoms with great energy.

The higher the particle accelerator energy, the more you can go back in time.

Today, things are made of atoms, but in the minutes after the Big Bang, the universe was so hot that there were no atoms, and electrons couldn't get into the nucleus.

Instead, the universe is a swirling sea of ​​matter smaller than an atom.

Seconds after the big bang, it was still very hot, and because of that heat, there wasn't enough power to keep protons and neutrons in the nucleus.

Let's take a look microseconds after the Big Bang. Protons and neutrons are just beginning to be made from quarks, which in particle physics are the basic building blocks of matter.

But at that time, the energy was so strong that the quarks were still in pieces.

Physicists want to see a time when all forces were one by using greater energy, so we can more easily understand how the universe came into being.

And to do that, not just the larger colliders, but the pooling of our knowledge, from the very big to the very, very small, including yours, of course, to bring together each other's brilliant ideas.

You should!

Then in the end we should be able to reach the universe where everyone was one

Of all the things on earth, the human eye is the most sophisticated.

It's like a 500 megapixel camera in bright light - in the dark - even underwater.

It tells your brain a lot about the world.

Look through the eyes to find a partner -- to understand the people around you -- to read -- to watch TV shows -- a big wrecking ball that throws people into cold water.

Yeah, people's eyes are so amazing I'm lucky to have two of them

But even if you look really hard, you can't see perfectly.

For example, if you look at a horse running, your eyes can't follow fast-moving hooves, so you can't tell if all four legs are off the ground at the same time.

The camera will answer these questions.

About 150 years ago, photographer Eadweard Muybridge used his camera to solve the riddle of the galloping horse.

He used the skill of photography to prove that the horse was flying in the air at one particular moment while the horse was running.

"Look! It's flying!"

Since then, the art of photography has been used in all areas of mathematics and science.

Cameras help us better understand the world we thought we already knew, but there's still more to the world that we don't see.

Not just when you're moving too fast and your eyes can't keep up

Cameras let us see things that are too small to see with the naked eye.

Botanists use a series of photographs to tell us about the life cycle of a plant, and how the flowers turn and grow towards the light in response to the movement of the sun, a property called heliotropism.

Mathematicians also use pictures, which part of the bending of the whip exceeds the speed of sound to produce the snapping sound.

Meteorologists and environmental scientists tell us about the growth of large hurricanes and the retreat of glaciers over the years.

Slow-motion video, or high-speed photography, can show us how a hummingbird flaps its wings and a bullet pierces its target.

In one project, a corpse was frozen and sliced ​​into thousands of pieces.

Those "slices" were photographed and animated, so that you could move them up and down the skeleton so you could see the flesh, the bones, the veins.

Every cell phone and every computer has a camera, so in today's classroom, even the youngest scientists can observe the world around them -- record -- and share it online.

Whether it's the changing seasons or the way seeds germinate, we can see the beautiful world through the new eyes of the camera.

Have you ever wondered who has the power to make laws and the power to judge people?

When we think of power in America, we usually think of the president, but he can't work alone either.

In fact, he's also just one piece in the power puzzle for very good reasons.

When the American Revolution ended in 1783, the American government was in a precarious state.

The Founding Fathers didn't want a country ruled by a single king, so the debate centered on creating a strong and just government that protected individual liberties and didn't abuse power.

When the new U.S. Constitution was approved in 1787, the structure of the nascent American government called for three independent branches, each with power, and a system of checks and balances between them.

We ensured that each division could always hold back the power of the other divisions so that no one division could become too strong.

These three departments worked together to run the country and guide the people in their lives.

The legislative branch is defined in Article 1 of the U.S. Constitution

Many might think that the Founding Fathers put the legislative branch first because it was the most important.

The legislative branch is made up of 100 senators and 435 representatives.

better known as Congress

The legislative branch's primary role is to make laws, but it also has other responsibilities, such as approving federal judges, approving the national budget, and declaring war.

Every state has two senators and several representatives, depending on the state's population.

The administrative division is stipulated in Article 2 of the Constitution

The leaders of this sector of the federal government are the president and vice president, responsible for enforcing the laws enacted by Congress.

The president works closely with a group of advisors known as the cabinet.

Appointed ministers help the president make important decisions in their areas of expertise, such as defense, finance, and homeland security.

The executive branch appoints government officials, directs armed forces, and meets with leaders of other countries.

All together, there's a huge amount of people doing a huge amount of work.

In fact, the public sector employs over four million people to do all the work.

The third branch of the U.S. government is called the Judiciary, and it's defined in Article III of the Constitution.

This division is made up of all the courts in the country, from the federal district courts to the Supreme Court.

These courts interpret the laws of the country and punish those who violate them.

The Supreme Court, the most prestigious court, resolves disputes between states, hears appeals from state and federal courts, and ensures that federal law is consistent with the Constitution.

The Supreme Court has nine justices, and unlike other government positions, they're guaranteed tenure for life or as long as they choose.

Our democracy is based on informed citizens, so it's our duty to know how our democracy works and what powers each branch of government has over its citizens.

At some point in your life, not just when you vote, you may be asked to participate in government, whether it's serving on a jury, testifying in court, or petitioning legislators to pass or block legislation.

Knowing who's running which departments of government and how they work together enables you to participate, to be informed, to make the right decisions.

This is Zeno of the Elean school, an ancient Greek philosopher known for creating many paradoxes that seem logical at first glance but lead to irrational or contradictory conclusions.

For more than 2,000 years, Zeno's arcane propositions have helped mathematicians and philosophers better understand the nature of infinity.

One of Zeno's most famous questions is the dichotomy paradox, which in ancient Greek means "paradox of halving."

It's something like this: After sitting and thinking all day, Zenon decides to take a walk from his house to the park.

Because the fresh air clears my head and helps me think.

To reach the park, you must first go half way to the park.

It takes a finite amount of time to move this part.

When you reach the halfway point, you have to travel half the remaining distance.

This also takes a finite amount of time

Once there, you have to walk another half of the distance, which also takes a finite amount of time.

this happens over and over again

You can see that this repeats itself forever, and as you divide the remaining distance into smaller and smaller pieces, it takes a finite amount of time to move any part.

So how long will it take to get to the park?

To find that out, you have to add all the times it takes for each leg.

The problem is that there are infinitely many parts of finite size.

So will the overall time be infinite?

However, this discussion is quite broad.

I'm saying that it takes an infinite amount of time to move from one point to another.

This means that any movement is impossible.

This conclusion is obviously absurd, but where is the flaw in this logic?

To solve this paradox, we can turn this story into a mathematical question.

Let's say Zeno's house is one mile away from the park, and Zeno walks at one mile an hour.

Using common sense, the trip should take an hour.

But let's look at it from Zeno's point of view and divide the distance traveled.

The first half distance takes 30 minutes, the next part takes 15 minutes, the next part takes 7.5 minutes, and so on.

If you add all these times together, the formula should look like this

Zeno might say, "Well, the right side of the equation has an infinite number of numbers, and since each number is finite, the sum must be infinite, right?"

This is the problem in Zeno's argument

Mathematicians later discovered that it is possible to add infinitely many finite numbers to get a finite number.

Why?

Think of it like this

Consider a square with an area of ​​1 square meter.

We're going to divide this rectangle in half, and then divide the halves into halves, and so on.

While continuing this, don't lose sight of the total area of ​​each part.

The first split will be two, each half the area, and the second split will be half the half, and so on.

But no matter how many times we divide the rectangle, the sum is still the sum of all the parts.

Now you know why I decided to cut the rectangle like this.

Because you get an infinite number of squares similar to Zeno's travel time.

As the number of blue squares increases, in mathematical terms, as n, the number of divisions, approaches infinity, the entire square becomes blue.

But the area of ​​a square is exactly 1, so the sum of infinity must be 1.

Back to Zeno, we now know how to solve the paradox.

Not only is the sum of infinite numbers a finite number, but that finite number is the common sense answer.

It takes an hour to move Zenon.

Great things are happening at every intersection

In fact, I believe that many of the interesting events that we experience happen at intersections in boundary space.

There is freedom, there is freedom to redefine yourself from the uncertainty of being neither here nor there.

When you think of famous crossroads in the world, you think of the Arc de Triomphe in Paris or Times Square in New York, both of which are filled with the excitement of the seemingly endless flow of people.

Other crossroads, like the Edmund Pettus Bridge in Selma, Alabama, or Copper Creek Court on Canfield Street in Ferguson, Missouri, come to mind because at those crossroads, there's an incredible energy that comes from people, ideologies, and the constant struggle for justice.

Looking beyond Earth, some of the best-known celestial bodies are also gifted at the crossroads.

Stars are born at intersections filled with gas and dust, driven by the unavoidable force of gravity.

And the star ends up with that same intersecting force, this time being flung outward in violent collisions of much smaller atoms, crossing and merging again and again to become an entirely different, much heavier object.

So we can see that intersections have a special meaning to us.

So by "intersecting," I mean having a place at the intersection.

I've always spent my time at the boundary, the intersection of dream and reality, race and gender, poverty and abundance, science and society.

i'm black and i'm a woman

As stars are born in the sky, recognizing the powerful combination of these two is an explosive fusion of identities that shines as an example.

I'm also an astrophysicist

I study blazers, very active supermassive black holes in the centers of giant elliptical galaxies that emit jets at near the speed of light.

I've dreamed of becoming an astrophysicist since I was 12.

What I didn't know at the time was that Dr. Jamie Alexander's record of African-American women in physics showed that there were only 18 black women in the United States with a Ph.D.

As I navigated my way through life, the best and worst of my life happened at crossroads: moments of self-definition, collisions of expectations and experiences, joys of hard-won triumphs, and, at times, agonizing pains of rebirth.

I started college life right after my family fell apart.

The family's financial situation fell apart not long after the father died.

So my mother, my sisters, and I went from being relatively affluent and middle-class to struggling to make ends meet.

So I'm joining the ranks of about 60 percent of women of color who believe their financial status is a barrier to completing their education.

Luckily, Norfolk State University fully paid for my tuition, so I got a bachelor's degree in physics.

After graduating, I communicated my desire to pursue a PhD in astrophysics, but it was ignored.

What saved my dream was one poster and some really great people and programs.

The American Physical Society had this beautiful poster encouraging students of color to become physicists.

What struck me when I saw this poster was that there was a black girl, about 12 years old, staring intently at some kind of physics equation.

I remember staring back at the girl who had tried this dream before me.

I immediately wrote to the Society asking if they would share one of the posters, which I still have in my office.

In an email to the academic society, I wrote about my educational background and that I wanted to try once more for a PhD.

The academy introduced me to the Fisk-Vanderbilt University Bridge Program, which is itself a crossover program between master's and doctoral programs offered by the two universities.

After a two-year hiatus, I was admitted there and started my PhD.

After my master's degree at Fisk College, I went to Yale University to finish my PhD.

When I was a kid, I used to think that if I could just settle down in the place I dreamed of, I could easily get a PhD.

(Laughter) But it quickly became clear that not everyone welcomed the arrival of outsiders into the world.

I was ostracized by many of my classmates, some of whom tried to force me to wash all the dishes after everyone had finished eating, as if to "know where I was."

I'd really like to think it just happened, but women of color who are involved in science, technology, engineering, mathematics, STEM, have actually endured this for a long time.

In a recent study by Joan C. Williams of UC Hastings, all 60 women of color interviewed said they experienced racial and gender discrimination, including some who were mistaken for cleaning staff.

None of the 557 white women who participated in the same study reported being mistaken in this way.

I'm not saying janitors are bad. In fact, my predecessors were able to go to college because their parents worked as janitors.

This kind of thing certainly hurt me deeply, but the real problem isn't that, it's that people judge everything I'm capable of by what I look like.

But more than that, it should be emphasized that the disability that women of color in STEM experience is different from the disability that they experience because they are women or because they are people of color.

And that's why I'm talking about women of color in STEM today.

STEM itself is an "intersecting" term, so to understand the true richness of STEM, we need to take into account the space at the boundaries between disciplines.

Chemistry, physics, and biology are the sciences that seek to understand the physical world, but without mathematics, we cannot achieve this.

Engineering involves applying basic science and mathematics to real life.

Technology is built on the foundations of mathematics, engineering and science.

And mathematics acts as the Rosetta Stone that deciphers and encodes the laws of physics in the world.

STEM is completely incomplete without each working.

Not to mention the richness that is realized when STEM is combined with other disciplines.

The purpose of this talk is two-fold. One is to tell directly to every black, Latino, Native American, First Nations, and every other woman and girl who finds themselves at the intersection of race and gender grace that you can be anything you want.

I'd love to be an astrophysicist, but anyway, whatever you really want to be is fine.

Don't think for a moment that you can't fulfill your dreams for the future.

I have to hold on to my dreams and move on to a world I couldn't even imagine

And we find that many of the pressing challenges that exist in our time intersect in STEM.

As a global society, we have issues that we need to work together to solve.

It's a challenge that continues to require interdisciplinary investigation to generate solutions for a multidimensional tomorrow.

No one is better at solving boundary problems than someone who's been through it all at the crossroads.

As thought leaders and policymakers, we must move beyond the early stages of diversity into a prosperous, vibrant world where everyone has equal rights.

One of my favorite boundary gurus is the late Dr. Claudia Alexander, a black female plasma physicist who died in July after a decade-long battle with breast cancer.

She's a NASA project scientist who led NASA's famous Rosetta mission, which landed a probe on a comet earlier this year, and the $1.5 billion Galileo mission to Jupiter, two of the greatest scientific victories for NASA, the United States, and the world.

He said, "I'm used to going back and forth between the two cultures.

For me, it is a daring quest, a purpose in life, that takes us from ignorance to understanding.”

This is a power that can only be possessed by people on the border.

She had the technical ability to lead an ambitious space mission, and she perfectly understood where she stood in any given situation.

Jessica Matthews, who invented the SOCCET series of sporting goods such as soccer balls that can generate electricity repeatedly while playing, said, "Inventing is not just about making things, it's about understanding people and understanding the systems that make up our world."

I tell my story and the story of Dr. Alexander, Jessica Matthew, because it's basically a story that happens at the crossroads, a life story that's at the core of new race, gender, and innovation.

My place in the elite was questioned in the shadows, but I'm proud to report that when I graduated, in the history of Yale University, which was 312 years old, I was the first black woman to earn a doctorate in astrophysics.

(Applause) And now, in a small way, I'm part of the STEM cadres of women of color, and we're bringing new perspectives and realizing ideas to some of the most pressing challenges of our time: education inequality, police brutality, HIV/AIDS, climate change, genetic engineering, artificial intelligence, Mars exploration, and more.

It's something no one has ever thought of before.

Women of color in STEM are tackling difficult but rewarding social engineering challenges.

So we're in a unique position to drive these conversations with the wealth of real-world experiences of a much more diverse group of people.

This perspective can be extended to a multitude of people at the crossroads, whose experiences, positive and negative, can enrich conversations in ways that are superior to well-resourced, homogenous groups.

This is not a request out of a desire to join the ranks.

It's a warning to ourselves, to remember that the best results for all of mankind come from the collaboration of people who have had a wide variety of completely unique experiences at the boundary, who have lived their lives desperately.

In a nutshell, when we, as collective geniuses, pour our love into humanity, the highest wisdom will emerge.

thank you

(applause)

Feathers are one of the most remarkable things animals have produced.

Despite its stunning complexity and delicacy of construction, it is strong enough to keep a bird thousands of feet in the air.

Like everything in nature, feathers evolved into their present form over millions of years.

It's hard to imagine how it evolved

What shape did it take during evolution?

What's the use of wings with feathers in the process of evolution?

Thanks to science, we now know that birds are living dinosaurs.

A common part can be seen in the skeleton

Some dinosaurs have anatomical features that are not found in other animals, such as the same wishbone found in birds.

And yet, in the late 1990s, paleontologists unearthed some evidence to support that theory: dinosaurs with feathers.

Since then, scientists have discovered dozens of dinosaur species with traces of feathers.

Some were as big as pigeons, some were as big as school buses.

According to the phylogenetic tree, the evolution of feathers doesn't seem so impossible.

The most distant feathered relatives of birds were wiry feathers.

The wire split and branched out.

Many dinosaurs evolved their simple feathers into the more complex structures found in modern birds.

At the same time, the feathers changed from patchy downy feathers to thick feathers that spread all over the dinosaur's body, all the way down to its feet.

Some fossils retained molecules of feather pigment.

There was a beautiful range of colors, including glossy black feathers reminiscent of crows, black and white stripes, and bright red mottled patterns.

Some had large crests on the top of their heads, while others had long, magnificent tail feathers.

Such dinosaurs could not fly with their feathers, their arms were too short and their bodies too heavy.

However, birds don't just use their feathers to fly.

The woodpecker uses its feathers to perfectly mimic the forest behind it.

The ostrich spreads its wings over the nest to shade its chicks.

Peacocks show off their fine tail feathers to attract females.

Feathers would have played the same role for dinosaurs.

How winged dinosaurs flew is still somewhat of a mystery.

But if a small winged dinosaur flapped its wings and climbed a hill, the wings would have created lift to run faster.

This physical coincidence may have led to the evolution of longer arms, which allowed us to run faster and fly short distances.

Eventually its arms stretched out and spread out into wings.

Perhaps 50 million years after the first wiry wings evolved, dinosaurs were able to fly.

Big data is an elusive concept

It refers to large amounts of digital information that is difficult to store, transfer, and analyze.

Big data is so large that it cannot be handled with current technology, and it poses the challenge of creating next-generation data storage tools and technologies.

Big data is nothing new

In fact, physicists at CERN have been tackling the ever-expanding challenges of big data for decades.

Fifty years ago, CERN data could be stored on a single computer.

Instead of regular computers, they used computers called mainframes that could fill a building.

Physicists from all over the world were coming to CERN to connect to this giant machine to analyze the data.

In the 1970s, the ever-proliferating amount of big data was distributed and stored on separate computers all over CERN.

Each computer was connected by its own homegrown network.

But physicists were working across computer boundaries, but physicists were working across computer boundaries, so they needed access to data from all computers.

So we put together independent networks and built our own network called CERNET.

In the 1980s, similar networks with different dialects proliferated and expanded throughout Europe and the United States, and remote access was possible, but extremely cumbersome.

In order for physicists around the world to access the ever-growing amount of big data stored at CERN without having to travel to the site, every network had to speak the same language.

We adopted the then immature Internet, which was standardized in the United States and followed by Europe, and in 1989 at CERN we connected Europe and America for the first time, and this was the beginning of a truly global Internet.

It gave physicists terabytes of big data, and it gave physicists easy remote access to terabytes of big data, and they could get results -- they could write papers in the lab without having to travel.

The need to share new knowledge with colleagues has emerged The need to share new knowledge with colleagues has emerged

We developed the web in the early 1990s to facilitate information sharing.

Physicists no longer need to know where information is stored, and the world's hottest ideas for finding and accessing information on the web have transformed the way we communicate in everyday life.

Even in the early 2000s, big data continued to proliferate, and even though CERN had a building full of computers, it outstripped its analytical capabilities.

To compute and store data locally at hundreds of facilities In order to compute and store data locally at hundreds of facilities, petabytes of data needed to be distributed across partner computers.

In order to coordinate these interconnected resources using various technologies, we developed grid computing technology so that computing resources around the world can be shared seamlessly.

Although it depends on trust and interaction,

In this grid model, it's not easy to transfer data outside the community, because not everyone has the resources to share it, and not everyone has the same level of trust in the company.

Recently, the more business-like approach of cloud computing has been thriving as an alternative to accessing resources on demand, and it's now being used by other communities to analyze big data.

Paradoxically, places like CERN, dedicated to the study of particles that are, paradoxically, unimaginably small, are the source of big things like big data.

But to study elementary particles and their interaction forces, you have to create them for a fraction of a second, bombard them with protons in accelerators, accelerate them to velocities close to the speed of light, and observe their trajectories.

To observe the orbit, a detector with 150 million sensors acts like a massive 3D camera, capturing each collision that occurs up to 14 million times per second.

Generates a lot of data

But if big data has been around for so long, why has it suddenly become so common these days?

As the old metaphor goes, groups are more powerful than the sum of their parts, and this isn't unique to science.

By combining related information and finding correlations, we gain more knowledge that enriches many aspects of our daily lives, whether it's real-time things like traffic jams or economic conditions, short-term changes like health care or the weather, predicting business, crime or epidemics.

Virtually every field is gathering big data. Mobile sensor networks are spreading all over the planet, cameras are on the ground and in the air, information on the web is being archived, and every activity of Internet users around the world is being logged.

The challenge is to develop new tools and technologies, to extract information from vast amounts of data, to inform decision-making, to improve medical diagnosis, and to meet the needs and demands of tomorrow's society that are unimaginable today.

Is it possible to create "existence" from "nothingness"?

More precisely, can we turn energy into matter?

You can, but matter always appears in pairs with its twin, antimatter.

But strangely enough, there seems to be far less antimatter than there should be in the universe.

Let's start with the most well-known formula, E=mc²

What this formula means is that mass is a condensed form of energy, and mass and energy are convertible, like two currencies, but the exchange rate is huge.

90 trillion joules of energy equals 1 gram of mass.

But how do you actually turn energy into matter?

The secret lies in the "energy density"

If you focus a huge amount of energy into a tiny spot, you create new particles.

If you look closely, you'll see that these particles always appear in pairs, sort of like twins.

Every particle must have a partner, and this is the antiparticle.

It sounds like something out of science fiction, but at Particle Accelerator, we do this every day.

Colliding protons at CERN's Large Hadron Collider creates billions of particles and antiparticles every second.

think of the electron

Electrons have very little mass and have a negative charge.

The positron, the antiparticle of the electron, has exactly the same mass but a positive charge.

But if you don't care about the positive or negative charge, the two particles are identical and very stable.

The same is true for their slightly heavier cousins, protons and antiprotons.

So scientists believe that a world made of antiparticles looks, feels and smells like our world.

In this anti-world, there may be anti-matter of water and gold, anti-water, anti-money, and anti-marbles, and there may also be anti-marbles.

What happens when you bring a normal marble and an anti-marble close together?

These two solids disappear completely, and in their place a tremendous amount of energy, comparable to that of an atomic bomb, is produced.

When you put matter and antimatter together, you get an enormous amount of energy, so science fiction often uses the idea of ​​taking the energy out of antimatter and using it. Star Trek's spaceships are a good example of this.

In fact, the energy stored in recycled materials is hundreds of millions of times more than ordinary fuel.

With one gram of antimatter, you can drive a car around the Earth 1,000 times or launch a space shuttle into orbit.

So why not use this antimatter for energy production?

In fact, antimatter isn't lying around, so you can't collect it.

You have to make it before you can use it as fuel. But to make antimatter, you can get it by using it as fuel, but to make antimatter, you need billions of times more energy than you can get by using it as fuel.

But somewhere in the universe, there might be a lot of antimatter, and we could mine it from antiplanets and use it.

In fact, until a few decades ago, even scientists believed this was possible.

But today, we know from observations that there isn't enough antimatter to be used anywhere in the universe as far as the eye can see.

Because the number of antiparticles and particles should be the same, so why can't we find antimatter?

this is really strange

To find out what's going on, we have to go back to the moment of the big bang.

At the moment the universe was born, a tremendous amount of energy turned into mass. In the very early universe, there was equal amount of matter and antimatter.

But right after that, matter and antimatter canceled each other, and matter and antimatter canceled each other, releasing an enormous amount of energy in the process, which is still observable today as microwaves.

So about 100 millionth of the original matter remained, but about 100 millionth of the original matter remained, but no antimatter remained.

You might be thinking, "Wait a minute, why did antimatter disappear and only matter remained?"

Well, it looks like we're in luck, because there seems to be a slight asymmetry between matter and antimatter.

Otherwise, particles wouldn't exist in the universe Otherwise, particles wouldn't exist in the universe, and of course there wouldn't be humans.

So what caused this asymmetry?

At CERN, we're looking for answers to questions like this: Why isn't the universe empty? Why do things other than electromagnetic waves exist in our universe ?

no answer found yet

I used to travel a lot these days, sometimes for weeks at a time, with just one suitcase.

One day, I was invited to an important event and I wanted to wear something special and new.

I looked in my suitcase, but there's nothing I can wear

Luckily, I was at a tech conference that day, and I had access to a 3D printer.

So I quickly designed a skirt on my computer and sent that file to a 3D printer.

Printed overnight parts

The next morning, I took the parts out and put them together in my hotel room, and here's the skirt I'm wearing right now.

(Applause) It wasn't the first time we'd printed clothes.

For my final year of fashion school, I decided to 3D print all the pieces for the collection at home.

The problem was, at the time, I knew nothing about 3D printing, and in just nine months, I needed to be able to print five nice pieces of clothing.

I felt that I was most creative when working from home.

I loved experimenting with new materials, and I was always trying new techniques to create very unique fabrics for my fashion projects.

I used to go to old factories and weird shops, find weird leftover materials and powders, and take them home to experiment with.

As you can imagine, my roommate didn't seem to appreciate it.

(Laughter) And then I decided to try a big machine that wouldn't fit in my living room.

I love to create precision and unique things using different fashion techniques, from knitting machines to laser cutting to silk screen printing.

I came here to New York during my summer vacation to apprentice at a boutique in Chinatown.

I made two amazing 3D printed dresses.

It was amazing as you can see

I had a little problem

It was made of hard plastic, so it was very fragile.

People who wore it couldn't even sit down, and they would scratch their armpits.

3D printing gave designers a great deal of freedom to make the dress look exactly the way they wanted, but it required a large and expensive industrial printer, which was located in a workshop far from the workplace.

That year, a friend gave me a 3D-printed necklace that I printed on a home printer.

I knew those printers were much cheaper and easier to use than the ones I used during my internship.

And when I saw that necklace, I thought, if you can print your necklace at home, you can print your clothes.

I really liked the idea that instead of going to the market and picking out fabrics that someone else decided to sell, I could design my own and print them at home.

I found a small makerspace, and that's where I learned everything I know about 3D printing.

They gave me the keys to my room right away, so I could experiment every day until midnight.

The challenge was finding the right filament to print the clothes on.

A filament is

Materials used in 3D printers

I experimented with PLA resin for about a month, but it was hard, itchy, and fragile.

The big turning point was finding out about a material called FilaFlex, which is a new kind of filament.

strong yet very flexible

I was able to use this to print the first piece of clothing, a red jacket woven with the word LIBERTÉ, which is French for "freedom."

I chose this word because I felt so free and empowered to be able to design and print clothes at home.

Anyone can easily download this outfit and change the words to whatever they want.

It can be your own name or your lover's name

(Laughter) It's a small printable size, so I had to put the pieces together like a puzzle.

I had one more problem to solve.

I wanted to print a fabric that could be used just like regular fabric.

And then I found an open-source file by an architect who designed one of my favorite patterns.

And then you can print beautiful fabrics and use them like regular fabrics to make clothes.

It even feels a little like racing.

I tweaked that person's file and tried different variations.

It took another 1,500 hours of printing to complete the collection.

So I brought six printers into my house and printed 24 hours a day, 24 hours a day, 7 days a week.

3D printing is slow, yes, but the Internet was much slower 20 years ago. 3D printing will eventually be so fast that anyone can print a T-shirt at home in minutes.

Ladies and gentlemen, would you like to see the clothes I made?

(Audience) I want to see it!

(Applause) Rebecca is wearing one of the five outfits I've made.

I printed almost everything she wore at home.

The shoes are also printed.

(audience) Great!

(audience) Nice!

(Applause) Thank you, Rebecca.

thank you everyone

In the future, as materials advance, we'll be able to create fabrics that look and feel just like regular fabrics, like cotton and silk.

Imagine personalized clothes that fit perfectly

Music used to be a material commodity.

I had to go to the record store and buy a CD, but now I can download music directly to my phone.

Fashion is now material

I wonder what the world will be like when all clothes are digital like this skirt.

thank you

(applause)

The ancient Greeks had a brilliant idea that their universe was simple.

I thought that all things were made of only four elements. I thought that all things were made of only four elements. Earth, air, fire, and water. Earth, air, fire, and water. Earth, air, fire, and water.

beautiful in theory

simple and elegant

You can mix and match the four elements, mix and match the four elements, and create the wonderful diversity of the universe.

For example, "earth" and "fire" create dry substances

"Air" and "water" make wet things, and so on.

But there was a problem with the theory.

This theory cannot predict what can be measured, and experimental science is based on measurement.

Besides, the theory was wrong.

But Greece had many great philosophers, and in the fifth century B.C., Leucippus of Miletus came up with a concept of science that would be believed for many years to come.

The concept that everything we see is made up of tiny, invisible atoms.

This theory was simple and elegant, and this theory was simple and elegant, and much more correct than the theories of earth, air, fire, and water.

After centuries of scientific research and experiments, we know that today's elements, hydrogen, carbon, iron, hydrogen, carbon, iron, hydrogen, carbon, iron, can be broken down into atoms.

Even in Leucippos's theory, an atom is the smallest unit that cannot be divided.

What Leucippus lacked was that the atom could be divided into smaller pieces What Leucippus lacked was that the atom could be divided into smaller pieces

He also found that the atomic conception that he started could explain only a small part of what makes up the universe.

Ordinary matter in our universe seems to be rare Ordinary matter in our universe seems to be rare

It turns out that Leucippus' atoms and what they make are only about 5% of what's in the entire universe.

Physicists call the other 95% of the universe the dark universe. They call it the dark universe. It's made of dark matter and dark energy.

How do you know that?

We physicists observe and discover things We physicists observe and discover things

It sounds simple, but it's actually very meaningful.It sounds simple, but it's actually very meaningful.

Things made of atoms can be seen with the naked eye

You can see it because the light bounces off

When you look into space, you see stars and galaxies.

A beautiful galaxy like ours moves gracefully in space as it swirls.

In the 1930s, scientists measured the speed at which clusters of galaxies moved, and in the 1930s, scientists measured the speed at which clusters of galaxies moved and the mass of matter they contained, and what they found surprised them.

It turns out that the sum of all the observable masses is not enough to make a cluster of galaxies.

Later measurements of each galaxy yielded the same results Later measurements of each galaxy yielded the same results.

There's no gravity that holds galaxies together with just what we see There's no gravity that holds galaxies together with just what we see

If it's just what we see, it'll fall apart But it won't

That means there must be something invisible That means there must be something invisible

So we named it dark matter.

The most important evidence for the existence of dark matter comes from observations of something called the cosmic microwave background.

All the evidence we have today proves the existence of dark matter. All the evidence we have today proves the existence of dark matter.

what does that mean?

We've known for a long time that the Earth is not the center of the universe. We've known for a long time that the Earth is not the center of the universe.

The discovery of dark matter makes us even less central.

What makes us is a small part of the whole universe.

but there is still

At the beginning of this century, a scientist studying the far reaches of the universe proved that the universe is expanding, and that the universe is expanding, as you can imagine in a universe born from a hot, dense Big Bang, is accelerating the expansion of the universe.

What do you mean?

Maybe there's some extra energy that's increasing this acceleration. Maybe there's some extra energy that's increasing this acceleration, like the energy it takes to accelerate a car.

Scientists mostly think it's the former, that some unknown energy is responsible for the acceleration, and they've dubbed this dark energy.

From all the measurements available today, we can calculate the proportion of the unseen in the universe From all the measurements possible today, we can calculate the proportion of the unseen in the universe

Dark energy is expected to be 68% of the universe Dark energy is 68% of the universe Dark matter is expected to be 27% The remaining 5% This includes everything we can see The remaining 5% This includes everything we can see

What is this invisible thing?

We don't know yet, but there's something called supersymmetry that gives us a clue, but there's a theory called supersymmetry that gives us this clue.

The theory of supersymmetry, also known as SUSY for short, suggests the possibility of new particles that make up dark matter. It suggests the possibility of new particles that make up dark matter.

If SUSY can be proven correct, then our understanding of the universe is about 5%, or about one-third of what we can see, or about one-third of what we can see.

That's amazing

Dark energy is even more complicated, but there are some promising theories for this, and there are some promising theories for this as well.

Some of the theories are like the ancient Greeks, and some of the theories are like the ancient Greeks.

This kind of theory explains that there's just one thing that creates the universe's incredible diversity, and it's like a vibrating string.

According to this theory, all the particles we know today are simply different timbres of strings.

Unfortunately, this string theory is still untestable Unfortunately, this string theory is still untestable

But expectations are rising for a better understanding of the universe. But expectations are rising for a better understanding of the universe.

I feel so small when I hear stories like this

you don't have to

On the contrary, it should feel amazing. As far as we know, it's the only creature that's beginning to understand the mysteries of the universe.

Today we're going to look at the Roman Empire through the eyes of a girl.

She's the hero of the story, painting a self-portrait in the atrium of her father's mansion.

My name is Domitia and I'm 5 years old.

Her brother is 14 years old and named after his father, Lucius Domitius Ahenobarbus.

Girls don't get long names like boys

The worst thing is that this dad-- he calls all his daughters Domitia.

"Domitia!"

My father is calling Domitia III, who paints on the pillars.

She had a sister, Domitia II, who was seven years old.

Domitia I is 10 years old

Domitia IV was about to be born, but she died in childbirth with her mother three years ago.

Confused?

so did the ancient roman

You've inherited your ancestral names through the male line, nice three-part names, for example -- Lucius Domitius Ahenobarbus.

But the real headache is when you document which Domitia married to whom, and whether that person was a great-aunt or a great-stepmother.

Domitia III doesn't just paint on the pillars, she observes carefully.

Even though it was early in the morning, dad's clients and friends came to his house to pay their respects.

Seventeen-year-old Lucius Popidius Secundus came to visit Domitia II, hoping to marry him within five to seven years.

He seems to be begging his father to marry him, not his wife.

Poor Lucius Domitia's father thinks his family is rich, but they're condescending from the slums.

In fact, it was a district in Rome, full of barbers and prostitutes.

All of a sudden the men leave the room with their father.

It's past two o'clock, and it's time to enter the courtroom.

it's quiet in the house

The men won't be back for another seven hours before dinner.

So what's going on in the house for those seven hours?

What do the three Domitias do all day?

Hard question!

All surviving Roman documents from that period were written by men.

That's why it's hard to know what a woman's life is like.

But it can't just be the history of Roman men, so let's take a look.

Start with the Atrium

There's a huge loom, and my dad's newly married wife is weaving a new toga.

Domitia and Domitia and Domitia spin the yarn, and this thread is over nine meters long, and it's used to weave large oval garments.

The Romans allowed their wives to weave wool.

I know this because it's inscribed that way on the tombstones of many Roman women.

Unlike Greek women, Roman women left their homes and roamed the streets.

I went to the bathhouse in the morning to avoid men, and went to the women-only bathhouse.

Some followed the fashion of the 70s and bathed naked in front of men.

Where there was no place for women was where men were, in public squares, in courts, and in the Senate.

The public places where women were allowed were gardens and sculpted porticoes, gardens and sculpted porticoes, and corridors for walking.

When Domitia and Domitia and Domitia want to go somewhere like the porticos of Livia, we have to be prepared.

Domitia II and Domitia III are ready, but Domitia I is not ready yet, as she is about to marry her beloved Pilatus in two years.

It's not that I'm late, it's that I have more to do

You must wear the seal of engagement, the engagement ring and all the gifts from Pilatus -- jewelry, earrings, necklaces, and pendants.

Some even wear myrtle crowns

These ornaments are signs that say, "I am going to marry the 19-year-old who gave me these gifts."

While waiting, Domitia II and Domitia III are playing with a doll modeled after their sister who is about to get married.

These dolls are offered to the temple on their wedding day.

ready

Daughters climb into baskets carried by strong slaves

They have chaperones, and they've arranged to meet their aunt in Livia's portico.

Held aloft by the slaves, the girls look through the curtains to the hustle and bustle below.

Drive through the city, past the Colosseum, then take a side road up the hill to the Livian Colonnade.

It was built by Livia, the wife of the first emperor Augustus, on the ruins of Vedius Pollio's mansion.

he is not very good

The kind of person who once tried to feed slaves to eels in a pond just by breaking a plate.

Luckily, the emperor was at the table and calmed his tantrums.

The basket is lowered to the ground, and the girls go outside. Arm in arm, two by two, they climb the stairs to the garden, which is surrounded by many pillars.

Domitia III is immediately drawing on the pillar.

Domitia II is also approaching, reading the graffiti on the top of the pillar.

I'm trying to imagine what it would be like to find graffiti on a gladiator and watch a fight, because she's only allowed to be seen in the back row of the Colosseum.

From there, you have a very good view of the 50,000 spectators, but you can barely see the bloody fights.

If you really want to see it, you can become a priestess in the service of the goddess Vesta and you can sit in the front row.

However, there are pros and cons for protecting the goddess Vesta's torch.

Domitia I met a 10-year-old girl dressed up with a sign of engagement.

it's time to go home

Something happened when I got home after 8:00.

A broken plate is lying on the floor

All the slaves were gathered in the atrium, awaiting their master's return.

dad will be angry

They don't lay hands on their children, but like all Romans, they believe that slaves should be punished.

A whip is placed in preparation for the master's return

No one knows who did it, but your father will use torture to find the culprit.

The gatekeeper opens the door of the house

Anxious slaves quiet down

It wasn't my husband who walked in, but my pregnant teenage daughter.

My husband's eldest daughter, she's 15, she's been married and had children.

do you know her name?

There is a 5% to 10% chance of dying during childbirth, but I came here to have a meal with my family on this day.

As a teenage mother, she plays the role of a good wife by giving her husband an heir to bear and raise her children and carry on her name.

The family goes to the dining room to have dinner

Dad seems to be invited to dinner somewhere.

After dinner, the girls walk through the atrium to see off their older sister, who is in a basket and is accompanied by her father's bodyguard.

go home and walk through the atrium

Slaves, young and old, men and women, await the return of their masters.

When the master returns, he punishes them, demonstrating his power to his slaves through violence and fear.You never know which slave will suffer.

But the girls were getting ready to sleep upstairs.

Imagine a place where it's pitch black and you can't even see your own nose

Whether your eyes are open or closed, the sun doesn't reach them.

I can see the light ahead

Blue light flutters around when you approach quietly

I think, "I can't watch this forever."

You can't do that because the anglerfish's mouth opened wide and swallowed you whole.

There's a lot of life in the ocean that disappears like this without ever understanding the power of bioluminescence.

Bioluminescence is the ability of living things to emit light.

Our bodies produce earwax and toenails, but bioluminescent organisms can turn parts of our bodies into psyllium.

It's like you were born to go to the disco

Why?

Bioluminescence increases the chances of an organism's survival.

Take fireflies for example

The green glow attracts mates on hot summer nights.In addition to fireflies, there are many other creatures that can glow.

The body of the Flixotorix, aka the railroad worm, glows in two colors, red and green.

Do you eat critters like runways?

Even normal predators won't eat

Shining light protects insects

How about deep-sea shrimp

When it senses danger, it spits out a glowing sticky substance from its mouth.

Is there anyone who doesn't run away after being vomited?

And the vomit attracts creatures that prey on the shrimp's enemies.

But what if it can't emit itself?

No worries!

Even if you can't emit light yourself, there are other ways to use bioluminescence for yourself.

Back to the anglerfish, I saw it before you were eaten.

artificial bait with glowing head

in a leather bag called an esca

There are glowing bacteria

The anglerfish can't emit light itself, so it has a dangling pouch of glowing bacteria.

Do you remember fireflies?

That's what makes your body glow.

There are two chemicals inside the light-emitting cell: luciferin and luciferase.

When the firefly mixes luciferase and luciferin, and when it comes in contact with the cellular fuels of oxygen and ATP, the chemical reaction manifests itself in the form of light.

After discovering how fireflies produce luciferase and luciferin, scientists have genetically engineered luminescent reactions in organisms that cannot emit light.

For example, scientists gave tobacco leaves genes, or instructions, to produce firefly luciferase and luciferin.

And the tobacco leaf lit up like a Christmas tree, following the instructions imprinted in its DNA.

What's special about bioluminescence is that it doesn't get as hot as sunlight or an incandescent light bulb.

It's a temperature that doesn't burn living things.

Also, the psyllium will stop glowing when the chemicals inside are depleted, but the ingredients for the bioluminescence reaction can be replenished.

That's one of the reasons why engineers are trying to develop glowing trees.

If you plant a glowing tree by the side of a highway, you can light it with oxygen and clean, readily available energy.

It's just a life-prolonging effect!

life on earth may be extended

Are you thinking now about how bioluminescence can be used more profitably?

The psyllium you shake at the disco may find you a boyfriend or a girlfriend, but isn't there another way to use bioluminescence to extend your life?

You started to think like that, I guess you can see the light

what is the algorithm

In computer science, it's a set of instructions for solving a problem step by step.

Algorithms are usually run on computers, but humans also use algorithms.

For example, how would you count the number of people in a room

If you're like me, you'll probably point to one person at a time, start at 0, and count 1, 2, 3, 4...

here is the algorithm

So let's actually try to express it in pseudocode, a programming language-like English-like syntax, albeit a little more formal.

First let N = 0

When we count the people in the room one by one, we write N = N + 1.

Let's interpret this pseudo code

The first line declares a so-called variable N and initializes its value to 0.

This means that at the beginning of the algorithm, the value we are counting is 0.

So before we start counting, we haven't counted anything yet.

It's just a convention to set the variable to N

You can use almost anything even if it's not N

Now, the second line is the starting point for the loop, repeating a series of steps several times.

In this case, the looping step is counting the number of people in the room.

The third line that follows describes exactly how to count.

Indentation means repeating the work on the third line.

So this pseudocode starts at 0 and increments N by 1 for each person in the room.

Now, is this algorithm correct?

let's try

What if there are two people in the room

let's see

Initialize N to 0 in line 1

Increase N by 1 for each of the two

So on the first iteration of the loop, N goes from 0 to 1, and on the second iteration of the loop, N updates from 1 to 2.

And when the algorithm finishes, N is 2, which certainly matches the number of people in the room.

So far, so good

What about special cases

If there's no one in the room - except me counting -

In line 1 we initialize N to 0 again

This time, line 3 doesn't run at all, because no one is in the room, so N stays at 0, matching the actual number of people in the room.

Easy, right?

But counting people one by one is very inefficient, isn't it?

Of course you can improve!

What if we count two people at a time?

Instead of counting 1, 2, 3, 4, 5, 6, 7, 8, let's count 2, 4, 6, 8...

It's going to be faster, but it's actually faster.

So let's express this optimization in pseudocode.

set N to 0

Let N = N + 2 for each pair in the room

It's a very easy change

Instead of counting people one by one, we count two people at a time.

This algorithm is twice as fast as before

But is this okay?

let's check

What if there are two people in the room

Initialize N to zero in line 1

Increase N by 2 for each pair

And when the algorithm finishes, N is 2, which matches the actual number of people in the room.

Next, let's consider the case where there are no people in the room.

Initialize N to 0 in line 1

The third line doesn't run at all, because there are no people in the room, so N stays at 0, which matches the number of people in the room.

But what if there are three people in the room?

does the algorithm work

let's see

Initialize N to 0 in line 1

Increase N by 2 for each set, then?

There are no more pairs in the room, so the second line no longer applies.

So the algorithm ends, N is still 2, which is wrong.

This algorithm is said to have a bug, because it is wrong.

Let's fix it with new pseudo code

set N to 0

Let N = N + 2 for each pair in the room

If there is one unpaired person, let N = N + 1

To solve this problem, I've introduced a condition in line 4, which is also called branching, and it's executed when there's only one person without a pair.

Now, whether the number of people in the room is one, or three, or any odd number, the algorithm can count.

can i do better

You can count three, four, five, even ten, but if you go beyond that, it becomes a little more difficult to point.

In short, whether run by a computer or a human, an algorithm is just a set of instructions for solving a problem.

We only introduced three algorithms

What problem do you want your algorithm to solve?

childhood

this was my team

(Laughter) I'm not into exercise

I hate playing and watching sports

I was just fishing

I spent all my adult life fishing off the shores of Connecticut, and this is the fish I had back then.

I grew up and went to college, and in the early '90s, I moved back to my parents' house, and this is what I found.

the team was getting smaller

It's just a drastic decrease in members

As a fisherman, I did a little bit of research out of personal curiosity, and I started to get a sense of what was going on in other places.

I checked the fish market first.

When I go to a fish market, wherever it is -- whether it's in North Carolina, whether it's in Paris, or in London -- the strange thing is that I keep seeing four kinds of fish -- over and over and over again, on the menu and on ice -- shrimp, tuna, salmon and cod.

I thought it was very strange, and looking at it, I wondered if anyone had noticed the decline in fish stocks at the fish market.

And when I looked into it, I realized that people didn't think of fish as a team.

Ordinary people viewed seafood in this way.

It's human nature and not uncommon to reduce the natural world to just a few elements.

It can be traced back to 10,000 years ago when humans emerged from caves.

If you look at a 10,000-year-old furnace, you can see a variety of animals, including raccoons and wolves.

But if you look into the world 2,000 years ago, you'll find four mammals: pigs, cows, sheep, and goats.

so are the birds

If you look at restaurant menus in New York City, 150 or 200 years ago, sandpipers, woodcocks, grouse, ducks and geese were staples.

But there are four types of domesticated birds today: turkeys, ducks, chickens and geese.

There is a trend toward shrinking

Why is there such a tendency?

picture-

First of all, it's a very new problem.

This is how the ocean has been fished for the last 50 years.

World War II was a major catalyst for the arming of fisheries.

Technologies perfected during World War II, such as sonar and lightweight polymers, were later applied to fishing.

You can see that the fishing capacity has increased significantly, and it has quadrupled from the end of World War II to the present day.

So that means we're landing 80 to 90 million tonnes every year.

We harvest from the sea the equivalent of the weight of China's entire population each year.

It's no coincidence that I used China as an example, because China is now the world's largest fishing nation.

this is one of the reasons

The rest is due to the boom in farmed and aquaculture fisheries, which has been trending for the last few years, outperforming wild fish.

If you add farmed fish to wild fish, you'll get two China's worth of fish from the ocean each year.

Again, I didn't use China as an example by accident, because China is not only the world's largest fish producer, but it's also the world's largest fish farmer.

Let's examine 4 types of fish here

The first is shrimp, the most consumed shrimp in America and most of the Western world.

Wild shrimp in the wild is a terrible product.

In order to bring 1kg of shrimp to market, 5kg, 10kg, 15kg of wild fish are routinely sacrificed.

It's also very inefficient in terms of fuel efficiency before it hits the market.

A recent study from Dalhousie University found that shrimp trawling is one of the most carbon-emitting fishing methods.

If someone starts farming, someone else starts, and this area is full of farms.

The problem is

The shrimp farms are located in mangrove forests, which is natural shrimp habitat.

Cute roots are growing downwards

It's important for the environment because it strengthens the soil, protects the coast, and creates habitat for juvenile fish and shrimp larvae.

But much of the coastal mangrove forest has become like this.

Millions of acres of coastal mangroves have been lost in the last 30-40 years.

The rate of destruction is slowing, but we're still declining primary mangroves.

And there's one more thing I want to talk about: a phenomenon that movie director Mark Benjamin calls "grinding Nemo."

It's very relevant to what happened to tropical coral reefs.

Because right now, the shrimp trawling is a huge bycatch, and the Hedo is ground up and fed to the shrimp.

Occasionally, these large ships carry forced laborers and even catch what's called small fish. They grind up the reef fish you want to see and feed them to the shrimp.

The next most eaten fish in the United States and Western countries is tuna.

Tuna is the ultimate migratory fish

We have to monitor this vast area to manage tuna properly.

Our management area is also known as Regional Fisheries Management Organizations, also known as ICCAT, the International Commission for the Conservation of Atlantic Tunas.

Carl Safina, the brilliant naturalist, calls it "an international conspiracy to hunt tuna."

Of course, over the last few years, ICCAT's management has improved tremendously, and it's improved in many ways, but tuna is a migratory fish, and to manage it, you have to manage it globally.

There have been attempts to farm tuna, but tuna is not suitable for farming at all.

Not many people know that tuna is a warm-blooded fish.

Its body temperature is 20 degrees higher than that of seawater, and it can swim at speeds of 65 kilometers per hour or more.

So do you understand why it's not suitable for farming?

The fish that can be farmed are cold-blooded, not very mobile fish.

Growing a protein source is a good thing

A wild, wild fish that swims at 65 kilometers per hour—and warm-blooded, tuna is not a good candidate for aquaculture.

The next fish is salmon, the most eaten fish in America and Western Europe.

Salmon are also being displaced, but not necessarily by fishing.

This is my home state of Connecticut.

There used to be a lot of wild salmon

But look at this map, all the dots are dams.

Connecticut has over 3,000 dams.

I always say that this is what makes people so frustrating and conservative.

Once, at a conference, I said to a national park official, and he's from North Carolina, and he came up to me and said, "I'm getting too mad about Connecticut. North Carolina has 35,000 dams."

Dams are all over the country, no, all over the world.

Dams are everywhere, and they're preventing wild salmon from moving up rivers to spawn.

That's why we farmed it. Salmon is in many ways the most successfully farmed fish.

When salmon farming first started, it took six kilograms of wild-caught fish to feed one kilogram of salmon.

To the credit of the industry, we've come a long way.

It's less than 2 to 1, but it's also a little bit of a deception, where aquaculture feed manufacturers weigh the pellets, and for a kilo of salmon, they give you many pounds of pellets.

This pellet also reduces fish abundance.

After all, you throw in the fish, you get the fish, FIFO for short. It's a hard word to say.

But anyway, to the credit of the industry, we're reducing the amount of fish we feed to every kilo of salmon.

The problem here is that salmon farming prices are skyrocketing.

Aquaculture is the fastest growing food system on the planet.

Growing at 7% per year

We're trying to cut down on the amount of fish we feed to market, but we're still catching a lot of small fish.

Fish don't just feed on fish, chickens and pigs also feed on fish.

We eat chickens and chickens eat fish, but strangely we eat fish that eat chickens.

Feathers, blood and bones other than chicken are ground up and used as food for fish.

I often think, "Is there a fish that eats a chicken that eats a fish?"

It's kind of like "the egg or the chicken?"

What I want to tell you is that 20 to 30 million tons of wild fish are landed and ground.

That's about a third of the weight of all Chinese people, or the equivalent of the weight of all Americans, is landed every year.

The last, fourth fish, doesn't refer to any specific fish.

It's what the industry calls whitefish.

A lot of fish goes into this whitefish, and I think this has something to do with the filet-o-fish that revolutionized the traditional American diet.

Filet-O-Fish started with halibut

A local franchise owner noticed that McDonald's didn't have customers on Fridays.

Because it's a Catholic community, Friday was fish day.

He went to see Ray Kroc and said, "I'm going to make a halibut burger and bring it over."

Ray Kroc said, "I don't think it's going to work.

How about a hula burger with sliced ​​pineapple in the bun?

Let's bet on which one will sell

Whoever sells the most will be the winner."

Unfortunately for the fish of the sea, Hula Burger lost.

Ray made a burger with halibut

Unfortunately, it cost me 30 cents to purchase.

Wanting 25 cents, Ray turned his attention to Atlantic pollock.

You know what happened to the New England Atlantic cod?

Today, Filet-O-Fish is made from walleye pollack.

Once you've caught all the walleye pollock, the next candidate will be tilapia.

Twenty years ago, tilapia was one of those unknown fish.

It efficiently converts plant protein into animal protein, which is a godsend for the Third World.

It's actually a very sustainable solution, hatching to maturity in nine months.

For Westerners, there is a problem. Westerners lack what they want.

Tilapia is not an oily fish

Does not contain EPA and DHA omega-3, which are sources of longevity

What should I do?

First, what about the poor croupade?

Crew paid accounts for the majority of the 20-30 million tons of landings that I mentioned earlier.

Many conservationists have argued, "Is it edible?

How about just eating them instead of using them as salmon bait? "is

There are arguments in favor of

Crew-Paid is very fuel efficient to market, with a fraction of the fuel cost compared to shrimp and one of the lowest carbon emissions.

Rich in EPA and DHA, the source of omega-3

be a strong candidate

It boils down to this: instead of paying hundreds of dollars a kilo or hundreds of dollars a ton to feed aquaculture, can we change the treatment of these particular fish by halving the catch and doubling the price for the fishermen?

Another much more interesting possibility is bivalve mussels.

Mussels are rich in EPA and DHA, similar to canned tuna.

It's also very fuel efficient

The carbon it takes to market a kilo is about 1/30th the carbon it costs to market a cow.

They don't need fish for feed, they get their omega-3s by filtering seawater that contains microalgae.

In fact, we get our omega-3s from microalgae, not from fish.

Microalgae make omega-3s, which are simply concentrated in the fish.

Mussels and other bivalves filter tremendous amounts of seawater.

One mussel can filter dozens of liters every day.

Looking at the world, this is very important.

Now, nitrification in waterways and overuse of phosphates are causing algal blooms.

Over the last 20 years, more than 400 new hypoxic areas have been created, killing vast amounts of marine life.

Even if you don't look for nutrients in fish at all

there are vegetables

You'll also have seaweed and kelp.

Like mussels, they filter seawater.

Oddly enough, it's actually used as cattle feed.

i don't like cows

Continuing to raise cattle can be constrained by limited water resources at times and places, but growing seagrass underwater doesn't require watering, so it's worth considering.

And what about the last fish? is

We have the power to create farmed fish that provide a net gain in ocean protein.

It's a vegetarian, fast-growing, climate-friendly, oily fish, which means it's probably loaded with EPA, DHA, omega-3s, fatty acids, and so on.

exists on paper

I've been reporting on this subject for 15 years.

Every time I tell a new story, they say, "We can do it all, we know how to do it all.

It provides a positive gain of marine protein and produces fish with omega-3s.”

It is wonderful

But it doesn't look like it's growing in scale.

It's time to scale

Then 30 million tons of seafood, one-third of the world's catch, could come from the sea alone.

I've been talking about the reality of the fishing industry.

We tend to prioritize appetite over contentment.

But if something like this is attempted, if a system like this is created, maybe we'll see a few more of these kinds of fish.

thank you

(applause)

Olive oil is 100% fat and contains nothing else

Hotcake mix, on the other hand, has at most 11% fat.

But olive oil is good for you, but pancakes are bad for you.

Why?

It's not the amount of fat you eat that matters, but the type of fat you eat -- the type of fat you eat -- that has a big impact on your weight, your cholesterol, and your risk of heart disease.

But wait a minute, what is fat?

Let's zoom in on salmon, which is fatty. If you go through the guts, through the tissue, into the cells, if you go through the tissue, into the cells, you'll find that what we call fat are molecules called triglycerides. And they're not all the same.

I'll give you an example

The three carbons on the left are glycerol.

It's like a backbone that holds other molecules together.

The three long chains on the right are fatty acids, and subtle differences in the structure of these chains determine the properties of a fat: whether it's solid or liquid, whether it oxidizes quickly, and most importantly, whether it's good for you or bad for you.

Let's see the difference

one is the length

Fatty acids can be long or short

Another important difference is how the carbon atoms are bonded.

Some fatty acids have only single bonds

On the other hand, there are fats that have both single and double bonds.

Fatty acids with only single bonds are called saturated fatty acids, while fatty acids with one or more double bonds are called unsaturated fatty acids.

Most unsaturated fats are good fats, while saturated fats are bad fats if you eat too much of them.

Well, that's all for saturated fat, but we're still talking about unsaturated fat.

The double bonds in these molecules have an unusual property: they don't move.

This means that there are two forms of double bonds.

One is like this, both hydrogens are on the same side, and both carbons are on the same side.

the second is like this

Hydrogen and carbon face each other across a double bond.

These two molecules are made of exactly the same element, but they are very different substances, and they work very differently in our bodies.

The one on the left is called Sith, a word you've probably never heard before.

The one on the right is called trans, and you've probably heard of trans fatty acids.

Trans fats don't oxidize, they're more stable than other oils when frying, and they can change the texture, something no other oil can do.

And trans fats, which are theoretically a type of unsaturated fat, are worse for you than saturated fats, worse than saturated fats.

You might think that's crazy, but molecular shapes on paper mean nothing to your body.

The three-dimensional structure is important, such as where the molecule fits, where it doesn't fit, and where it passes through.

So how can you tell if a food contains trans fat?

The only sure way is if the ingredient list says "semi-hydrogenated oil."

Don't be fooled by nutrition labels and advertising

The Food and Drug Administration allows up to 0.5 grams of trans fat per serving to be labeled as "0" even if the product contains trans fat.

But there's no hard and fast rule about how much to serve per serving, so you'll have to rely on labels like "semi-hydrogenated oils," because trans fats are made by semi-hydrogenating unsaturated fatty acids.

So let's go back to the olive oil and the pancake mix.

Olive oil is 100% fat

The fat content of hotcakes is only 11%.

But olive oil is mostly unsaturated fats, and it doesn't contain any trans fats.

On the other hand, most of the fat in pancake mix is ​​either saturated or trans fat.

So olive oil has 10 times more fat than pancake mix, but it's good for you, and pancake mix is ​​bad for you.

Pancake mix isn't the only bad thing.

There are many foods with this fat content.

The point is, it's not the amount of fat you eat, it's the type that matters.

And it's the shape of the fat that determines whether it's good fat or not.

There are still many unanswered questions about the universe, like whether time travel is possible.

Are there aliens somewhere in this galaxy?

But there's only one thing about the universe that I believe is that it's going to kill me.

The universe isn't aiming at me personally.

They're trying to kill everyone, including you.

please think about it

When we go into space, nothing we need to survive exists naturally in space. There is no air, temperatures are either too hot or too cold, and there is no ozone to protect us from UV rays.

I know it sounds bad, but what does space give us when we're on Earth?

What we have to understand is that we can think that we have a finite number of days left by objects in space, even if events on Earth cause us to be injured or killed before the universe does anything.

What are the chances that these objects will actually harm the earth or you or me in our lifetimes?

We can use what we know about the universe to come up with an answer.

You've probably heard stories about asteroids hitting Earth.

it's hard when it happens

Scientists believe that an asteroid impact caused most of the dinosaurs to become extinct.

It's natural to worry about this

Astronomers can now observe asteroids in space and predict their orbits using complex computer models.

For a while, the odds of the asteroid Apophis hitting Earth in 2036 were 1 in 625.

But after updating the data, astronomers say the odds are extremely low.

What about the sun?

Hollywood movies have used the sun to show how solar flares destroy the earth, or how the sun dies and the earth freezes.

Astronomers predict that the sun will contain energy-producing gas for the next three to five billion years.

So in three to five billion years, if humans are still on Earth, we're going to face that problem.

we are safe for now

Occasionally, the sun emits flares toward the earth, but most of the radiation is blocked by the earth's surrounding magnetic field.

Radiation that reaches the earth creates phenomena like the aurora borealis.

Large flares can affect our satellites and electronics, but they're far less likely to cause death.

So what about the supermassive black hole at the center of our galaxy?

What would happen to the earth and us if we were swallowed by a black hole?

'Cause it's super big

no that won't happen

This gigantic object will not trouble us.

How do you know?

Our solar system is on the edge of the galaxy, and the nearest supermassive black hole is 26,000 light years from Earth.

So you don't have to worry about being eaten by a black hole.

After all this, do you think you're still going to be killed by an object in space?

It convinced me that the chances of me being killed by space or objects in space seemed very unlikely.

But I'll keep looking up at the sky to make sure nothing's coming at me

When you see news reports of strong winds from a hurricane or tropical storm blowing down trees and homes, ask yourself, "Why are the winds so strong?"

Amazingly, the wind movement began more than five billion years ago.

But to understand that, you need to know about rotation.

In physics there are two kinds of motion

one is linear motion

When you push an object, it moves forward.

The other is rotational motion, in which an object rotates around a stationary axis.

An object in linear motion will go on forever unless something slows it down and stops it, like friction on the ground.

The same is true for rotating objects.

It will keep spinning unless something stops it

But the rotation can also speed it up.

A skater who is skating on ice in a straight line pulls his arm against his body without changing his speed.

But if you're spinning on ice and you pull your arm in, you know what happens?

it spins faster

This is called conservation of angular momentum.

Mathematically speaking, angular momentum is the product of two numbers, one is the speed of rotation and the other is the distance from the axis of rotation.

In free rotation, as one gets bigger, the other gets smaller.

If you pull your arm, the rotation will be faster.

Extend your arms to slow down

Rotation also has another effect

If you ride a spinning merry-go-round and throw a ball at your friend, it will appear to turn and fly.

But the ball is not curved

it's flying straight

It's your own path that's curving, but from the perspective of the rider, it looks like the ball is curving.

This is the Coriolis effect

And right now, we're on a fast-moving merry-go-round.

I mean the earth

Earth rotates on its axis once a day

Why does the earth rotate?

Beginnings go back billions of years

The sun, the earth, the other planets, and -- the dust and gas clouds that made you and me -- the dust and gas clouds that made you and me began to contract as gravity pulled them together.

But before the contraction began, this cloud was slowly spinning.

And as the contraction progressed, it rotated faster and faster, like an ice skater pulling on his arm.

Everything that came out of that cloud -- the sun, the planets, the sun, the planets, the satellites -- inherited that rotation.

This rotation creates day and night

And it's this day-night cycle that changes the weather.

The Earth is warmer during the day and cooler at night, and the equator is warmer than the poles.

A change in temperature creates a change in air pressure, and a change in air pressure moves the air.

it becomes the wind

But because the Earth is rotating, the movement of air in the northern hemisphere is caused by the Coriolis effect, and the movement of air is bent to the right in the northern hemisphere by the Coriolis effect.

Where there's low pressure, like water flowing through a gutter Where there's low pressure, like water flowing through a gutter, air is pushed towards it.

But the airflow bends to the right, which creates rotation.

In a powerful storm-forming low, the air gets denser and faster, and that's how hurricane winds are created.

If you see a spinning storm in the weather forecast, think that the rotation comes from the rotation of the Earth, which is a remnant of the slow rotation of the cloud of dust and gas that gave birth to the Earth nearly five billion years ago.

The rotation you're seeing is older than dirt and rock, dirt and rock, and the earth itself.

How big was the fish you caught?

How much?

Or this much?

How much more?

You can't prove you've caught a big fish without a photo, and fishing has always been like that.

In fact, hundreds of years ago, when it was not possible to capture a moment in a photograph, Japanese fishermen devised a unique way to document their big catches.

That's a fish tank

Gyotaku is the age-old art of photographing fish that originated in Japan and predates modern cameras as a way to document the capture of large game.

'Gyo' means fish and 'Tak' means marks made by pressing.

There are various theories about the origin of gyotaku.

A fisherman brought paper, ink and a brush to the sea when fishing A fisherman brought paper, ink and a brush to the sea when fishing

They recounted breathtaking adventures at sea

The Japanese worshiped certain types of fish, and fishermen would take these gyotaku and release them back into the sea.

To make a gyotaku, paint the fish with harmless ink and transfer it onto Japanese paper.

This way, the fish can then be returned to the sea or washed and sold at the market.

At first, the gyotaku was made simply as a record, and no details were written.

Beginning in the mid-1800s, they began to paint the details of the eyes, and other decorations began to appear.

Count Sakai, a famous nobleman, was an avid angler, and when he caught a big fish, he wanted to preserve the memory of that big sea bream.

So he asked a fisherman to copy the fish.

After this, many fishermen began to bring their own gyotaku to Earl Sakai.When the count found a gyotaku that he liked, he hired the artist to make his own gyotaku.

During the Edo period, many gyotaku were displayed in mansions.

After the Edo period, the gyotaku culture faded.

Today gyotaku has become a national art enjoyed by many people Today gyotaku has become a national art enjoyed by many people

And gyotaku is said to bring good luck to anglers.

But the format is quite different from what it used to be.

Most people learn by trial and error

Before you can copy, you have to prepare the fish for copying.

put the fish first put the fish first

Spread out the fins and pin them to dry

Then wash the fish with water

There are two ways of copying

The indirect method involves applying a damp cloth or paper coated with a paste made from rice.

Next, a cotton ball wrapped in silk is soaked in ink. Next, a cotton ball wrapped in silk is soaked in ink.

This method requires skill, and you have to be very careful not to tear the paper when removing it from the fish.

The direct method involves inking the fish directly and then gently pressing a damp cloth or paper onto the fish.

No two gyotaku will ever be exactly the same, but they both give us a dramatic image of the fish.

As a finishing touch, you can use a seal, sign it, and then you can hold it up and say, "That fish was that big!"

Fifty years ago, in the former Soviet Union, a team of engineers secretly moved large objects through the barren countryside.

With it, I was going to reach outer space for the first time and capture the hearts and minds of people around the world.

Rockets are huge

At the top was a silver sphere with two radios.

On October 4, 1957, they launched a rocket.

At this time, one Russian scientist wrote, "We have created a new planet, the planet Sputnik."

Long ago, explorers like Vasco da Gama and Columbus had the good fortune to open up uncharted lands.

Today we are blessed with the good fortune to reveal the mysteries of the universe,

Someday in the future you will be envied

The movie "Sputnik" is my fifth documentary, and it's almost finished.

It's a story about Sputnik and what it resulted in for America.

After the launch, Sputnik was treated with curiosity

Ordinary people could see the "artificial moon", and this aroused awe and pride that mankind was the first to launch an object into space.

But just three days later, on a day called Red Monday, the media and politicians claimed that the launch of Sputnik was proof that our adversaries had defeated us in science and technology, and that, using the Sputnik rocket as an intercontinental ballistic missile, the Soviets could immediately attack us with hydrogen bombs.

it's been a fuss

Sputnik quickly became one of the three greatest shocks to hit America, historians say, on par with Pearl Harbor or 9/11.

This incident revealed a gap in missile technology

It also sparked an arms race

Then, the race to advance into space began.

Later that year, Congress decided to build up its troop strength, increasing the number of nuclear weapons from 1,200 to 20,000.

Moreover, the response to Sputnik was not limited to military build-up.

For example, some of you here will remember the civil defense drills that took place today in July 1958, when tens of millions of people went underground in 78 cities.

A Gallup poll found that 70% of Americans believe a nuclear war will eventually happen, and that at least 50% of the population will die.

But Sputnik also brought positive changes.

For example, some of you here went to school on scholarship because of the Sputnik Shock.

Support for education soared, led by engineering, mathematics and science

Vint Calf points out that Sputnik's impact directly prompted the creation of ARPA, the Internet and, of course, NASA.

My documentary shows how a free society can run amok due to manipulation of the media.

It also depicts how a situation that was initially thought to be bad will eventually turn into something good for America.

The movie "Sputnik" will be released soon

I just want to say a little thank you to one of my investors and longtime TEDster, Jay Walker.

and thanks to all of you

(applause)

thank you Chris

i am a marine chemist

explore current ocean chemistry

Explore the Chemistry of Oceans of the Past

For historical considerations, we use coral fossils in the deep sea.

this is a picture of a coral

It's collected in the deep sea, thousands of meters deep, near Antarctica, and it's very different from the coral that you might be lucky enough to see if you've ever been to a southern country.

In this story, I want to give you a four-dimensional view of the ocean.

For example, this beautiful flat image of sea surface temperature becomes two-dimensional.

This was captured by a satellite with incredible spatial resolution.

The overall characteristics are really straightforward.

Equatorial regions are warm due to the high amount of solar radiation.

The poles are cold due to the lack of solar radiation.

This will develop ice caps in Antarctica and the Arctic.

If you dive deep into the ocean, or even just stick your toes in, you'll see that it gets colder as you go deeper, and that's largely because the bottom water in the deep ocean is a cycle of cold, dense water from the polar regions.

If you go back 20,000 years, the Earth looks very different than it does today.

I'm going to show you one of the main differences you'll see if you go back in time a long time ago.

the ice cap was much larger

A mass of ice covered many continents and extended out to sea.

Sea level is 120 meters lower than now

The amount of carbon dioxide was much lower than it is today.

So the global temperature at that time would have been three to five degrees cooler overall, and the polar regions would have been much colder.

What my colleagues and I are trying to understand is how we transitioned from the cold climate of the past to the warm climate of today.

Studies of ice cores show that the transition from cold to warm periods was not as stable as you would expect based on the slow increase in solar radiation.

The reason you can see these in ice cores is that if you dig down into the ice, you can see the annual layers, which are also found in icebergs.

It's a blue and white layer like this

Ice cores contain trapped gas, so we can measure carbon dioxide levels, and know that they were low in the past, and the chemistry of ice can tell us about polar temperatures.

If you were to come from 20,000 years ago to the present day, you would notice an increase in temperature.

Temperature rise was erratic

Sometimes it went up sharply, it went into a plateau, and it went up again.

This was different in the north and south poles, where carbon dioxide levels also spiked.

we believe in a great connection with the sea

The ocean stores a lot of carbon, about 60 times more than the atmosphere.

It also acts to transport heat across the equator, and the ocean is rich in nutrients, which determines basic productivity.

To know what's going on in the deep ocean, it's imperative that you actually dive into it, see what's there, and investigate.

This stunning image was shot on a seamount about a kilometer deep in the international waters of the equatorial Atlantic Ocean, far from land.

Few people, including our research team, have ever seen footage of the ocean floor like this.

You're probably seeing new species that we don't even know about.

We just collect samples and sort them out in earnest.

I have bubblegum coral

Some brittle stars grow hidden in corals.

It's like tentacles growing out of the coral.

Coral, made up of various forms of calcium carbonate, is growing on the basalt of a giant seamount. This dark object is fossilized coral.

First we rent a survey boat

Oceanographic research vessel James Cook anchored in Tenerife.

beautiful

You don't have to be a sailor to understand

Sometimes I do it like this

This is the scene where we're making sure we haven't lost any valuable samples.

It's not always fun, like everyone's scurrying around, and I get really seasick, but most of the time it's fun.

We had to be good cartographers.

Such a spectacular distribution of corals is rare.

It's in deep water all over the world, but we really need to find the right place.

What you've just seen is a map of the world's ocean floor, and overlaid on top of that is last year's route.

It's been a seven-week voyage, and in just seven weeks, we've independently mapped about 75,000 square kilometers of the seafloor, and this is just a small portion of the seafloor.

Moving from west to east, on a large-scale map, the ocean floor looks featureless, but some of these mountains are as big as Mount Everest.

The maps that we create on board have a resolution of about 100 meters, which is sufficient for choosing where to place equipment, but not for observation.

That's why we need to have remote-controlled drones swim about five meters above the ocean floor.

So you get a map with a resolution of one meter at thousands of meters deep.

This remotely operated rover is research grade.

You can see a row of large lights on the top.

There's a high-definition camera, a manipulator arm, and lots of small boxes to hold the samples.

Now it's my first dive on this voyage, I'm diving in the ocean.

The unmanned probe dives at a fairly high speed so that it will not be affected by other ships.

If you dive deeper, you'll see something like this.

There are sponges that are about one meter long.

This is a swimming echinoderm, a small sea cucumber.

this is slow motion

Most of the footage actually takes a long time, so I'm fast-forwarding.

This is also a beautiful sea cucumber

You'll be amazed by the animals I'm going to show you.

I had never seen it before, so we were all surprised.

After about 15 hours of work, just when we were getting a little frustrated, suddenly this giant sea monster twisted past us.

it wasn't what we were looking for

We were looking for deep-sea corals.

i will show you a video

Small, about 5 cm long

It's made of calcium carbonate, so you can see the tentacles, and they're moving with the ocean currents.

Such creatures live for perhaps 100 years.

And as it grows, it takes in chemicals from the ocean.

The types and amounts of these chemicals depend on water temperature, pH and nutrients.

Once we know how chemicals are incorporated into the skeleton, we can go back and collect fossil specimens to recreate what the ocean looked like in the past.

This is how we collect corals in a vacuum and place them in sample containers.

I would like to say that this is very careful work.

Some animals live even longer

This is the black coral leiopathes, photographed by my colleague Brendan Roark about 500 meters below sea level in Hawaii.

4000 years have passed

If you take one of these branches and polish it, the width of the screen is several hundred microns.

Brendan put this to some analysis, and you can see the tracks, and he's been able to visualize real growth rings, which means that even corals at a depth of 500 meters can record seasonal changes.

But 4,000 years isn't enough to reach the height of the last ice age.

Then what should we do?

investigate these fossil specimens

Because of this, I'm really unpopular in the research group.

If you go down to the seafloor, there are big sharks, sea squirts, swimming sea cucumbers, big sponges here and there.

And then we collect all these corals and take them home and sort them.

They are of different ages, and if we know their ages, we can measure their chemical signals and help us understand what happened in the ocean in the past.

The photo on the left is a piece of coral that was taken, carefully polished, and then optically imaged.

The picture on the right shows the same piece of coral placed in a nuclear reactor to induce nuclear fission.

What is this analysis for?

Uranium has a very bad reputation, but I like it.

Collapse allows us to measure the rate and the age of the event.

If I remember the first time, that's what I wanted to find out in my climate studies.

Laser analysis of the uranium and daughter nuclide thorium in the coral reveals exactly how old the fossil is.

I'm going to use this beautiful video of the Antarctic Ocean to explain how we get information about ancient oceans from corals.

This video by Ryan Abernathy shows us the density of seawater at the surface of the ocean.

It's only one year's worth of data, but it shows how active the Antarctic Ocean is.

The box shows an area of ​​intensely mixed seawater density, especially the Drake Passage, which is one of the most tidal areas in the world, with tides flowing from west to east.

Because it flows over large mountains in the ocean, it mixes violently, and as it flows over large mountains in the ocean, it mixes violently, which allows it to exchange heat with carbon dioxide in the ocean and in the atmosphere.

Basically, the ocean breathes through the Antarctic Ocean.

We traversed the Antarctic straits, collected corals, and uranium dating made an astonishing discovery: corals were actually migrating from south to north during the glacial-to-interglacial transition.

I don't know why, but I think it's related to oxygen in food and water.

now from here

I'll describe the climate insights we got from Antarctic corals. We went up and down seamounts and collected coral fossils.

Here's my explanation

After studying the Ice Age, we learned that the deep Antarctic Ocean was rich in carbon, and the upper layer was a layer of low-density seawater.

This keeps carbon dioxide out of the ocean.

Later, we found intermediate-age corals that showed that seawater mixed during the climate transition.

This allows carbon to be released from the deep ocean.

If you analyze more modern corals, or actually just dive down to the ocean floor and chemically measure corals, you'll know that we've moved to an era where carbon can move in and out.

This is how we use coral fossils to help us learn about our environment.

see the last slide

This is an excerpt from the video you saw earlier.

A beautiful coral garden

It's unimaginably beautiful

Thousands of meters below water

there are new species

anyway it's a beautiful place

I've given you the real value of all the fossils out there, and the fossilized corals in the deep sea.

The next time you're lucky enough to fly or sail across the ocean, remember that at the bottom of the ocean are giant seamounts that no one has ever seen, and beautiful coral gardens.

thank you

(applause)

Imagine a world where numbers and letters printed in black seem to have color, where music and voices swirl in colored shapes, where words and names fill your mouth with strange flavors.

Jail tastes like cold hard bacon while Derek tastes like earwax

Welcome to the world of synaesthesia. It's the combination of two or more senses, a neurological trait that 4% of people have.

Synesthetes can not only hear my voice, but they can also see, taste, and feel my touch.

It has the same root as 'paralysis', which means 'not feeling anything', and synaesthesia means 'connected sensation'.

Like color and hearing, if you have one synesthesia, you have a 50% chance of having a second, third, or fourth synesthesia.

1 in 90 people perceive graphemes, elements of language such as letters, numbers and punctuation marks, as colored.

Some have genders and personalities

For Gail, 3 is active and athletic, and 9 is a pompous, elite-minded girl.

Conversely, the sound elements of language, or phonemes, trigger gustatory synesthesia.

For James, college tastes like sausage, so do other words that end in "-age", such as message

Synaesthesia is a trait like blue eyes, it's not a disease, there's nothing wrong with it.

In fact, synesthetes are better at remembering because of these extra cues.

For example, if a girl is reunited with someone she met a long time ago

"Well, she had a green name-

Because D is green Debra Darby Dorothy Denise

yes! Her name is Denise! "

Once perfected in childhood, the combination never changes

Synesthetes have a biological tendency to have very strong connections between neurons in the brain, but synesthesia manifestation requires exposure to cultural artifacts, such as calendars, food names, and alphabets.

What's amazing is that a single nucleotide change in a person's DNA sequence can change their senses.

Synesthesia thus provides an avenue for research into understanding the subjective differences that make two people see the same thing differently.

Sean, for example, prefers foods that have a blue taste, like milk, oranges, spinach.

A gene enhances the connection between the gustatory cortex in the frontal lobe and the color perception in the back.

Suppose a gene acts on a part of the brain that does not belong to the senses.

That way you can connect seemingly unrelated things It's all about metaphor Finding similarities in seemingly dissimilar things

Not surprisingly, synaesthesia is often associated with metaphorical artists, such as novelist Vladimir Nabokov, painter David Hockney, and composers Billy Joel and Lady Gaga.

But how do we, who don't have synesthesia, understand metaphors like "(sharp →) pungent cheese" and "(sweet →) kind person"?

Sight, sound and movement, sound and movement, are associated with parts of the brain so close to each other that even a poor ventriloquist can make it appear as if a puppet is talking.

Films can similarly make the sound appear to be coming from the actor's mouth rather than from the speakers.

So, internally, we are all synesthetes, and externally, we are unaware of the perceptual combinations that are happening all the time.

Crosstalk in the brain is the rule, not the exception

This is a very sweet story!

Raise your hand. Has anyone flown in this venue in the past year?

there are quite a few

So that means more than 3 billion people have the same experience each year.

When planes fly around the world with so many passengers on board, sometimes things like this can happen, and you get an epidemic.

I first brought up this subject when I heard about the Ebola outbreak last year.

What we've learned is that Ebola spreads through large droplets, which have a narrow reach, but many different kinds of diseases can be transmitted in the cabin of an airplane.

The trouble is, when I looked it up, I found these numbers, and it's kind of scary.

In the case of H1N1, an infected person took an airplane and infected 17 people on a single flight.

In the SARS case, 22 people were infected in a three-hour flight.

This is not a very desirable psychic ability.

Moreover, it is very difficult to detect these diseases in advance.

In fact, if a passenger on a plane is ill, or has an infectious agent in the latent period but before symptoms appear, the disease may be passed on to many passengers in the cabin.

How does it actually get infected? Air is pumped from the ceiling and sides of the cabin, as indicated by the blue arrows.

Exhaust from the filter The efficiency of the filter is high, and the exhaust port removes 99.97% of pathogens.

What I'm showing you is a swirling pattern of air currents.

When someone sneezes, the air circulates many times before being exhausted through the filter.

I thought, "This is a problem."

I don't have the money to buy a private plane to avoid this, so I decided to write computer software instead.

When you create a computational fluid dynamics simulation, you get much higher resolution data than you can actually measure from an airplane.

So how do we do that? Let's start with a 2D drawing. These are the technical documents available on the internet.

If you put these into 3D modeling software, you can create a 3D model.

We break that model down into smaller grids of subdivided elements that the computer can handle better.

You just enter where the air is entering and exiting the cabin, throw in the physics, and wait for the computer to calculate the simulation.

After examining the traditional cabin, we found that when the passenger in the middle seat sneezes, "Pescha!" comes across the faces of the other passengers.

I'm horrified

If you look at it from the front, you can see that it's not in good shape for the passengers sitting on either side of it.

If you look at it from the side, you can see the pathogen spreading forward and backward.

At first I thought, "This is not good."

After more than 32 simulations, we arrived at this solution.

Named Global Inlet Director Patent pending

It cuts the transmission of pathogens by 55 times, and increases the percentage of fresh air you can breathe by 190 percent.

So how this actually works is, you put this piece of composite material in an existing spot on the plane.

Installation is very cost effective and can be installed overnight

Just screw it in 2 places

But the results are spectacular.

Instead of the germ-laden air swirling around, we create a wall of air between the passengers, and we create a wall of air between the passengers, which creates separate breathing areas.

Again, the passenger in the middle sneezes, but this time we can see that it's effectively pushing the droplets down, so we can filter them out.

You can see the pathogens being pushed down directly from the side as well.

Same scenario, but with this installed, if the passenger in the middle sneezes, this time it goes straight to the exhaust, so it doesn't infect the other passengers.

So the two passengers sitting on either side would be able to breathe with virtually no germs.

If you look at it from the side, you can see that it's a very effective system as well.

In short, this system is wonderfully effective.

What this means is that it's not only effective for sneezing the middle passenger, but it's also effective for sneezing the window and aisle passengers.

What does this solution mean for the world?

Let's put the computer simulation into action, and you can see it in the three-dimensional model that I created using 3D printing technology, and you can also see the airflow going towards the passengers.

In the past, when the SARS epidemic occurred, there was a loss of 5 trillion yen worldwide.

A major disease outbreak in the future could cost more than 360 trillion yen.

In the past, to make any improvements to an airplane would have required taking it out of service for a month or two, spending tens of thousands of man-hours and hundreds of millions of yen.

But now, you can set this up overnight and see immediate results.

It's going to have to be certified, flight-tested, and approved by regulatory authorities before it can be put into practice.

But as I've shown you, sometimes the simplest is the best solution.

Two years ago, this project wouldn't have been possible because the technology at the time simply wouldn't have been possible.

But now, thanks to advances in computers and the development of the Internet, we are truly in a golden age of innovation.

What I want to ask you today - "Why wait?"

Let's create the future together today

thank you

(applause)

Imagine you're standing on the beach Look out over the ocean and the waves crash in There's blue as far as the eye can see

Let's think about the breadth and depth

Think, "How big is it?

how big is the ocean? ”

First of all, let's understand that there is only one ocean, and there are five regions in it, the Pacific Ocean, the Atlantic Ocean, the Indian Ocean, the Arctic Ocean, and the Antarctic Ocean.

These five are also called "oceans" and seem to be separate, but they are actually part of one big, big ocean, and most of the surface of the earth.

The ocean covers 71% of the planet's surface, roughly 360 million square kilometers, or about 36 times the size of the United States.

It's so big that when viewed from space, a large part of the Earth is the ocean.

Speaking of space, the sea is currently 1.3 billion billion 1.3 billion cubic kilometers of water

In other words, if you were to submerge the United States and pour more and more seawater over it, it would reach a height of 132 kilometers, far higher than the tallest clouds, reaching into the upper atmosphere.

That much would make the oceans 97% of the water on Earth.

And what's more, the ocean is 99% of the planet's biosphere, where life lives.

what do you mean

The world around us The land we live in All the continents together make up only 1% of our living space

1％！

everything else is the sea

the sea is so big

The sea is incomparably important to living things

Moreover, there is also an oversized terrain in the sea.

Just give me four

First of all, there is the world's largest mountain range in the ocean called the Mid-Ocean.

At about 65,000 kilometers long, this submarine mountain range is ten times longer than any land mountain range, the longest on land, the Andes.

Next, under the Danish Sea, there is the world's largest waterfall.

The volume of water that flows through this gigantic waterfall in one second is 116 times that of Inga Falls on the Congo River, the highest volume of water on earth.

And the tallest mountain in the world is actually under the sea.

Hawaii's Mauna Kea is 4,200m above sea level, but 5,800m is hidden below sea level.

If you measure from the snowy top to the bottom of the deep sea, it's about 10,000 meters, more than a kilometer higher than Mount Everest.

Lastly, speaking of Everest, the deepest valley in the world is the Challenger Ocean, which is 11km below sea level and six times deeper than the Grand Canyon.

If Everest is submerged, the summit will finally come 2.1km below sea level.

The depth of Challenger Sea is about the same as the height of the sky where airliners fly.

See, no matter where you look, the ocean is huge!

This is what determines the shape of this planet.It has an enormous landform, there is a large area where life can live, and almost all life on earth lives in the sea.

In fact, there are many things that we do not understand

But don't think that it's too wide, too big, too different, and unfamiliar

Half of the world's people live within 100 kilometers of the coast, and many others live near lakes, rivers, and marshes, all of which eventually lead to the ocean.

Human influence can be seen in every ocean, depth doesn't matter, distance doesn't matter

The ocean makes this planet, but really we make the ocean

What is at the center of the universe?

This is a fundamental question that humanity has asked for centuries.

It's been a strange journey so far in search of answers.

If you want to find the answer to this question in 3rd century B.C. Greece, you have to look at the night sky and believe what you see.

Aristotle was the one who asked this question at the time, and believed what he saw.

We thought that since we were standing on the Earth looking up at the sky, the Earth must be the center of the universe.

He thought that the sphere of the universe was made up of four elements: earth, water, air, and fire.

These elements surrounded each other in layers as a solid transparent sphere.

Each planet, a wandering star, had a transparent sphere.

The rest of the universe and the stars it contains were on the outermost transparent sphere.

If you look at how the sky changes over time, you'd think that this idea would work well for explaining the motion of the stars.

For centuries, this has been central to cosmology in Europe and the Islamic world.

But in 1543, a man named Copernicus proposed a different model.

he believed that the sun was the center of the universe

This dramatically new idea was not accepted by many.

In the end, Aristotle's idea was what it seemed, it was rational and very convenient for humans.

But subsequent discoveries made the Sun-centered model no longer negligible.

First, Johannes Kepler pointed out that orbits are not perfect circles or spheres.

Galileo's telescope then picked up that the motion of Jupiter's moons was completely independent of the Earth, orbiting Jupiter.

Later, Newton proposed the theory of universal gravitation, showing that all matter is attracted to each other.

Finally, we had to abandon the idea that the Earth was the center of the universe.

Shortly after Copernicus, in the 1580s, the Italian monk Giordano Bruno proposed that other stars were also suns with planets, and that the universe was infinite.

this idea is unacceptable

Bruno was burned at the stake for his radical proposal.

Centuries later, the philosopher Rene Descartes proposed what he called the vortex theory, that the universe was made up of vortices, and that each star was at the center of a vortex.

Eventually, we found far more stars than Aristotle had ever imagined.

When astronomers like William Herschel got their hands on far more advanced telescopes, they revealed that our Sun is really just one of many stars in the Milky Way.

Now, what are these "blotches" in the night sky?

It's another galaxy, just as big as ours.

Perhaps we're farther from the center of the universe than we ever thought.

In the 1920s, astronomers studying nebulae wanted to know how they moved.

According to the Doppler effect, the light of an object approaching us should be blue-shifted, and the light of a star moving away from us should be red-shifted.

But only redshifts were observed.

Everything was moving away from us at high speed.

This observation is one of the key pieces of evidence for a theory now called the Big Bang.

According to this theory, all matter in the universe was once singular particles of infinite density.

In this sense, the universe was at the center of itself.

But this theory rules out the idea of ​​a center, because there can be no center in an infinite universe.

The big bang wasn't just an explosion within the universe, it was an explosion of the universe itself.

Each new discovery proves that while our observations are limited, our ability to speculate and dream about what's out there is limitless.

What we think we know today may not be the same tomorrow.

Like many of the thinkers I've met here, sometimes bold guesses lead to humble but surprising answers, and even more troubling questions.

Ever help set the table or don't know where to put your forks?

Seated at a restaurant Have you ever been unsure which one to use?

Here are some simple traditional etiquette tips for table settings

What if we set the table like this?

It's not pretty, and before you can start eating, you have to clean up first.

let's start over

First, use either a mat or a tablecloth to keep the plate off the table.

It's more a matter of looks than manners, but unless you're on a picnic, it's unusual to have nothing under your plate.

Place your favorite decorations such as flowers and candles

Candles are usually used only at night

Start with what you're going to use for your main course Place your dinner fork on your left and your dinner knife on your right Place it next to your hand

Here's a helpful tip: Always work from the outside in. So for salads, put the salad fork on the outside of the dinner fork and the salad knife on the outside of the dinner knife.

Eat the salad first, then the main course.

The point here is that the edge of the knife is pointing toward the plate.

It's an old tradition, back when dinner knives were much sharper.

You can also eat the soup, because the soup is usually served first, so the soup spoon is on the outside of the knife, so you use your right hand.

Here's another tip: put only what you need on the table

If you don't eat soup, you don't need a soup spoon

Now, I'm going to eat ice cream for dessert, and I won't need it for a while, so I'll put a dessert spoon on top.

Note that the tip of the spoon is pointing to the left

This way, when it's time to use it, just move it down and it'll be in the right place.

If you're going to eat the cake, turn the fork 180 degrees so it's facing the right side for the left side.

Let's put the plate next

You can also serve food directly from the kitchen to the table.

Place the bread plate on the top left and place the butter knife diagonally on the plate, again with the blade facing inwards.

There's only one space left

Place the wine glass to the top right and the water glass diagonally to the left.

If you're like me and have trouble remembering which one, just remember water and wine W-A and W-I A and I alphabetically from left to right.

Another tip: To remember the order of bread and drinks from left to right, remember B-M-W like car brands.

B is bread and is placed on the left. M is meal, so it is placed in the middle. W is water. Place water on the right.

Finally, the napkin is traditionally placed on the left side of the fork, but it can also be placed under the fork.

A neat seat like this one takes up a lot of space, so I put it in the middle.

I'm ready

Hope these tips help you next time you're asked to set the table or have a proper meal.

bon appetite!

Some superheroes can be as big as Bill

It's so scary!

But if you're a scientist, you should ask where all that extra matter comes from.

According to the law of conservation of mass, mass cannot be created or destroyed, which means that even if the hero's body changes size, its mass should remain the same.

For example, when you bake a fluffy sponge cake, the resulting size is much larger than it was before you put it in the oven.

Even when the molecules are rearranged in a chemical reaction formula to form a new compound, its chemical composition remains the same as before.

When the hero becomes gigantic and triples in size from 2m to 6m

According to Galileo's law of squares and cubes, weight is multiplied by 27. 3 x 3 x 3 = 27. Multiplying 3 3 times expands it in all three dimensions.

So there are two possibilities when superheroes become gigantic.

1. Even if the height is 6 meters, the weight remains 100 kg, the same as when in human form.

2. At a height of 6 m, the weight is 2,700 kg, which is 27 times 100 kg, and the weight is 2,700 kg, which is 27 times 100 kg.

You won't be able to get on the elevator with him because the buzzer will sound.

Scientifically speaking, the second is somewhat more realistic, but the problem is how can he walk through the park without sinking into the ground, because the pressure he exerts on the ground is calculated as his weight divided by the area of ​​the soles of his feet.

And when you run, do you think there's a super sock or super shoe that can withstand the tremendous friction caused by a weight of 2,700 kg against the road?

I wonder if I can run in the first place?

Don't ask me where I can get stretchy pants that can be huge.

Let's think about what happens to the density in the two possibilities above.

Density is mass per volume

The human body is made up of bone and flesh and has a range of densities.

One possibility of weighing 100 kg at any given time is that when it's normal size, it's made of bone and flesh.

If you still weigh 100 kg and you get big, you should look like a big fluffy teddy bear You should look like a big fluffy teddy bear

In the second possibility, I always weigh 2,700 kg, and I have to be 6 meters tall, have a flesh-and-bones body, and have to support 2,700 kg on my two thin legs.

Every time you move, your entire weight changes angles on your leg bones.

Bone is hard, but it's inflexible—it doesn't bend, so it's very fragile.

Risk of tendon tear

Tall buildings stand up because they have steel frames and don't run around in the jungle.

But our hero just landed at a bad angle and it's going to be terrible.

Assuming that the body mechanism is the same as that of mammals, in order to move the 2,700 kg body, the heart must pump a huge amount of blood to supply oxygen to the whole body.

That requires a lot of energy. You have to eat 27 times 3,000 calories every day. You have to eat 27 times 3,000 calories every day.

About 150 Big Macs—

27 times 3,000 calories is 81,000 calories, equivalent to 147 550-calorie Big Macs 81,000 calories, equivalent to 147 550-calorie Big Macs

You don't have time to fight crime because you'll be eating all the time and you'll have to work nine to five to pay for your food.

What about superheroes who can turn their bodies into rocks and sand? What about superheroes who can turn their bodies into rocks and sand?

Everything on earth is made up of elements

The type of element is determined by the number of protons in the nucleus

The periodic table of elements is arranged in order

Hydrogen has 1 proton Helium has 2 Lithium has 3 etc.

The main component of ordinary sand is silicon dioxide.

The human body, on the other hand, is made up of 65% oxygen, 18% carbon, 10% hydrogen, 7% other elements, and only 0.002% silicon.

Chemical reactions change the combination of elements to form new compounds.

So where do you get the silicon you need to turn your body into sand?

Elements can be changed by nuclear fusion and fission Elements can be changed by nuclear fusion and fission

But nuclear fusion requires a lot of heat, and it only happens naturally in stars.

In order for fusion to occur quickly, the temperature of the location must be hotter than the sun The temperature of the location must be hotter than the sun

All the innocent people around me will be charred black

Sudden nuclear fission isn't so bad either, because it creates a lot of radioactive particles.

So our hero becomes a walking and talking nuclear power plant that harms everyone who tries to help.

Would you still want to have the heat of the sun and a nuclear power plant inside you? Would you still want to have the heat of the sun and a nuclear power plant inside you?

Which psychic physics should I study next? Which psychic physics should I study next?

The power to change the size and composition of the body The power to move at super-high speed The power to fly The power to create superhuman strength The power to be immortal

There are superheroes who can teleport faster than the wind.

In 1969, Apollo 10 re-entered the Earth's atmosphere at a speed of 40,000 km/h, the fastest ever.

Don't you think it would save a lot of time if you could move quickly like that?

What are the pitfalls?

the air is not empty

The air that surrounds us is made up of elements like oxygen and nitrogen and millions of dust particles.

As you pass through these substances, your body and substances rub against each other, creating great friction and generating heat.

Just like rubbing your hands together to keep warm when it's cold or rubbing wood together to make a fire, the faster things rub against each other, the more heat they produce.

So if a person were to run at 40,000 km/h, the heat from the friction would burn their face.

Even if you manage to endure the heat, the sand and dust in the air will rub all over your body, and you'll be covered in countless cuts all at once.

Have you ever seen a bumper on a car or a front grill on a truck?

What if a bird or bug hits your open eye or exposed skin?

Alright, let's put on a mask and protect our face.

But what about the people and buildings between where you are and where you want to go?

It takes about one-fifth of a second to react to something in sight.

By the time you see and react to what's in front of you, time times speed = distance, so 1/5 of a second times 40,000 km/h 1/5 of a second times 40,000 km/h So the distance is about 2 km.

Or, worse, if we were invincible, our bodies would turn into missiles that would destroy everything in our path.

If you travel long distances at 40,000 kilometers an hour, you either burn, you get covered in bugs, or you don't have time to react to your surroundings.

How about a short trip to an area in sight with no obstacles in between?

For example, let's say a bullet is about to hit a beautiful girl in distress.

Our hero grabs her at lightning speed and takes her to safety.

This sounds romantic, but in reality, the girl will suffer more damage from the hero's super-fast movement than from the bullet.

Newton's first law of motion, the law of inertia, is the force that resists changes in the state of motion.

An object will continue to move or stay in the same place unless something tries to change it.

Acceleration is the rate of change in velocity over time

If the girl was stationary, her speed would be 0 km/h, and she would start accelerating and reach her top speed within seconds.If her speed rapidly increased to 40,000 km/h, her brain would hit the side of her skull and shatter.

Also, when she stops abruptly, her speed rapidly returns to 0 km/h, and her brain now hits the other side of her skull and gets messed up.

The brain is so fragile that it can't respond to sudden movements.

The same goes for other parts of the body

Look, speed doesn't hurt you, because the Apollo 10 astronauts made it home safely. Acceleration and sudden stops can hit your internal organs against the sides of your body, just like a bus driver who hits the brakes hard and almost falls forward.

What the hero did to the girl was technically like hitting her with the fastest space shuttle.

girl will die instantly

The hero will pay the poor girl's family an apology and a large amount of alimony.

I may also get jail time.

Doctors must have liability insurance against medical errors.

How much does superhero insurance cost

Now, which special ability would you like to take a physics lesson about?

The power to change the size and contents of the body The power to fly at super speed The power to fly in the sky Super strength The power to immortality Or the power to become invisible?

If one day you wake up and become 1000 times stronger, how should you spend your days?

Everything around me will become fragile It's a thousand times more powerful!

You have to be careful not to break your bones when you shake hands, and you must not strangle them when you hug them.

Eating broccoli with a fork without breaking through a plate would be as difficult as brain surgery.

For example, let's say it's time to save a tragic heroine who fell out of a helicopter.

open your arms and wait for her

Then, the next moment I caught her, she was dead.

Why?

Pressure is force divided by area

The smaller the area, the higher the pressure

So you can lift something heavy and it won't tear your skin, but one needle prick will bleed.

To calculate the pressure on her body, divide the force by the area of ​​the arms in contact with her.

It doesn't matter if you're strong enough to catch her without breaking a bone.

Her spine is so weak it breaks when you catch me

Even if you rip open the door over there and increase the area, you can't save her.

You don't die because you fell, you suddenly stop on the ground

Let's say you fall from the 32nd floor About 90m You're 180cm Even if you stretch your back and raise your hands and hold the door, it's about 3m Even if you think that the area has been expanded and the pressure will be dispersed, all you've done is raise the ground by 3m

It fell from 90m to 87m. The speed just before collision was about 50m. Air resistance is not taken into account.

It's the same as hitting a wall door at about 150km/h.

The only way to save her is to fly

But there is another scientific question...

Suppose you can fly First, jump up and descend at the same speed as her Hold on tight and slow down until you come to a complete stop

You'll need a cushion of space between her fall point and the ground.

I can't waste a single second Because she's getting closer and closer to the pavement while I'm changing into superhero clothes and jumping

She fell from a great height And she's close to the ground If I can't help her until the last minute, I can't help her anymore If I can cast a spell on the pavement and turn it into a marshmallow, then I can slowly stop

So get some chocolate and crackers and let's eat

Hmmm good!

Now, which special ability should I study physics for next?

Is it the ability to become gigantic? Or the power to become transparent?

power of immortality

In movies, the king is often searching for the secret to gaining immortality.

But is it really that good?

A year is 10% of a 10 year old boy's life

But for a 40-year-old mother, one year is only 2.5% of her life.

The same year, 365 days, feels different in length depending on the person

If you live to be 82, that's about 30,000 days.

If this boy lives 30,000 years, a year will feel like a day

And even if I could endure millions of years without getting tired of it, I'd be very lonely and sad, because I'd lose all the people I loved.

But what if everyone had the power of immortality?

First of all, the size of the earth is limited.

Where should I live?

"Excuse me!" "That's my face!"

"Stop!" "Excuse me."

"This place is cramped!"

Remember what we did last year? What about when you were five years old?

How long have you forgotten the past?

If you can't remember when you were five years old - how can you remember a thousand years ago?

What about a million years ago?

Because of the limited capacity of our brains, we don't remember everything that happened in the past in detail, and unwanted memories - like the PIN code for your locker in middle school - get overwritten with relevant information.

If this immortal young man finds a lover every 100 years, he will have 10,000 lovers in a million years.

So how can you remember the names of 10,000 girls?

It completely changes the meaning of dating

It would be so? The power of immortality has another drawback: Humans weren't always dressed alike.

This is familiar with Darwin's theory of evolution

For example, if women prefer taller men, taller men will have more children and will pass on more of the taller genes.

So in the next generation, more children will carry the taller gene.

Repeat this for a million years, and the average height would be much taller than it is today, barring natural disasters that would wipe out tall people.

our ancestors were short apes

I still have hair, but I don't look like an ape anymore.

If only you were immortal, everyone else would continue to evolve generation after generation, and you would look very different from those around you.

"Hi there"

If our ape ancestors were still alive, how many people would be willing to make friends without calling the Museum of Natural History?

One more physical consideration of immortality: wounds.

After all, immortality doesn't mean invincible, it just means you can't die.

I can't guarantee how you'll survive

I want you to look at your body and count the scars

If you bear a lot of wounds that leave scars, how many wounds will you have by the time you reach 1000 years old!

Now, about 185,000 people in the United States are discharged from the hospital each year with amputations.

This is due to an accident or illness

If you only live for 100 years, it's certainly a small percentage compared to the total population.

But if you live for a million years, the odds of you having all four limbs are pretty slim.

What about little decorations - eyes, noses, ears, fingers and toes?

what about the teeth?

What are the odds of having healthy teeth for 100 years?

in a thousand years?

in a million years?

You might end up looking like a messed up Mr. Potato Head with missing parts and teeth

Now, do you still want eternal life?

Which special ability physics lesson would you like to take next?

The power to manipulate the size and contents of the body The power to fly at super speed The power to fly in the sky Super strength The power of immortality Or the power to become invisible?

(Nicole Paris) Hey TEDYouth, let's go!

(beatbox) TEDYouth, come on (beatbox) (end of beatbox) Are you ready?

(Cheers and applause) Are you ready?

(Ed Cage) Yay!

(Beatbox) (Laughs) (Ed) Do you like it? I used to do it like this (Nicole) try it

(Ed) In the 90s when I grew up

(Beatbox) (End of beatbox) (Laughs) (Beatbox) (Nicole) Hey, wait, wait, wait, wait!

What should I do

you want to fight me

wait wait a minute

Remember when you beatboxed me to sleep?

(Ed) Of course

When Nicole was a baby

I was doing it like this

(Beatbox) (Nicole) I remember that

(Beatbox) (Nicole) Got it, got it, stop it

wait wait wait wait

(Ed) You all remember this video, right?

This is like repayment to the 50 million people who called me a loser.

(Nicole) Wait a minute

Most people don't know what a beatbox is in the first place, so we have to start there.

(Ed) That's right

(Nicole) where it all started

Let me tell you a little bit of its history, just a glimpse of where it all began.

(Ed) Beatbox started here in NY

(cheers) Yes, New York, New York!

"Yay!"

we're from saint louis

(Laughs) (Nicole) You can all put your hands down.

(Laughter) (Ed) But beatboxing started here in New York

When you guys go to parties, there's DJs and rappers

But my body can't generate electricity, so I had to do what Beat does.

That's why you often see beatboxers sitting right next to you, don't you think?

So when the rappers start rapping, you know we're doing a simple beat 'cause the backing beat is simple (beatbox) or (beatbox) It was a simple beat

But now there are people who want to put a beat on everything and try to embarrass their own father It's wrong to want to embarrass someone who pays for their education (Nicole laughs) Especially when there's an audience of 50 million people Just hanging around and calling people "losers"

you're a terrible girl

But at home we do different things We have jam sessions Sometimes we jam in church

In church we look at each other like this (Beatbox) (Laughter) And text each other this beat

Whether you're cooking in the kitchen, driving or at the airport

(Nicole) Standing in a corner, "Papa, listen to me."

(Beatbox) I'm just joking, but do you know?

This jam session and so on, we talk about all sorts of things

(Ed) yeah

(Nicole) Shall we liven it up a bit? How about a little jam session?

(Nicole) Want to improvise something? (Ed) Are you ready?

(cheers) (Nicole) Huh? Inaudible

(cheers) Let's go!

(Beatbox) (Applause) (Beatbox) (End of beatbox) (Applause) (Nicole) Let's go!

(Ed) Are you ready? Standing! Hey everyone stand up!

Let's start! Now stretch your body!

(Beatbox) (End of beatbox) (Nicole) It's over

(Cheers and applause) Thank you! see you!

(Ed) Thanks everyone!

(Nicole) See you soon! see you!

thank you!

If you could fly in the sky without using tools or machines, how fast would you be able to fly?

As of 2012, the world record for sprinting at full speed is approximately 43 km/h.

The speed of running is determined by how much force the runner's legs produce.According to Newton's second law of mechanics, force is mass multiplied by acceleration.

Furthermore, the third law states that for any action there is a reaction of equal magnitude and opposite direction.

So to run, you need a ground that you can step on and return force to the runner's feet.

Flying is more like swimming

Michael Phelps is the fastest human in the water and has won more medals than anyone else in Olympic history.

how fast do you think

The answer will surprise you

His fastest record is under 8km/h.

With Phelps in the water, even a kid could easily run past him, but why?

Let's go back to the third law of Newtonian mechanics

When you run, your body moves forward.When you kick the ground with your feet, the ground pushes your feet back, so you keep moving forward.

the ground is solid

So each particle is stuck in one place, it's not going anywhere, it's pushing back, but water is a liquid, so it's easy to move.

When you move your hands and feet to draw water, some of the water molecules move and change their position, instead of being pushed back.

think about flying

There's more free space in air, and the molecules are free to fly around, so the energy you add is wasted even more.

To move forward, you have to push a lot of air backwards.

When astronauts navigate the shuttle in zero-gravity space, they have to hold onto handles on the floor and ceiling.

But if I had the ability to float in the sky

How do you move in the middle of the road?

Do you think you can go far if you go through the air?

Absolutely not!

Let's say it has the ability to float and has the speed to move well, but what about how high it flies?

According to the ideal gas equation of state, PV = nRT Pressure is proportional to temperature, so pressure and temperature rise and fall at the same time

Because when the pressure is low, the air expands, and when the pressure is low, the air expands, so there's more space for the molecules to move around, they don't collide with each other, and they don't generate heat.

Atmospheric pressure drops sharply as altitude increases, so if you fly over clouds, it's freezing cold.

You have to wear a lot to keep your core temperature above 35 degrees or you won't be able to stop shivering and your mind will start to go haywire and eventually you'll fall out of the sky Hypothermia will make your muscles - disobedient!

According to the ideal gas equation of state, the volume of the gas increases as the pressure decreases.

If it rises too quickly, the internal gases expand rapidly, like shaking a soda bottle.

This phenomenon is called burrowing sickness, decompression sickness, or diving sickness, because the same thing happens when a deep-sea diver suddenly tries to rise to the surface.

The result can be pain, paralysis, and even death, which is made worse by the way the blood bubbles.

So let's say you want to fly a few meters off the ground, where you can see the road signs and have easy oxygen.

But you still need goggles and a helmet. Protect yourself. Birds, insects, road signs, power lines, and there may be other flying people and flying police officers.

If you hit something in the air and you lose consciousness, you're head over heels until you hit the ground.

Without the laws of society and physics, flight is the highest ability.

Even if you can levitate in the air by just a few centimeters and only have the speed of a snail, don't you think it's a cool ability? Hey you?

After all that's right

Which special ability physics lesson would you like to take next?

The power to become gigantic The power to fly at super speed The power to fly Super strength The power to be immortal Or the power to become invisible?

Wouldn't it be wonderful if... I could be invisible!

You think so?

Because you can follow someone without being noticed and do whatever you want!

Magicians have already created the illusion of making people disappear by reflecting light in large mirrors.

Scientists can use metamaterials to guide light around small two-dimensional objects Can guide light around small two-dimensional objects

With a camera, you can project what's behind you and project that image With a camera, project what's behind you and project that image, and you can even make it look like you're transparent from the front

But none of these methods can make a human-sized object appear transparent from all angles and distances while in motion.

But if you're really transparent inside and out, you're going to run into some unexpected problems.

First, you have to be naked to move around without anyone noticing.

It doesn't matter how cold it is outside

And you can't carry anything, not even your wallet or your keys, or you'll see your wallet and keys floating in the air.

Cars and pedestrians can't see you either, so they'll probably bump into you somewhere.

Oh yeah, don't wear perfume or listen to your breathing, they'll know you're there

And just because you've become transparent doesn't mean you'll stay that way forever

What if someone accidentally spills hot coffee on you?

What if it rains?

That said, if you think liquids are the only things that need attention, you're dead wrong.

Dust is made up of many things, including dead human cells, tiny particles of soil, and fibers of cotton cloth.

It sticks to damp skin when you're sweating, and sticks to the fine hairs on your skin when you're dry.

So even if you're transparent, the dust sticks all over your body

Normally you don't notice dust on your skin, but that's because you can't see the thin layer of dust that hides behind the color of your skin.

But if it's transparent, you're going to have a human-shaped clump of dust walking around on the very dirty soles of your feet.

Wow!

What do you think the world would look like if you were transparent?

The answer is "I can't see anything"

You can't see anything in the dark because there's no light

To see an apple, the light must hit the apple and bounce back to your eyes.

Then the retina of your eye receives the reflected light and the brain creates an image of an apple.

If you're transparent, naturally light will pass through or around your body.

So the retina of your eye doesn't receive light either.

Your brain can't create images

Can you see yourself without a mirror to catch the light?

I can't

That's why no one can see it, but you can't see it either

I was there!

Now, have you ever wondered if it's possible to stay invisible forever?

If it were possible, could the doctor heal me when I got hurt?

Doctors can't see me, so I don't know where to apply medicine or wrap bandages.

I can't see you

What if I get sick or have an infection?

If you can't see the color change or swelling, how can you diagnose it?

And what if everyone was forever transparent?

Don't you think the world would be boring if no one was visible from the street? From the TV, from the house, from the computer, look like this

It's sad to be transparent

Now, which special ability would you like to take a physics lesson about?

The power to change the size and contents of the body The power to fly at super high speed Super strength The power of immortality Or the power to become invisible?

Remember when you found out your computer wasn't just a monitor and keyboard?

Between the click of the mouse and the video starting to play, there's something about capturing your intent, understanding it, and making it happen.

What is that?

A small demon fiddling with a machine?

Let's imagine that we can shrink our bodies down to the size of an electron and dive into the clicked mouse world.

If you take the mouse apart, you'll see that it's a very simple device.

It contains a set of buttons and a system that measures the direction and distance of movement.

Optical mice measure with light and sensors, and older mice use a hard rubber ball and a plastic disc.

both have the same idea

When you click a mouse button, the mouse sends a message to the computer containing location information.

When a mouse click is received, the basic input/output system (BIOS) takes care of it

This subsystem works like a computer's eyes, ears, mouth and hands.

It basically provides a way for computers to interact with their environment.

But the BIOS also acts as a buffer to keep the CPU from being overwhelmed with all these things.

In this case, the BIOS thinks mouse clicks are very important and interrupts the CPU.

"Hey, CPU-kun, there was a click."

The CPU, also called the central processing unit, is the brain of the entire computer.

Like your brain doesn't occupy the entire body, the CPU is just another part of your computer, but it always does the same job.

And the CPU's job, all of its job is to read the instructions out of memory and execute them.

While you're typing very quickly, about 60 words per second, while you're still typing, the CPU reads and executes billions of steps per second in parallel.

That's right, billions per second. It's the steps you take to move your mouse around on your screen, the steps to bring up the clock app on your desktop, the steps to play internet radio, the steps to edit files on your hard drive, and so on.

Your computer's CPU is a monstrous concurrency performer.

"But there was an important mouse click just now!

Aside from everything else, we have to handle the clicks! ”

There are other programs for the CPU to process.

A program that specializes in handling the mouse, a clock program, a network radio program, and a program that processes the characters sent from the keyboard.

Such programs were originally written by humans in a human-readable programming language, such as Java, C++, or Python.

But human-written programs take up a lot of space and contain a lot of information that computers don't need, so programs are compiled into smaller chunks and stored in memory with bits that are either 1's or 0's.

The CPU realizes it needs instructions on what to do with a mouse click, looks up the address of the mouse program, and sends a request to the memory subsystem asking for instructions.

The individual steps of the mouse device driver are read and executed flawlessly

But that's not the end of the story!

Because when the CPU sees that the mouse has been clicked, and sees that the cursor was over the image of some button on the screen at that time, the CPU accesses memory for the monitor program to figure out what that button was.

Then the CPU needs to access the memory for that button's program, because the CPU will ask the monitor program again to display the video associated with that button, and it will play.

So between the time you click the mouse and the button flashes on the screen, there are so many programs running.

The simple act of clicking your mouse will take you through all of the critical components that make up your computer: peripherals, BIOS, CPU programs, and memory, but you're not included.

Float in the warm and comfortable pool and say, "It would be cool if I could become an astronaut!

I wish I could float in space and look down on the earth."

Have you ever wondered?

But it doesn't float in space

Being in space, orbiting the Earth, is free fall.

it's falling towards the earth

It's falling toward the earth.

When you're in orbit around the Earth, when you're in orbit around the Earth, this goes on for hours and days and hours and days, it goes on and on.

This goes on forever This goes on forever

To know what it means to be on track

Let's take a look at Newton's book

Newton imagined an experiment like this Newton imagined an experiment like this Taking a cannon up a hill Taking a cannon up a hill

When you fire a bullet, it jumps a little further.

I thought that if I launched harder, it would fall just beyond the curve of the Earth, and if I fired harder, it would fall just beyond the curve of the Earth.

Now, if you fire much harder, the bullet should circle the Earth, come back, and hit your back.

Let's zoom out all the way and imagine that we're inside a satellite above the North Pole. Let's imagine that we're inside a satellite above the North Pole.

It seems like it hits the ground when it falls

moving laterally at great speed

Even if you fall, don't hit the ground

It comes next to the Earth, it falls again, but the Earth pulls the satellite sideways.

It's being pulled down, so it doesn't hit the ground again, it's under the earth.

Earth tries to pull the satellite up, but it's still moving sideways, so the Earth tries to pull up the satellite, but it's still moving sideways.

It doesn't hit the ground. It's on the side of the earth.

As it moves up, it pulls sideways from the earth, so it falls sideways

It also moves up and doesn't hit the ground.

And then it's back over the North Pole again, and it's going sideways and falling down, so you know what's going to happen.

It moves so fast that it doesn't hit the ground.

Astronauts orbiting the earth

It's falling toward the earth, but it doesn't always hit the ground, it's always falling.

It feels like you're falling, so you just have to get used to it.

Theoretically, if you run fast enough and stumble, you can fly off the earth.

But there are big problems

First, you have to run at a speed of 8 kilometers per second.

It's 29,000 kilometers per hour, the speed of Mach 23!

There's another problem. If you run that fast, when you go around the Earth and come back to where you came from, of course, there are people and things that get in the way when you go around the Earth and come back to where you came from, but there's a lot of air resistance.

burn out

so i don't recommend

There are many myths and misconceptions about biological evolution.

let's think again

You probably know that evolution is accepted by most scientists, but some people still doubt it.

Even if you're not a skeptic and you think you know a lot about evolution, it's very possible that some of the things you believed about evolution were wrong.

This is an old theory that has now been debunked: the theory of evolution.

About 60 years before Darwin published On the Origin of Species, Lamarck believed that organisms evolve by growing to develop certain traits over their lifetime and passing them on to their offspring.

He gave the following example, explaining that giraffes struggle all their lives to stretch their necks to eat the leaves of tall trees, resulting in offspring with longer necks than their parents.

But now we know that the genetic mechanism is different from this hypothesis.

In fact, individual organisms never evolve.

Instead, a random mutation in the gene produces a giraffe offspring with a slightly longer neck, and that individual has a better chance of surviving than others -- this is known as the "survival of the fittest" theory.

According to this theory, the biggest, strongest, and fastest creature in evolution would always be the winner, but that's not actually the case.

The reason for this is that evolution's focus on adaptation is "how well you fit into your environment."

If tall trees were to die out and only short grass remained, a long neck would be a disadvantage for giraffes.

Second, it's not "survival" that enables evolution, but "reproduction" that enables it.

What if all the creatures in the world were like the male anglerfish, so tiny and so weak at birth that they had to find a female to mate with so quickly before they died?

If an organism dies without leaving offspring, isn't it a wasteful death from an evolutionary point of view?

No!

Recall that natural selection occurs at the genetic level, not the individual level of an organism, and that genes that are present in an individual organism have the same genes in their relatives.

That's why genes in animals that sacrifice themselves to keep their siblings and cousins ​​alive and facilitate future reproduction may thrive more than those that try to keep themselves alone.

An organism that can contribute to passing on more copies of its genes to the next generation serves its purpose as a species, but it fails its evolutionary purpose.

There's a common misconception about evolution that people usually say "genes try to make more copies of themselves" or "natural selection," both of which are actually metaphorical descriptions.

Genes themselves don't want anything, and there's no external mechanism for choosing the best genes worth keeping.

Evolution is essentially the random mutation of genes that causes various changes in the behavior and morphology of the organisms that carry them.

Some of the changes lead to the passing of mutated genes to the next generation, increasing their numbers.

Nor does evolution mean systematic change toward an ideal.

The blind spot in the human eye isn't ideal. The blind spot is where the optic nerve exits the retina. It's simply the result of eye evolution that started with a single, simple photoreceptor cell.

In hindsight, if humans had the tendency to want other nutrients and vitamins in addition to calories, they would probably have a greater survival advantage.

But for thousands of years as our ancestors evolved, calories were scarce, and "nature" could not have predicted that the day would come when they would be readily available.

This is how evolution proceeds blindly, step by step, and the result is the diverse world we see today.

Commas are very difficult, especially when they involve subordinate words and coordinating conjunctions. Especially when they involve subordinate words and coordinating conjunctions.

A few basic rules, some simple laws of physics, and some common scenarios will help you learn to use commas correctly.

Let's replace each part of the sentence with a character.

Let me introduce you to a few: the little coordinating conjunction, the powerful subordinating conjunction, and the clever comma.

Coordinating conjunctions are small and quick

It is a word that connects clauses, words, and phrases.

For easy memorization of coordinating conjunctions, remember FANBOYS

The coordinating conjunctions are for, and, nor, but, or, yet, so.

It's so small that most of the time you don't need the help of a comma, but that's not always the case.

On the other hand, the subordinating conjunction is the WWE World Heavyweight Champion of Sentence.

A subordinating conjunction connects two unbalanced things: a main clause and a subordinate clause.

Dependent clauses clarify what takes precedence in a sentence

Commonly used subordinating conjunctions are although, because, before, however, unless and even though.

Subordinating conjunctions are strong and strong, so they can lift a lot of weight.

But of course, sometimes even the strongest need the help of a wise friend.

Clever Comma is so kind that she walks around the neighborhood looking for ways to help people.

As soon as I left the house today, I saw a subordinating conjunction holding up two complete sentences, one in each arm.

"Barthelme loves to debate politics even though she usually loses"

The comma asked the subordinating conjunction if it would help

You know that subordinating conjunctions are the WWE World Heavyweight champions of sentences.

The weight is evenly distributed between the arms, so you can easily lift two complete sentences.

So even if Comma asked me to help, I was surprised that the subordinating conjunction wouldn't need help.

No, that's fine. See you next time!

So the comma rushed ahead

Soon the comma saw a subordinating conjunction trying to support the sentence that preceded it.

"Barthelme loves to sing, but never sings in public."

The comma asked the subordinating conjunction to help

I hate to admit it, but this time the subordinating conjunction needs help.

The complete sentence is quite heavy

A simple law of physics tells us that in order to support a heavy object, the weight should be balanced.

So subordinating conjunctions can support two complete sentences when you have weights in your arms, but it's hard to lift one.

Comma hurriedly rushes to the subordinating conjunction that is trying its best, but how can it help?

When the subordinating conjunction comes at the beginning of the sentence, the comma comes immediately after the first thought or complete sentence.

After helping with the subordinating conjunction, our heroine comma next finds a coordinating conjunction supporting two complete sentences.

"Barthelme was accepted to the University of Chicago and is on the alternate roster of Stanford University."

Comma asked the coordinating conjunction to help

Of course I need your help! quickly!

The comma hastily entered before the coordinating conjunction.

FANBOYS are not as belligerent as subordinating conjunctions

So commas aren't pushed behind FANBOYS.

Because FANBOYS are polite

put a comma in front of us

Helping others is not easy!

On the way back, commas find coordinating conjunctions supporting complete and incomplete sentences.

"Barthelme wants to major in molecular biology or creative dance."

Though exhausted, Comma asks the coordinating conjunction to help support the words.

This is one of those rare cases where coordinating conjunctions don't need the help of commas.

The coordinating conjunction reassures Comma that he doesn't need help Comma is relieved 'Cause Comma just wanted to go home and get some rest 'Cause Comma just wanted to go home and get some rest and prepare for tomorrow's grammar-checking job.

Here are some of the often overlooked but lucrative investment opportunities.

In the UK, over the past decade, cemetery returns in the real estate market have outperformed the average by a ratio of about three to one.

Private cemeteries are popping up, and plots for investors are being sold starting at about $7,000.

Expected growth of around 40%

The biggest advantage is that there's always demand in this market.

Now, the business proposition is real, and there are companies out there that actually offer these kinds of investments, but I'm interested in something else.

I'm an architect and urban planner, and I've spent the past year and a half exploring death itself, how we think about dying, and how death shapes our cities and our buildings.

So in the summer of 2014, I opened my first exhibition in Venice about death and architecture, called "Death in Venice."

A lot of people find death difficult to talk about, so I incorporated a playful element into the exhibition to make it accessible to everyone.

One of the pieces was an interactive map of London, showing just how much of the city's real estate is mortal.

Wave your hand over the map to reveal the names of properties like buildings and cemeteries.

All the white areas are hospitals, hospices, funeral homes and cemeteries in London.

But in reality, most of it is a cemetery.

What we wanted to make clear was that funerals and death are an important part of the city that surrounds us, even if we don't usually think about it.

About 500,000 people die each year in the UK, and about a quarter of them want to be buried.

But Britain, like the rest of Western Europe, has a shortage of burial places, especially in the big cities.

The Greater London Authority has been aware of this for some time, mainly due to population growth, and the fact that existing cemeteries are almost full.

In Britain, by convention, graves are to be owned permanently, but there are pressures from development, as some people want to use the land for housing, offices, and commercial premises.

A solution was proposed there

After 50 years, can the cemetery be reused?

The hope is that by burying the bodies four times deeper and burying four people in the same plot, we'll be able to make better use of the land and have a place to bury them for a while.

Local authorities, on the other hand, have traditionally not managed cemeteries.

Surprisingly, in England, no one has a legal obligation to secure a burial place.

Traditionally, burial sites have been secured by private religious bodies such as churches, mosques and synagogues.

There are for-profit organizations that just want to take a bite every once in a while.

If you look at the fact that cemetery lots are small and expensive, you could make a big profit.

In fact, if you want to run your own cemetery, you can do it.

This couple in South Wales were farmers and wanted to take advantage of the land next to their home.

I had a lot of ideas

We first tried to turn it into a trailer park, but it wasn't approved.

Then we thought about a fish farm, but that didn't get approval either.

That's when I came up with the idea of ​​building a cemetery, and it turned out that the land price, which was originally about 17 million yen, would go up to over 180 million yen.

Don't you think it's a little strange to just make money in a cemetery?

In fact, it's a misconception that cemeteries seem expensive.

It looks expensive, but in reality, the price reflects the cost of maintaining the cemetery, say, 50 years from now, we'll have to keep mowing the lawn.

So it's very difficult to make money in a cemetery.

That's why cemeteries are primarily run by local governments and nonprofits.

Still, private cemeteries can be built if the municipality approves.

So let me explain how it works. If you want to build something in the country, like a cemetery, you first need to apply for a building permit.

So if I'm contracted to build an office building, or if I'm building an extension to my house -- if I'm converting a store into an office, for example -- I have to draw a bunch of blueprints and submit them to the municipality for approval.

Municipalities confirm whether the building is suitable for the surrounding environment.

consider its appearance

Municipalities also consider the impact of their construction on the local environment.

And then I think about whether the building will cause pollution, or whether I'll build something that will cause more traffic.

Also consider the benefits

It's about whether the building can provide a local service, such as a store, that residents want to use.

This is how you weigh the pros and cons and make a decision.

The same is true when creating large graveyards.

So what if I have a little piece of land and just want to bury five or six people?

In that case, you don't actually need permission.

There are very few regulations on burials in England.

So if you want to create your own little graveyard, you can.

But will anyone actually try to make one? I'll do it?

If you're a nobleman and you own a large estate, you might build a mausoleum to bury your family.

But strangely enough, you don't have to own a certain amount of land to get a burial permit.

So, in theory, you could build it in the backyard of your suburban home.

(Laughter) What happens when you really try to make it?

Some municipalities have guides on their websites that may be helpful.

The first thing that's listed is that you need a burial permit before you can actually bury people.

(Laughter) And then we need to document the location of the graves.

But that's the only formal requirement.

It's been pointed out that neighbors may complain, but legally there is little they can do.

He also points out that the value of real estate could drop by 20 percent because of people who have profit expectations, hypothetically, how much a burial site is worth and how much they can make.

But the reality is that if you build a cemetery, no one will buy a house.

I'm interested in these things because they are the epitome of our attitudes toward death.

It's probably similar across Europe, but in the UK, only about a third of people have told others what they want to do when they die, and even only 45% of people over the age of 75.

The reason everyone gives is that they're not going to die yet, and they feel like talking about it would make people around them feel uncomfortable.

But there are people who will take it on our behalf to some extent.

Governments have different regulations and institutions about things like burying the dead, and there are people in funeral homes who are professionally devoted to the issue of death.

But our cities lack regulation, design, and thought beyond imagination when it comes to how death fits into our cities.

We're not thinking about this, and the people we thought were thinking about it weren't actually responsible.

thank you

(applause)

measure the circle

Radius and diameter are easy. They're straight lines, so you can measure them with a ruler.

But to measure circumference, you'll need to use a tape measure or a string, unless there's a better way.

It's clear that the circumference scales with diameter.

The ratio of the circumference to the diameter, the circumference divided by the diameter, is always the same regardless of the size of the circle.It is always the same regardless of the size of the circle.

Historians don't know when or how this number was discovered, but it was known about this number about 4,000 years ago.

Its approximation is referred to in the writings of ancient Greek, Babylonian, Chinese, and Indian mathematicians.

It is even believed that they were used to build the Egyptian pyramids.

Mathematicians got an approximation of this number by drawing a polygon inside a circle.

By 1400 AD, it was calculated to ten decimal places.

So when did we find an exact number that wasn't just an approximation?

Haven't found it yet!

The ratio of circumference to diameter is known as an irrational number, which can never be expressed as a ratio of two whole numbers.

We can get close, but no matter how close the fraction is to the correct value, there will always be a small margin of error.

So when you try to write it in decimal form, you end up with endless numbers that start at 3.14159, start at 3.14159, and go on forever! That number will last forever!

That's why instead of writing infinite numbers each time, we use the Greek letter pi. That's why we use the Greek letter pi.

Recently, to test the speed of computers, we've had them calculate pi, a computer with breakthrough performance that was able to calculate up to 2,000 trillion digits.

Some people compete to see how many digits they can remember Some people compete to see how many digits they can remember The highest memory record is over 67,000 digits

But the first 40 digits or so are generally used in science.

What is the scientific use here?

First, all the calculations that involve circles, from the capacity of soda cans to the orbits of satellites.

And not just pure circles

Pi is also useful for analyzing curves, so it's useful for understanding periodic and oscillatory systems, like clocks, electromagnetic waves, and even music.

In statistics, pi appears in the formula for calculating the area under the normal distribution curve. It's useful for everything from analyzing the distribution of standardized test scores to calculating tolerances for financial models or scientific results.

And if that's not enough, pi is used, for example, in particle physics experiments using the Large Hadron Collider, not only in that it's circular, but also in something much smaller: how tiny particles move in circular orbits.

Scientists have also used pi as a bewildering concept -- to prove that light behaves both as a particle and as an electromagnetic wave. And most impressively, pi is also used to calculate the density of the entire universe.

The Vitruvian human figure became the most famous symbol of the Renaissance in Leonardo da Vinci's paintings.

Why?

Is it just a drawing?

disappointing!

Let's try to answer this question mathematically first.

I know how to find the area of ​​a circle

Multiply the circumference by the square of the radius

I know how to find the area of ​​a square

bottom x bottom

But how can you make a square with the same area as a circle?

This is called the "circle problem," and it began to be proposed in the ancient world.

Like many ideas of the time, it blossomed anew during the Renaissance.

In the end, I found out that I couldn't solve this problem because of pi, but that's another story.

Da Vinci's painting is an ancient Roman architect Da Vinci's painting is influenced by the ancient Roman architect Vitruvius, placing the man firmly in the center of the circle and the square.

Vitruvius argued that the navel is the center of the human body, and that if the needle of a compass is aligned with the navel, a perfect circle can be drawn around the human body.

Besides, Vitruvius knew that the length of his outstretched arms and his height were about the same, so he placed his body inside the square as well.

Da Vinci used this idea to figuratively solve the circle problem by fitting humans into both figures.

But I didn't just have Vitruvius in mind.

One of the intellectual movements that flourished in Italy at the time was Neoplatonism.

The movement used a concept developed by Plato and Aristotle in the 4th century - the Great Chain of Being.

In this idea, the universe is divided into hierarchies, like a chain, starting with God at the top of the chain, then down to the angels, the planets, the stars, all living things, and finally the devil.

In the early days of this philosophical movement, humans were thought to be in the middle of this chain.

Humans eventually die, but because they have immortal souls, they divide the universe exactly in half.

Around this time, Da Vinci drew a Vitruvian human figure, but the Neoplatonist Pico della Mirandola had a different idea.

He took man out of the chain, and preached that man's unique abilities would take him to the position he wanted.

According to Pico, God wanted a creature that could comprehend the beautiful and complex universe he created.

That led to the creation of man, and God placed man at the center of the universe so that he could become whatever he wanted.

According to Pico, humans can choose to act like animals at the bottom of the chain or like gods at the top of the chain.

Let's go back to the picture. By changing the human posture, it is possible to fit shapes that do not fit, such as squares, perfectly.

If the universe is written in the language of geometry, this painting seems to say that humans can exist in any element of the universe.

In whatever shape you like, both geometrically and philosophically

In this single painting, da Vinci combined mathematics, religion, philosophy, architecture and the artistic techniques of his time.

No wonder it's been such a great symbol for so long.

please read this article

What do you think?

get annoyed?

Confusing?

What was the article about?

With dyslexia, you have to decipher words like this, and this is a simulation of that.

People with dyslexia always have a hard time reading.

Most people tend to think that people with dyslexia see letters and words with the front and back reversed. For example, "d" and "b" look reversed.

In fact, people with dyslexia see the same way.

Dyslexia is a problem with phonological processing, and it's not about how you see words, it's about how you "manipulate" words.

For example, if you remove the "c" sound from the word "cat", what would you say if you removed the "c" sound from the word "cat"?

It's "at"

Dyslexia can make this task difficult.

When presented with just the word "fantastic" without context When presented with just the word "fantastic" without context students with dyslexia cannot read it unless they break it down like this: fan tas tic

Because it takes so long to decipher, it's difficult to fully understand it at the same pace as other students.

As you've heard, it's common to spell "stick" as "stik", "stick" as "stik", "friends" as "frens", and "friends" as "frens".

More people have more symptoms than people think

1 in 5 people are said to have dyslexia.

symptoms vary

Some people have mild, some have severe

Dyslexia is also hereditary

It's not uncommon to have people in the same family who have trouble spelling, people in the same family who have trouble spelling, people in the same family who have trouble with spelling, and people who have trouble deciphering even short words like "catch."

Dyslexia comes in both strengths and weaknesses, and broader principles must be kept in mind when looking at how the brains of people with dyslexia process language.

Neurodiversity is the idea that, because each human brain is different in structure and function, and because each human brain is different in structure and function, we shouldn't lump brains that are 'normal' into one and brains that are not 'normal' into one and say they're sick or 'defective.'

Some people with dyslexia and other neurological mutations have creative genius and ingenuity, like Picasso, Muhammad Ali, Whoopi Goldberg, Steven Spielberg, and Cher, who have the power to live a glorious and successful life.

The brain of a person with dyslexia works in this particular way.

The brain has a left brain and a right brain

The left hemisphere is primarily responsible for language, or reading, while the right hemisphere is primarily responsible for spatial cognition.

Studies using fMRI have shown that people with dyslexia have more activity in the right hemisphere and frontal lobes than in the brains of people without dyslexia.

This means that when we read words, it takes longer for them to travel through the brain, delaying processing in the frontal lobe.

These nerve "bugs" make it difficult to read.

But people with dyslexia can also physically change their brains to improve their reading skills, using intensive multisensory therapy to break down language and teach it how to decipher words based on syllable and spelling rules.

The brains of people with dyslexia then use their left side of the brain more efficiently when reading, improving their reading ability.

This treatment is effective in correctly positioning dyslexia as "a difference in how the brain works," which of course brings attention to how the brain works differently in each person.

Neurodiversity emphasizes the spectrum of brain functions found in all people, suggesting that to better understand the perspectives of those around us, we should understand them not only through the perspectives of others, but through our brains.

You know that in a movie or a play, the actors read the script and memorize when and what to say, right?

There is a big artistic difference between the music that shows how to play

Like Beethoven and Justin Bieber, but neither.

We're using the same musical building block: the note. Even if the final piece is extremely complex, the reasoning behind the note is quite simple.

Let's see how it works in making music

Music is supposed to be written on five parallel lines, and these five lines are called staves, and they have two directions.

up and down and left to right

The up-down axis tells the player "pitch" or which note to play. The "pitch" or which note to play. The left-right axis tells the player "rhythm" or when to play it.

"Rhythm," which tells us when to play. First, let's talk about pitch. To make it easier to understand, I'm going to use the piano.

Western music traditionally

The pitch is represented by the first seven letters of the alphabet A B C

D E F G After that, this repeat A B C D E F G A B C D E F G

Why is it so named? For example, if you play an F and an F above or below it on the piano,

I think you'll find those sounds similar compared to other sounds like B.

Let's go back to the staff. Each line and gap between lines represents one pitch. On the line or between the lines.

When you write a note, it tells the performer what pitch to play, if the note is higher on the staff.

The pitch gets higher, but there are far more pitches than the 9 that can be represented by the 5 lines and the gaps between them.

A grand piano can play 88 pitches

So how do you squeeze 88 pitches into a staff? For that purpose, we use something called a clef.

This is the odd shaped thing at the beginning of the staff.

act as a reference point

Each line or gap indicates which note on the instrument it corresponds to. If you want to use a note outside the staff, add a line called a ledger line and write a note on it.

If you draw too many ledger lines it becomes confusing, so switch to a different clef to tell the performer when to play a note.

There are two basic elements: the beat and the rhythm.

it's boring it sounds like

There's no change, it's always the same, but I want you to be careful

speed is slow

It doesn't matter if it's fast, the second hand of the clock

Divide a minute into 60 seconds so that each second is the same length

A beat is the division of music into small pieces of equal length. With a fixed beat as the base, adding rhythm to the pitch makes music. This is a "quarter note."

The most basic unit of rhythm, which corresponds to one beat This is a "half note", which corresponds to two beats

This is a "whole note," corresponding to four beats.

This little thing is an "eighth note," which corresponds to a half beat.

What does this mean?

The little lines that separate the staves You might have noticed the little lines that separate the staves

This line is a vertical line

Each segment is called a "measure" at the beginning of the staff after the clef

There's something called a "time signature" that tells you how many beats there are in each measure.

This is 2 beats per measure This is 3 beats This is 4 beats etc etc.

Indicates the type of note used as a unit of beat 1 is a whole note 2 is a half note

4 is quarter note 8 is eighth note 8 is eighth note

This time signature indicates that there are four quarter notes in each measure 1 2 3 4 1 2 3

4 and so on But like I said before, just following the beat is boring Let's replace the quarter notes with other rhythms

Note that the number of notes in a measure does not change the number of beats in the measure.

What does the music made this way sound like? It's not bad, but it feels flimsy, doesn't it?

Pitch and rhythm—

Let's add a different instrument Look, it's become like music!

Reading sheet music quickly and playing an instrument certainly takes practice,

If you take your time and persevere, will you be the next Beethoven?

You could be Justin Bieber! You could be Justin Bieber!

English, as we speak, is a wonderful language, but it has a lot of mysteries.

For example, most of the time, when we talk about more than one thing, we put an S at the end of the word.

One is a cat, two is a cat

On the other hand, there are some words that work differently.

If there is only one man, it is man, but if there are friends, it is men, and if there are several women, it is women.

But if there's only one woman, say woman

One goose is goose, but multiple is geese So why is moose called mooses instead of meese?

I have two feet, but why are two books called books instead of beek?

In fact, if you were speaking English over a thousand years ago, you would have called two or more books a beek.

If Modern English is weird, then Old English needs therapy.

Believe it or not, English was a much more difficult language to learn than it is today.

2,500 years ago, English and German were the same language.

The two gradually diverged, and little by little the differences grew.

So early English had genders in inanimate objects, just like German.

Gafol, which means fork, is a feminine noun Laefel, which means a spoon, is a masculine noun Bord, which means a table, is a neuter noun that is neither male nor female

that's strange!

To use a word, not only did you have to know its meaning, you had to know the gender of the word.

There are only a dozen funny plurals today. Men and geese. Men and geese.

Is it strange that two or more geese are geese?

But think about it, a goat became a gat in a flock, and an oak tree became an ack in a forest.

To master these words, I needed to know the exact plural of each, and it's not as simple as adding an S.

Words didn't always end with S

In good old English, words sometimes ended with a different sound.

Two or more children became children Lambs were two or more lambru - Eggru for fried eggs - Even if there was some bread, it was breadru, not breads Even if there was some bread, it was breadru, not breads

Sometimes it didn't change its shape even if it was multiple.

A sheep is a sheep whether it's one or two A sheep is a sheep whether it's one or two

In Old English it was a house whether it was one house or two.

Bulls are still oxen, not oxes

In Old English it was toungen, not tongues - namen, not names.If it had been the old way, the face would have had eyen instead of eyes.

So why is it no longer what it used to be?

In a nutshell, it's the Vikings' fault

In the 8th century, Scandinavian pirates began occupying much of England.

They spoke Norse, not English.

And they were adults, and adults aren't as good at learning languages ​​as children.

After about the age of 15, it's almost impossible to pick up another language without an accent or a mistake.

The same was true for the Vikings, so they began to take the hard part out of the English system.

some of them were complex plurals

While the languages ​​they encountered had eggru and gat, they also had gat, but they also had days and stones that became plural just by adding an S.

Wouldn't it be easier to just add an S to every word?

So did the Vikings

Because of their large population and many of them marrying Englishmen, it was soon common to hear simpler English in England as well as the original English.

After a while, no one remembers the original English,

It was forgotten that doors were called doora, doors were called doora, and hands were handa.

Plural forms have become much easier to understand, but there are a few words that have stuck with us because they were used so often, like children and teeth.

In short, English makes a lot more sense than you might think.

Thanks to our ancestors in Copenhagen and Oslo, we don't have to say "pea-night please" when we want peanuts.

It might be interesting if it's just for a week or two. What do you think?

Pat Mitchell: I've thought about female friendship many times, and by the way, these two women have been my friends for a very long time, and I'm very proud of that.

Jane Fonda: Exactly

Pat: Have you ever read these words from Cervantes about female friends?

"If you look at the friends you're dating-" In this case, it's the women.

I don't know which side to look at- (laughs) Jane: It's going to be a big fight.

Lily Tomlin: Take one of those waters, it's going to be really dry

(laughs) Jane: Don't waste your time.

Lily: My life is getting shorter just by being with her.

(Laughter) Jane: Life is still a long way off.

But- I'm sorry

Pat: Come on, what are you looking for in a friend?

Lily: Someone who has a sense of humor, who is daring, who is candid, who has a policy, who cares a little about the planet, who is polite, who has a sense of justice, and who thinks that I am worthy of my existence.

(Laughter) (Applause) Jane: I was just thinking this morning about what would have happened if I hadn't had a girlfriend.

In other words, "I have friends, therefore I am"

(laughs) Jane: It's true.

I am who I am because of my female friends, and you are one of them.

I don't know about you, but anyway- (Laughter) My girlfriends make me strong and smart and brave.

Tap me on the shoulder when I'm wrong

Most of my friends are much younger than I am.

Do you understand? That's nice. Lily: Thank you.

(Laughter) Jane: I'm including you in one of those -- listen, because when you're nearing the end of your life, it's nice to have someone to play and learn with.

I'm nearing the end too, faster than you

Lily: It's an honor to grow old with you.

(laughs) Jane: I'll teach you how to age.

(Laughter) Lily: You know very well.

Pat: How do you keep your friendships alive as you get older and experience more things in life?

Lily: I use it a lot- Jane: She doesn't invite me to her house very often, that's true.

Lily: You use social media a lot. You shut up. (Laughter) Lily: I check my emails and text messages.

(Laughter) You're asking me for help, because many of my friends are writers, activists, and actors.

And there are other people in various positions, too.

Jane: Do you use emojis?

Lily: Hmm~ Jane: Are you not using it?

Lily: I hate that Jane: I love emoji

Lily: I want to express happiness, blessings, and sorrows in words.

Jane: You really put it into words. Lily: It's word for word.

(laughs) Jane: You're innocent.

The older I get, the more I realize how important friendships are, so I try to keep in touch, keep in touch - and try not to get too far away.

You know Lily well, but I read a lot and I send my favorites to my friends.

Lily: Since I knew you'd be here today, you've sent me so many books about women and female friendships. Lily: I do

(Laughter) Pat: So- Lily: Wait, it's important because this is one of those cases where women are looked down upon, marginalized, and disrespected.

We've spent a lot of time investigating cases like this, but we've made very little progress.

Jane: Really

(laughter) Lily: This is so funny, you're going to be interested.

A Harvard Medical School study found that women who had a female best friend were less likely to be disabled—they had fewer physical disabilities as they got older, and were more likely to lead more active and exciting lives when they had friends.

Jane: Women live five years longer than men.

Lily: I want to trade that amount of life for fun.

(Laughter) LILLY: The most important conclusion of the study, and it's a very interesting and compelling conclusion, is that the researchers found that not having a female best friend is just as bad for your health as smoking or obesity.

Jane: There's more... Lily: My turn is over, so...

(Laughter) Jane: Okay, so listen to me, I have more to add.

For years and decades, all the research into the effects of stress has focused on men, and only recently have they begun to study the effects of stress on women, and what we've found is that when we women are exposed to stress, the amount of oxytocin increases in our bodies.

It's a hormone that makes you feel good, calms you down, and reduces stress.

This also increases when I'm with my girlfriends

Maybe this is one reason why women live longer.

Poor men, that's what's missing

Testosterone in a man's body counteracts the effects of oxytocin.

Lily: When you and Dolly filmed 9 to 5

Jane: Oh- Lily: We laughed heartily, and we found a lot of similarities and differences.

You're like a Hollywood mogul I'm like a Detroit rogue Dolly's from a poor town in Tennessee Southern girl And we as women got along so well I'm sure I laughed at least ten years longer

Jane: We crossed our legs many times.

(laughs) you know

Lily: Everyone knows

(Laughter) Pat: You guys have added ten years to our lives.

One of the books that Jane sent us both about female friendships was written by Sister Joan Chittister, whom we greatly admire, and she said, "Female friendships are not just social acts, they're soul-to-soul relationships."

Do you think girlfriends are psychic?

Are you giving life something spiritual?

Lily: Mental - absolutely right

'Cause especially your longtime friends, the people you've spent time with, have a spiritual essence in their hearts, kindness and vulnerability.

There is such a thing as affection, love as a necessary element of human relationships.

there's a deep love in your soul

Pat: Jane what do you think of this? Lily: I have a special power

Jane: I have many types of friends.

business friends and party friends i have a lot

(Laughter) But when it comes to friends who increase oxytocin...

People who feel spiritual things, right? because you open your heart

You know, our relationship is deep - I was with my best friend, and I shed a lot of tears.

Not because I was sad, but because I was moved and strengthened.

Lily: It won't be long before one of you goes to the afterlife.

(laughter) Pat: There are two of you sitting here, Lily, who are you talking about?

(Laughter) I always think that when women talk about friendships, men always get confused.

What do you think is the difference between male friendships and female friendships?

Jane: It's very different. You have to be more empathetic to men. (Laughter) Men don't have feminine friendships.

so they die soon

(Laughter) Man, I'm so sorry. Seriously, women -- women's friendships are so deep that you shouldn't keep anything secret.

It's obvious

Show your weakness - something a man can't do

I asked you over and over, "Am I okay?"

You asked, "Didn't you screw up?"

Pat: I'm strong now

(Laughter) Jane: Women ask that question to each other, but men don't.

It's been said that relationships between women are like facing each other while men are like standing side by side.

Lily: Men rarely show their emotions and try to keep them in the back of their minds.

That's the old fashion

Men watch sports, play golf, talk about sports, hunting, cars, and have sex in their masculine rooms.

I mean, act like that kind of man.

Jane: You were trying to say that men talk about sex, right?

Lily: If you can bring someone into your favorite room, they might start having sex (laughs) But you know what? It's a funny story, but psychologists just recently figured out that men, like women, are naturally dependent on others.

If you look at the video, whether a newborn is a boy or a girl -- a baby boy, just like a baby girl, looks into his mother's eyes, which means they need to exchange energy with each other.

When the mother looks away, the child panics and even the boy starts crying.

i need a connection

The mystery is why it changes as we grow up.

The answer is patriarchal culture, where boys and young men are taught that being dependent and empathetic is feminine.

A real man doesn't ask for directions, doesn't say what he wants, doesn't go to the hospital when he feels sick

don't ask for help

There's a saying I love: "Man loses his 'self' because he's afraid to be 'we'."

This is his "self"

Conversely, the "self" for women is always full of holes

But "we" make up for each other's shortcomings and make us stronger

Women aren't better than men, they just don't have the masculinity to show off

Lily: And- Jane: That's what Gloria Steinem said.

So we can express our humanity - Lily: I know Steinem.

Jane: I know as much as you know (laughter) but that's a really nice word.

"Women aren't better than men, they just don't have the masculinity to show off."

it's very important

Lily: But men are culturally trained to behave properly under the patriarchal system.

But if we don't make a difference

Jane: Female friendships seem to be a source of power regeneration.

Lily: It's a really interesting topic.

Our friendships - female friendships evolve into female solidarity Sisterhoods give the world a very powerful power - change the world as it should be - give humans what they crave.

Pat: That's why we bring this up because female friendships, Jane, you're right, are the source of power regeneration.

How do you use this power?

Jane: Well, the female population, especially the elderly female population, is growing rapidly around the world.

If we can harness our power, we can change the world

good? that's what i need

(Applause) It should start soon.

One thing we have to do - one thing we can do because we are women - is to set the standard of consumption.

should consume less

In Western countries, we have to cut back on consumption, and when we buy things, we buy locally made products, and when we buy food, we need to buy locally produced products.

We should draw a line with the infrastructure network.

We shouldn't rely on fossil fuels

Fossil fuel companies -- bad guys like Exxon and Shell -- they say they need fossil fuels because they can't go back to the Stone Age.

They say alternative energy isn't enough yet, but that's a lie.

Are there countries in the world that still live and thrive on mostly renewable energy?

But they claim that if we stop using fossil fuels, we'll go back to the Stone Age. In fact, if we start using renewable energy, we won't have to drill in the Arctic, and Lily: Whoa-

Jane: We're not even digging the tar sands of Alberta, that's what it is.

That way, we'll be more democratic, more jobs, more spiritual wealth, and women will lead the way.

LILLY: Now the third wave of the women's movement may be about to begin, uniting women all over the world -- women who have never met or seen each other -- come together, because Aristotle said, "Many will die without male friends."

The important word here is "man"

They thought that friendships should be equal, and women were not. Jane: The Greeks thought women had no soul.

Lily: Exactly, it shows the limits of Aristotle.

(Laughter) Wait, here's the big part.

Good, men seem to want women

the earth needs women

The U.S. Constitution requires women

But it's not even spelled out in the constitution

Jane: You mean the Gender Equality Amendment?

Lily: Exactly

Judge Ginsburg said, "Every constitution written after World War II has a provision that says women's citizens are equal to men, but ours doesn't."

so i wish i could start here

A very gentle way to start Jane: That's right.

(Applause) Gender equality is like a tide that's helping everyone, not just women.

Pat: We need new role models to make this happen.

How do we become friends, think about how we use our power in different ways -- as consumers, as citizens of the world, and Jane and Lily are role models who can be female friends in this way, even if they sometimes disagree -- for a very long time.

Thank you

thank you both

(Applause) Jane: Thank you.

Lily: Thank you

Jane: Thank you

(applause)

Imagine you are sound asleep and suddenly wake up!

But it's not because of the alarm

When you open your eyes the devil is sitting on your chest and holding you down.

You open your mouth and try to scream, but no sound comes out

You get up and try to run away, but you find you can't move at all.

The devil tries to choke you, but you can't resist

And waking up from a dream, it was a nightmare

It sounds like a Stephen King movie, but it's actually a condition medically called "sleep paralysis." About one in two people will experience this strange phenomenon at least once in their lives.

This panicky event of coming face-to-face with a creature from a nightmare can last anywhere from seconds to minutes, and can be accompanied by visual and auditory hallucinations, such as ghosts and out-of-body sensations of floating.

Some people mistake sleep paralysis for saying they've seen ghosts or been kidnapped by aliens.

In 1867, Dr. Cyrus Ware Mitchell became the first medical expert to study sleep paralysis.

"Patients suddenly wake up to sounds around them, but they can't move their muscles.

apparently still asleep

He's actually struggling desperately to move and battling intense psychological pain.

When he manages to move his body slightly, the seizure immediately subsides."

Even though Dr. Mitchell was the first to observe a patient with sleep paralysis, it's so common that most cultures have long had some kind of unscientific explanation.

You may recall that in medieval Europe, "Inkubus", demons in the form of sex-hungry men, visited at night.

In Scandinavia, a demon-possessed woman named Mare visits a sleeping person and sits on their chest.

In Turkey, the "gin" will hold you down and try to strangle you.

In Thailand, the "piam" leaves scars while sleeping.

In the American South, the "hugs" (witches) come

In Mexico, it's called "Zubirse el Muerto" where the dead are possessed.

In Greece, a mora sits on your chest and tries to choke you.

In Nepal, a ghost called Kayak lives under the stairs.

It would have been easy to blame sleep paralysis on demons, because it's much harder to explain what's actually going on in the brain.

Modern scientists believe that sleep paralysis is REM sleep, an abnormal combination of rapid eye movements and the arousal phase of sleep.

During a normal REM sleep cycle, we experience a lot of sensory stimulation in our dreams, our brains are unconscious and well asleep.

When you're dreaming, a special neurotransmitter is released that paralyzes most of your body's muscles.

This is called "muscle hypotonia"

This keeps you from running in bed when someone chases you in your dreams.

During sleep paralysis, you experience the characteristics of normal REM sleep.

While you're dreaming and your muscles are paralyzed, your brain is largely awake.

So you imagine you've encountered a terrifying creature.

That's how hallucinations happen. But why do so many people experience feelings of panic, of being strangled, of choking of breath, of chest tightness?

During REM sleep, hypotonia works to keep you from moving while you're dreaming, but it also causes you to lose voluntary control of your breathing.

your breathing becomes shallow and rapid

You breathe in so much carbon dioxide that your airways feel a little blocked.

The body's fear response during sleep paralysis is linked to the perception of a demonic attack, and while the body is in REM sleep, large areas of the brain are awake, so you're trying to get more oxygen.

You gasp for air, but you can't because your hypotonia is taking control of your breathing.

As your body tries to breathe while you're asleep, you perceive a tightness in your chest or a feeling of choking.

A small number of people experience sleep paralysis on a regular basis, which may be related to a sleep disorder such as narcolepsy, but many people do not experience sleep paralysis very often, perhaps only once in their lifetime.

So get some rest 'cause the devil won't haunt you, haunt you, haunt you, haunt you, try to strangle you, strangle you, he won't try to strangle you

Enjoy it in a horror movie!

Ten years ago, I exhibited my work here for the first time.

I wondered if it would work or if it was even possible, but I took small steps, followed a steep learning curve, and completed my first sculpture, The Lost Correspondent.

Working with marine biologists and a local dive center, it was sunk off the coast of Grenada, devastated by Hurricane Ivan.

And then this wonderful thing happened

The work has been reborn

After that, the sculptural work became two

quickly increased to 26

And before I knew it, the world's first underwater sculpture park had been built.

In 2009, I moved to Mexico and started making statues of local fishermen.

It became like protesters who formed small communities and demanded protection from the oceans.

And it eventually developed into an underwater museum with more than 500 human figures.

It seems gardening isn't just for climate control.

Since then, we've scaled up to create "Atlas God of the Seas" in the Bahamas, five meters tall and weighing over 40 tons, and now we're working on Lanzarote to create the first underwater botanical garden in the Atlantic Ocean.

In every project, we choose materials and designs that are conducive to life. We use durable, neutral cement to provide a stable and permanent scaffolding.

The surface is finished so that coral polyps can easily adhere to it.

The work was placed under the ocean currents, away from natural reefs, where creatures could lay eggs and live comfortably.

The work is arranged so that many fish are gathered.

Even this Volkswagen Beetle can now have crustaceans like lobsters and sea urchins inside.

Now, why would you want to display your work in the ocean?

Honestly this is not easy

When you're in the middle of the ocean, using a 30-meter crane to lower an 8-ton work to the bottom of the sea, you'll wonder why you didn't turn it into a watercolor painting.

(Laughter) But I'm always fascinated by the results.

(music) The sea is the most desirable exhibition space for an artist.

Under beautiful, ever-changing lighting effects, the scattered sand becomes a cloud of enchantment, enveloping the sculpture, creating a timeless and unique beauty that attracts curious people, all of which add a special layer of color to the scene.

(Music) As the months went by, I realized the beauty of this, and it's very humiliating for a writer, but when the sculpture is submerged in the sea, it leaves us.

New reefs are born, the world literally evolves, and it never ceases to amaze me.

It's a bit corny, but the human hand can never match the imagination of nature.

Sponges that serve as veins on the face

Shikatsuno Coral that changes its shape completely

A sea worm that crawls over the statue and leaves a white line

Capsules that explode from the face

Sea urchins crawling night after night to feed

Coralline eyes as if they were dripping purple paint

The best crimson that can only be found in the sea

A folding fan woven by goat-eyed coral insects sways with the waves.

The purple sponge breathes in the water

A gray angelfish glides silently overhead

Seeing the amazing response to our work, I feel like I've been able to connect to something fundamental, because I think these things are universally applicable, and from that I've focused on my responsibilities as an artist, on what I'm aiming for.

Today, I'm standing here on a boat out on the open sea, and I've been blessed with a great opportunity to say something really, really important that comes out of my work.

As you know, our reefs are dying and our oceans are in danger.

Here are the most used and most searched and shared images of all my work.

There's a reason for that fact, or at least I'd like it to be.

What I really hope is that you realize that when you think about the environment and the destruction of nature, you have to think about the ocean as well.

Since creating these places, there have been unexpected and spectacular results.

Not only has it created more than 800 square meters of new habitats and reefs, but visitors to Cancun's marine parks now spend an equal amount of time on the museums as well as the natural reefs, bringing great relief to the stressed natural area.

People who saw "Atlas God of the Seas" in the Bahamas raised the issue of an oil spill from a nearby oil refinery.

Following international media pressure, the local government pledged $10 million to clean up the coast.

Grenada's Sculpture Park inspired the government to declare it a Marine Protected Area.

Admission fees help park rangers manage visitors and catches.

It has even been featured in National Geographic's "Superb Views of the Earth"

Now the reason we are here today-

must have a common thought

Our common concern is that we're not doing enough to protect our oceans.

In other words, we don't see the ocean as sacred, and we need it now.

When we see a great place -- like the Himalayas, the Sagrada Familia, the Mona Lisa -- when we see a great place or something, we understand its importance.

We honor it as sacred, we cherish it dearly, we protect it, we try to guard it.

But the premise is that we all need to recognize those values, or else we'll be blasphemed by those who don't understand them.

So I want to conclude tonight by talking about the sacred.

In naming our exhibition space in Cancun, we chose the name "museum" for a very important and simple reason: a museum is a place that is protected, conserved and educated.

Museums are places for us to preserve things of great value and enjoy them as they are.

If someone were to throw an egg into the Sistine Chapel, there would be an uproar.

And if someone said they were going to build a seven-star hotel at the base of the Grand Canyon, they'd laugh it off and kick them out of Arizona.

But we're digging up the ocean floor every day, polluting the sea, and overexploiting resources.

And I think the reason it happens is that when we look at the ocean, we can't see the disaster that our actions are causing.

For many of you, this is what the ocean means.

You can't imagine something so gentle and so big could be so fragile.

Because it's just big and wide and endless

What do you see from here?

In fact, all you can see is the far horizon

There is a danger here, the sea is out of sight, if you don't look at the sea, if you don't keep your eyes on the sea, if its greatness is overlooked, there is a great danger that it will be taken for granted.

Cancun is a spring break destination for college students famous for its tequila and foam parties

It's a sea that suits popular university students riding jet skis and banana boats.

We submerged our work in the waters of Cancun to create a small but precious exhibition corner.

We don't want to end up in Grenada or Cancun Bahamas.

Just last month, I put these "Four Horsemen of the Apocalypse" statues on the River Thames, right in front of the Houses of Parliament in central London, to send a straight message about climate change to those who have the power to change things.

for me this is just the beginning

Together with other inventors and creators, philanthropists and educators and biologists, we want to create a better future for our oceans.

I want to aim for something beyond sculpture and art.

To talk to a 14-year-old who was born in the city and has never seen the sea

Instead of taking them to a natural history museum or an aquarium, they actually take them out to sea, through a glass tunnel called an underwater Noah's Ark, to see the wildlife on the ground colonize the wildlife of the sea.

You will definitely be stunned

So think big and deep

If you have the creativity and the will, you can do it.

My hope is that by bringing art into the ocean, not only will it harness its incredible creativity and its visual impact, but we'll give something back to it, whether it's nurturing a new environment, or offering a new way of looking at it, or a very old way of looking at it: a view that it's a delicate and precious place that deserves to be protected.

our oceans are sacred

thank you

(applause)

On October 4, 1957, the world held its breath as the Soviet Union launched its first artificial satellite, Sputnik, into space.

This tiny hunk of metal, less than two feet in diameter, was the beginning of the space race between the United States and the Soviet Union.

This lasted 18 years and changed the world as we know it.

Sputnik wasn't actually the first man-made object to go into space.

The "first" deserves the title of the V-2 rocket, which Germany used to attack missiles, and it was used in a deadly war against the Allies towards the end of World War II.

It wasn't very effective, but at the end of the war both the United States and the Soviet Union began looting the technology and the scientists involved in its development and using it for their respective projects.

By August 1957, the Soviet Union had successfully tested its first intercontinental ballistic missile, the R-7, which was to be used to launch Sputnik two months later.

The scary thing about Sputnik was that this same technology, not the orbiting sphere itself, could be used to launch a nuclear warhead into a city somewhere.

Afraid of falling too far behind, President Eisenhower ordered the Navy to rush ahead with his country's projects and launch the satellites as soon as possible.

So on December 6th, 1957, excited people across the country tuned in to the live broadcast to see the Vanguard TV3 launch and two seconds later it hit the ground.

Vanguard's failure was a huge stain on America.

The headlines on the front page of newspapers are "Batterynik" and "Ponkotsunik"

A representative of the Soviet Union mocked at the United Nations, suggesting that the United States should receive foreign aid to developing countries.

Luckily, the Army was working on a parallel project called the Explorer, which was successfully launched in January 1958. But the United States was just catching up, and it was overtaken again, when Yuri Gagarin made the first manned space flight in April 1961.

Almost a year later, after several more Soviet astronauts completed their missions, the Mercury project succeeded, and John Glenn became the first American astronaut to orbit in February 1962.

By this time, President Kennedy had realized that catching up with Soviet progress in a few months was not enough.

America has to do something first.In May 1961, a month after Gagarin's flight, President Kennedy announced that he would land a man on the moon by the end of the 1960s.

America succeeded with the Apollo program, and Neil Armstrong famously took the first step on July 20, 1969.

Both countries had set their next target on an orbiting space station, so there was no telling how long the space race would last.

But as bilateral relations improved between Soviet General Secretary Leonid Brezhnev and American President Nixon, the Soviet Union and the United States shifted from competition to cooperation.

The successful joint program, known as the Apollo-Soyuz, combined the American Apollo spacecraft with the Soviet Soyuz, where the crews of both met, shook hands, exchanged gifts, and ended the space race in 1975.

So what was the point of the space race, after all?

Was it just a huge waste of time?

Is it just two superpowers chasing each other on a symbolic program of risk and high investment, just using resources that could have been spent elsewhere?

That's true, but the biggest gains in space exploration have nothing to do with whether nations win or lose.

Overall, during the space race, funding for research and education increased exponentially, leading to many advances that could not have been made without it.

Many of the technologies that NASA developed for space are now widely used in civilian life, from memory mattresses to freeze-dried food to the use of LEDs in cancer treatment.

And, of course, the satellites we use for GPS and cell phone communications wouldn't exist without the space program.

All of this shows that the benefits of scientific research and progress can often extend far beyond even the people doing the research.

Let's say you're watching soccer and you have an asshole next to you.

He's loud, he spills his drink, and he makes fun of your favorite team

A few days later, while walking in the park, it suddenly started to rain heavily.

At that time, someone gave me an umbrella

I saw him at a soccer game

Would you change your mind about him based on our second meeting? Or do I continue to hate him for his first impressions?

According to social psychology research, we quickly form impressions of other people based on what they say and do, and this lasts for a long time.

We do this effortlessly by inferring basic personality traits from a single behavior, such as a person's foul language or awkward gait.

Based on our impressions, we can accurately predict how people will act based on our impressions.

I met him for the first time at a game and I knew he was a jerk I expect it to be the same again in the future I expect it to be the same again in the future

Then you might avoid him the next time you see him.

But we can change our impressions based on new information.

Behavioral science researchers found consistent trends in overwriting impressions found consistent trends in overwriting impressions

First, very negative and immoral information about others is usually more powerful than very positive and moral information.

I mean, when it comes to guys you meet at games, I mean, when it comes to guys you meet at games, bad behavior there will unfortunately outweigh good behavior in the park.

Research suggests that the reason for this bias is that bad behavior is more representative of a person's true character.

According to this logic, bad things are stronger than good things when you change your impression

actually not always

For certain types of learning, this kind of "negativity bias" doesn't hold.

For example, when you learn about a person's skill or ability, easily reverse this bias, easily reverse this bias.

Good information outweighs bad information Good information outweighs bad information

Thinking about a soccer match

If a player scores a goal, he will be more impressed with his skill than when he misses it.

These two theories about overwriting are ultimately consistent These two theories about overwriting are ultimately consistent

In other words, in forming and rewriting impressions, people tend to give more importance to unusual events People tend to give more importance to unusual events People tend to give more importance to unusual events

What happens in the brain when you overwrite impressions What happens in the brain when you overwrite impressions

Using fMRI (Functional Magnetic Resonance Tomography) Using fMRI (Functional Nuclear Magnetic Resonance Tomography) A brain network that responds to new information that contradicts the first impression A brain network that responds to new information that contradicts the first impression has been discovered.

They are domains of social cognition, attention and cognitive control, domains of attention and cognitive control, domains of attention and cognitive control.

Furthermore, when rewriting impressions based on people's behavior, the activity of the ventrolateral prefrontal cortex and the superior temporal sulcus is related to the perception of how often the behavior occurs in everyday life.

In other words, the brain seems to use the low-dimensional elements of behavioral statistics to make the complex decision of judging someone's character.

It is necessary to judge whether the person's behavior is ordinary or whether the person's behavior is ordinary or not.

When a "bad soccer spectator" turns into a "nice person," as I talked about today, the brain judges, "From experience, most people lend their umbrellas."

And don't change your first impression

This points to a good thing: your brain, and you, the owner of it, can certainly be more focused on the bad things that other people do than the good things they are doing.

We are accustomed to doing good, like helping strangers in times of need.

In these situations, bad behavior would be more important, but only because good behavior is more common.

Let's remember the times when we judged someone by their actions Let's remember the times when we judged someone by their actions Especially when our impressions changed dramatically Especially when our impressions changed dramatically

Was the person acting mundane Was the person acting mundane Was the person acting mundane or did he act completely unusual?

There are two polar regions on Earth. The North Pole comes from the Greek word for "north" and the South Pole comes from "opposite of the north."

But there's an easier way to remember: just remember what surrounds you.

The North Pole is located in the northern hemisphere of the earth and is an ocean surrounded by land.

On the other side of the globe, Antarctica is a continent surrounded by ocean.

So the Arctic has polar bears but no penguins.So the Arctic has polar bears but no penguins.

Let's talk about the North Pole first.

The Arctic consists of vast ice-covered oceans surrounded by treeless permafrost.

This region can be defined as the ocean between the North Pole and the North Pole.

If you're standing at the North Pole, every direction you look is south.

Standing at the North Pole for long periods of time is difficult because the North Pole is over the ocean and the sea ice above it is constantly moving.

Should it fall into the ocean at the North Pole, it will sink into the ocean at a depth of 4.26 km.

Average winter temperatures at sea can drop as low as -40°C, with the lowest recorded temperature being around -68°C.

Despite these harsh conditions, people have lived in the Arctic for thousands of years.

The life in the Arctic is ice microbes, zooplankton and phytoplankton, fish and marine mammals, birds, terrestrial animals, plants and humans.

What about Antarctica

Antarctica is the southernmost continent on earth and has the South Pole.

It's the fifth largest continent on earth, roughly twice the size of Australia.

About 98% of Antarctica is covered in ice, and the ice is at least 1.6 kilometers thick.

Antarctica's climatic conditions are some of the harshest in the world

On average, it's the coldest, windiest, driest continent, and it has the highest average elevation of all continents.

You might think it snows all year round, but Antarctica is so dry that it's considered a desert, with only about 200 millimeters of rainfall along the coast and very little inland.

Antarctic temperatures have dropped to -89°C

No one lives in Antarctica permanently because of the harsh conditions and the difficulty of getting there, but between 1,000 and 5,000 people live year-round at research stations scattered across Antarctica.

Even the strongest animals are fighting for survival, and only the cold-adapted organisms can survive. The organisms in Antarctica are all kinds of algae, animals, bacteria, fungi, plants and protists.

But why is Antarctica colder than the North Pole?

First, most of the continents are above 3 kilometers above sea level, and temperatures decrease with altitude.

That's why there's snow on the mountaintops

Second, remember that the North Pole is a frozen ocean.

The water in the ocean beneath the ice is warmer than the frozen ground in Antarctica, and that warmth travels through the ice.

That's why temperatures in the Arctic don't drop to the extremely cold temperatures that land surfaces in Antarctica do.

Third, seasons also affect Antarctica.

At aphelion in July, when the Earth is furthest from the Sun, Antarctica is in winter, so it gets a double blow of cold.

It's a harsh environment, but we have our planet because of the north and south poles.

Both polar regions are very important in regulating the climate.

Thanks to the polar regions, temperate zones have moderate temperatures and stable weather.

As climate change and global warming reduce Arctic sea ice, the global climate becomes increasingly unstable.

War is the tragedy of human history, and will almost certainly be part of the future.

Since the founding of the United Nations, wars of aggression have been outlawed, and multilateral treaties have replaced warfare in armed conflicts.

But future warfare will be unlike the past.

In addition to traditional armed conflicts, the future will see cyber warfare fought against remote adversaries, with new kinds of weapons, computer viruses and programs that manipulate the performance of adversaries.

Not only is cyberwarfare not covered by existing legal frameworks, but even the requirements for cyberwarfare are still being actively debated.

How do we deal with cyber warfare when we don't even know what cyber warfare is?

One direction is to think about situations where new international law is needed.

Maybe there's a new kind of assassin who doesn't shoot bullets when he commits crimes and doesn't even live in the same country.

For example, an individual working for a government might use a radio to send a signal to another country's leader's pacemaker.

This device will cause the pacemaker to malfunction and the leader of another country to die.

Is this cyber assassination an act of war?

As a second example, imagine multiple allied nations working together to infiltrate the computer systems of an enemy nuclear-powered ship.

Suppose this attack evades a nuclear-powered aircraft carrier on the verge of a meltdown, killing thousands of soldiers and civilians.

In defense, the adversary responds with a self-defense cyberattack that shuts down the allied power grid.

Hospitals can no longer treat patients, entire communities lose energy and running water, and tens of thousands of civilians die.

The blackouts started with cyberattacks, but weak infrastructure, poor cybersecurity, outdated power grids, all contribute to civilian deaths.

Can the country fight back?

Who will you fight?

And would that retaliation be considered an act of war?

Is it a crime against humanity?

Who is responsible?

Are you the programmer who wrote the code?

The head of the military program who oversaw the writing of the code?

Is it the commander who pressed the button that triggered this incident?

A hardware engineer who built a computer knowing that it would allow attacks?

War has been around us for so long that the laws of war make it clear who is responsible for the actions of the war.

This legal framework seeks to curb atrocities and prevent them from escalating.

Hijacking a civilian aircraft and using it as a weapon, dropping a nuclear bomb, using gas chambers or poisonous gas in combat, etc., are defined by customary international law and the Hague Convention as acts of war and war crimes.

But to reiterate, the current legal system does not provide for hypothetical questions and countless other cases that are not easily answered. There are only two ways to advance this question: peace or new laws.

So what hypothetical scenarios can you think of that fit the suddenly defined definition of cyberwarfare? And what kind of system of international law could we design to deter these acts?

A hundred years ago this month, 36-year-old Albert Einstein presented at the Prussian Academy of Sciences in Berlin a groundbreaking theory of space, time and gravity: general relativity.

General relativity is undoubtedly Einstein's masterpiece, revealing how the universe works on a large scale, and in one beautiful line of equations, from why an apple falls from a tree to the beginning of time and space.

1915 must have been an exciting year for physicists.

Two new ideas have changed the way we see the world.

One is Einstein's theory of relativity, and the other is even more revolutionary, quantum mechanics, which is insanely bizarre and yet surprisingly capable of explaining the microscopic world of atoms and particles.

Over the past century, these two ideas have completely changed our understanding of the universe.

Thanks to relativity and quantum mechanics, we know what the universe is made of, how it began and how it evolves.

Now, 100 years later, we're at another tipping point in physics, but it looks different.

In the years to come, we may see results. Will we be able to continue to expand our understanding of nature, or will we, for the first time in the history of science, be faced with questions that we cannot answer, not because we lack wisdom or skill, but because the laws of physics do not allow us to do so.

The crux of the problem is that the universe is too interesting.

According to the theory of relativity and quantum mechanics, the universe should be a much more boring place.

It's a dark, inhospitable dead world.

But if you look around you, the universe we live in is full of interesting things: a sky full of stars, planets, trees, squirrels.

The question is, why does this interesting thing exist?

Why is there existence of things instead of nothingness?

This contradiction is one of the most pressing questions in fundamental physics, and whether we can solve it, the answer may come in the next few years.

There are two numbers at the heart of this problem, and they're very dangerous numbers.

It's a measurable measure of the nature of the universe, and it's dangerous because if it were even slightly different, the universe as we know it wouldn't exist.

One of the two numbers has to do with what was discovered at CERN, just around the corner from this venue, where CERN is home to the largest scientific instrument ever built by mankind, the Large Hadron Collider, or LHC.

This device accelerates subatomic particles to near the speed of light in a ring that's about 27 kilometers in circumference, then collides inside a giant particle detector.

On July 4, 2012, physicists at CERN announced that a violent collision by the LHC created a new fundamental particle: the Higgs boson.

If you were watching the news at the time, you would have seen that many physicists were very excited, and you might have wondered why physicists go so crazy every time a new particle is discovered.

That's part of it, but the bigs particles are a little bit special.

We're excited because the discovery of the Bigs boson proves the existence of a universal energy field.

It may be confusing to call it an energy field, but there is something that we all experience.

When you bring a magnet close to iron, you should feel an attractive force across it, and that's the effect of the field.

The Higgs field is similar to a magnetic field, except that the value is constant everywhere.

still around us

We can't see it, we can't touch it, but if it weren't for that, we wouldn't exist.

The Higgs field gives mass to the elementary particles that make us up.

Without it, particles wouldn't have mass, atoms wouldn't form, and we wouldn't exist.

But there's something very strange about the Higgs field.

The theory of relativity and quantum mechanics show that it has two natural states, like an electrical switch.

Either in the off state, zero everywhere in the universe, or in the on state, it has a huge value.

In either case, atoms can't exist, and all the interesting things we see in the universe also don't exist.

In reality, the Higgs field is faintly on, not zero, but it's a quadrillion times weaker than fully on, like an electrical switch getting stuck just before it turns off.

This value is very important

Because if it's even slightly different, there's no physical structure in the universe.

This is the first dangerous value, the strength of the Higgs field.

Theoretical physicists have spent decades trying to understand why these strange values ​​exist, coming up with various explanations.

They have cool names like "supersymmetry" and "large extra dimensions."

I'm not going to go into it here, but the key is that if any of these things explain the strange values ​​of the Higgs field, we should be able to see new particles being produced at the LHC along with the Higgs boson.

So far no signs of such have been found.

In fact, there's an even worse example of these dangerous values ​​doing strange values, and they come from the study of the opposite scale extreme, the faraway universe.

One of the most important consequences of Einstein's theory of general relativity was the discovery that the universe began with a rapid space-time expansion 13.8 billion years ago called the Big Bang.

In the early days of the Big Bang theory, the expansion of the universe was thought to be gradually slowing down due to gravitational forces.

But in 1998, astronomers made a startling discovery: the expansion of the universe is accelerating.

The universe is getting bigger and faster, and it's driven by a mysterious repulsive force called dark energy.

When you hear the word "dark" in physics, be suspicious, because it means that physicists don't really know what it is.

(Laughter) I don't know what dark energy is, but I dare say it's the energy of empty space, the energy of a vacuum.

When we use classical quantum mechanics to calculate the intensity of dark energy, the results are quite astonishing.

Dark energy should be 10 to the 120th power stronger than what is observed in astronomy.

It means that 1 is followed by 120 zeros.

This is a totally dizzying value, and I don't understand it.

We often refer to big numbers as "astronomical."

even that is not enough

This value is greater than any value in astronomy

A trillion times a thousand times a trillion times a trillion times more than the total number of atoms in the universe.

It's a very bad prediction.

In fact, it's been called the worst prediction in physics, and it's not just for theoretical curiosity.

If dark energy were that strong, the universe would fall apart, galaxies wouldn't form, and we wouldn't be here.

So that's the second dangerous number, the strength of the Turk energy, and to explain it, we're going to have to do an even more acrobatic tweak than the Higgs field.

Unlike the Higgs field, nothing is known to explain this value.

The hope was that the perfect combination of Einstein's theory of relativity, the theory of the universe at large scales, and quantum mechanics, the theory of the universe at small scales, might solve the problem.

Einstein himself spent much of his later years in the fruitless quest for a unified theory of physics that many physicists have since worked on.

One of the most promising candidates for a unified theory is string theory, and the basic idea is that if we expand the elementary particles that make up the world, it's not a particle, but a tiny vibrating string of energy, with different particles at different frequencies of vibration, like musical notes on a guitar string.

It's an elegant, almost poetic way of looking at the world, but it's actually an inescapable problem.

String theory isn't just one theory, it's a big collection of theories.

It's estimated that there are 10 to the power of 500 different versions of string theory.

Each one describes a different universe with different laws of physics.

Some critics say that's not science.

This theory cannot be disproved

On the other hand, there are those who see that what appears to be a bankruptcy of string theory may actually be its greatest advantage.

What if that 10 500 different possible universes actually exist somewhere in the multiverse?

And then suddenly you can understand why those two dangerous numbers are doing weird things.

In most of the multiverse, either the dark energy is too strong to tear the universe apart, or the Higgs field is too weak to form atoms.

We are living in a place where two values ​​just happen to be the right values.

Goldilocks universe

You can also see that this idea is highly controversial.

This way of thinking will never answer the question, "Why is there something instead of nothing?"

Much of the multiverse is empty, just that we live in one of the few universes where the laws of physics allow things to exist.

What's even worse is that this multiverse idea is unconfirmable.

There's no way to observe other universes, and we have no way of knowing whether they exist or not.

we are in a very frustrating situation

I'm not saying there's no such thing as a multiverse.

We have other planets, we have stars, we have galaxies, so it's not surprising that there are other universes.

The problem is that we will never get confirmation.

The idea of ​​the multiverse has been around for some time, but in the last few years we've begun to see the first signs that these theories might be supported.

Since the LHC first went live, we've been very hopeful that a new theory of physics will be discovered, whether it's supersymmetry or a large extra dimension, something that could explain the strange values ​​of the Higgs field.

But despite the high expectations, the LHC has shown us a barren wasteland with only one Higgs boson.

I had to wryly conclude that none of the papers that emerged from the experiment showed any signs of new physics.

Now the stakes are higher than ever

This summer, the LHC began its second phase, running at almost twice the energy as the first phase.

Particle physicists are all desperately hoping to find some indication of the violent collision at the LHC, whether it's a new particle, a micro black hole, or something completely unexpected.

Then we can continue the long journey that Einstein began 100 years ago toward a deeper understanding of the laws of nature.

But if, after a few years of operation, the LHC goes into a long hiatus again, and if all we've found is the Higgs boson, physics may be entering a new era, an era in which there are strange properties in the universe that we can't explain, an era in which we seem to be living in a multiverse forever out of our reach, an era in which we'll never be able to answer the question, "Why is there something rather than nothing?"

thank you

(Applause) (Bruno Giussani) Harry, you said there may be some things science can't answer, but I want to ask you two questions. First, building something like the LHC is a long-term project.

When I introduced you, I said we live in a short-term world.

How do you have the long-term thinking to build something like this?

(Harry Cliff): I've been very lucky. I participated in an experiment using the LHC in 2008, when it was just starting up. Some of our research groups have been working on this for 30 years, and they've spent their entire lives working on one device.

The LHC was first discussed in 1976, when the technology needed to build it didn't exist yet.

We didn't have the computing power we needed when we started designing in earnest in the early '90s.

We have a large detector that records impacts, but it was thought that there was no technology that could withstand the radioactivity produced by the LHC, so it's basically a lump of lead in the center with detectors around it, and we've been developing the technology as we go along.

We can only proceed in the hope that people will use their ingenuity to solve the problem, and that may take decades.

Giussani: China announced a few weeks ago plans to build a supercollider that's twice as big as the LHC.

How did you and your colleagues react to this news?

(Cliff) Size isn't everything (Giussani) That's right

(Laughter) It's weird for a particle physicist to say that.

Seriously, I think it's great news.

Countries around the world will need to pool their resources to build a device like the LHC.

No single country can build a machine this big, but China may be an exception, because it can mobilize vast amounts of people, money and resources to build machines like this.

This is not a bad story, of course.

And what they're planning to do is use that machine to study the Higgs boson in detail, and get clues about the realities of new ideas like supersymmetry, which I think is great news for physics.

(Giussani) Harry, thank you very much. (Cliff) Nice to meet you.

(applause)

Have you ever felt déjà vu?

It's a vague sense of familiarity with the situation.

The scene in the restaurant was exactly what I remembered—

The world moves the way you choreograph it, but it can't be based on your past experiences, because you've never dined here.

It's my first time eating clams - what the heck is going on?

Unfortunately, there is no theory that can explain déjà vu.

This experience is short and unpredictable, making it nearly impossible for scientists to document and study.

Scientists can't just sit back and wait for it to happen. It can take years.

Because this experience is invisible, it is described in research by subjects as sensations and impressions.

For years there was a lot of speculation due to the lack of hard evidence.

More than 40 theories have attempted to explain the phenomenon since Émile Bourac introduced the word "déjà vu", which means "already seen" in French.

Recent advances in neuroimaging techniques and cognitive psychology have narrowed the possibilities.

Let's take a look at the three most popular theories, the three most popular theories, in the same restaurant example.

The first one is the dual process theory.

I need movement first

Suppose a waiter drops a tray of plates

Your brain is processing a lot of information as the situation unfolds. Your brain is processing a lot of information.

In the space of a thousandth of a second, this information rushes through various circuits and transforms it into a split second event.

Although most of the time everything is recorded in parallel

According to this theory, déjà vu happens when one of the circuits is slightly deviated.

Due to the lag in information arrival, information that arrives later is processed by the brain as a separate event.

When it's played back over an already recorded moment, it feels like it happened before, because in some ways, that's exactly what happened.

The next theory is about turmoil in the past, not mistakes that happen in the present.

This is hologram theory, and I'm going to use a tablecloth to think about it.

As you look at the tablecloth, distant memories come flooding back from deep within your brain.

According to this theory, memories are stored in a form similar to holograms, and in a hologram you only need one fragment to see the whole picture.

Your brain may have sensed that this tablecloth is the same one you've seen before in your grandma's house.

But without remembering what you saw at your grandma's house, your brain triggered an old memory that you don't know what it is.

This puts you in a state of familiarity but inability to remember.

You've never been to this restaurant, but you've seen the tablecloth, it's just that you can't recognize the memory.

Now look at this fork

are you paying attention?

The final theory is about divided attention, according to which déjà vu happens when our brain is preoccupied with an object and subconsciously perceives a situation.

When you turn your attention again, it feels like you've seen it before.

For example, you were paying attention to the forks just now and didn't see the tablecloth or the falling waiter.

Your brain was recording everything with your peripheral vision, but you were doing it without a clear conscious mind.

When you finally turn your attention away from the fork, when you finally turn your attention away from the fork, you feel like you've been here before, because you weren't paying attention and you were here.

All three of these theories refer to common aspects of déjà vu, but none of them suggests a decisive factor in the phenomenon.

Until researchers and inventors come up with new ways to capture this fleeting moment, we can explore it ourselves.

After all, most research on déjà vu is based on first-hand accounts, so why not yours?

The next time you experience déjà vu, think about it for a second.

What was your preoccupation?

Did you see anything familiar?

Was my brain slowing down?

Or is it another reason?

Have you ever looked at the moon and wondered? I wonder why the moon near the horizon is big and the moon rising high in the sky is small

there are other people who feel that way

People have been puzzled by this strange phenomenon for ages. Surprisingly, we still don't have a definitive answer, but we've tried.

Some of the greatest philosophers in history -- Aristotle, Ptolemy, da Vinci, Descartes -- tried to explain the phenomenon, but they weren't able to fully explain it.

One of the first theories was that the moon in the sky actually looks bigger when it's near the horizon.

The idea is that during the moon's rise and fall, the Earth's atmosphere acts like a giant lens, making the moon appear larger.

But this theory lacked plausibility

Because with atmospheric refraction, the moon would actually look a little smaller.

And actually measuring the size of the moon at different positions doesn't change the size of the moon.

So why does the moon look bigger when it rises and falls?

It must be some kind of optical illusion

What kind of illusion is that?

The first is the Ebbinghaus illusion, in which two identical objects appear to be of different sizes relative to their surroundings.

The two circles in the center are actually the same size.

The moon near the horizon appears larger because trees, houses, and towers are closer to the moon and appear smaller in the distance.

On the other hand, the moon, which rises high in the sky, is enveloped in the darkness of the endless night sky, making it appear smaller in comparison.

Another possible theory is the famous Ponzo illusion.

You know, when you paint in perspective, the closer you are to the horizon, the smaller you draw.

Our brains subconsciously perceive objects near the horizon to be larger than they actually are.

The two yellow lines drawn are the same length, but the top line appears longer because your brain interprets it as being closer to the horizon.

The "Ebbinghaus illusion" and "Ponzo illusion" seem to have solved the mystery of the "Moon illusion", but unfortunately there are still some phenomena that cannot be fully explained by these theories.

If it's just the effect of the Ebbinghaus illusion, pilots flying above clouds won't get the moon illusion, because there's no object smaller than the moon near the horizon.

But in fact, pilots and sailors at sea also experience the moon illusion.

Furthermore, if the brain were to modify the size of objects near the horizon on its own, we would also have the "moon illusion" in planetariums, where the entire sky, including the horizon, is projected onto a spherical dome overhead.

But many studies have shown that there are no optical illusions.

And to make matters worse, the "moon illusion" doesn't seem to occur at all when you're bending over and looking at the moon between your legs.

It's become a ridiculous story

One of the currently prevailing theories is the "short-sighted theory of convergence."

Our brain determines the distance and apparent size of an object by focusing our eyes.

When you look at the horizon, your eyes focus far away, so your brain thinks you're looking far away.

The moon appears there with a certain size

The brain then concludes that the moon must be far away -- that is, the moon must be large.

But when you look up at the night sky, there's nothing to focus on, so your eyes are in an accommodative resting position, which means they're focused a few meters away.

As a result, the brain concludes that the moon is closer than it actually is -- that the moon isn't as big as it seems.

Rather than explaining why the moon appears larger when it's near the horizon, "convergence microscopicism" explains why the moon appears smaller when it's overhead.

Still not convinced?

In fact, many scientists seem to be confused, and the debate over the "moon illusion" will continue as long as the moon continues to shine in the night sky.

(Bruno Giussani) High Commissioner Welcome to TED.

(Antonio Guterres) You're welcome.

(Giussani) Let's start with statistics

In 2015, one million refugees and migrants flooded into Europe, from all over the world, from Syria, Iraq, Afghanistan, Bangladesh and Eritrea.

And here the reaction was split into two groups: the welcoming and the defending.

I'd like to break it down a bit into the short-term and long-term perspectives here.

The first question is quite simple: why has the refugee movement suddenly exploded in the last six months?

CA: I think the basic reason for this surge is the Syrian refugees.

Immigration from Africa and Asia to Europe was on the rise, but at a gradual pace, and then suddenly, in the first few months of the year, there was a sharp increase.

I can think of three reasons why that is, two long-term reasons and three triggers.

One long-term reason is that the hopes of the Syrian people are fading.

So when you look at your own country, when you go home, you see no hope beyond that, because there is no political solution, you see no light at the end of the tunnel.

Second, living conditions for Syrians in neighboring countries are deteriorating.

A World Bank study found that 87 percent of Syrians in Jordan and 93 percent of Syrians in Lebanon are below the national poverty line.

Children are only half enrolled in school, which means they live in poor conditions.

Not only are they refugees who have left their homeland, and they have had their own hardships, but they are also facing a very precarious life.

And the third trigger is the sharp decline in international aid.

World Food Program forced to cut food aid to Syrian refugees by 30% due to lack of resources

Because of the ban on working, they had no choice but to rely on international aid, and felt that the world had abandoned them.

I think that's where it started

One day, all of a sudden, a lot of people started moving, and to be honest with you, if I had been in the same situation -- and had the courage -- I would have done the same.

CA: What struck people was that not only was the event sudden -- it couldn't have been sudden.

Syria's civil war has been going on for five years

Millions of refugees are in camps, villages and towns near Syria.

For example, you yourself were warned about this situation and the consequences of the collapse of Libya, yet Europe seemed ill-prepared.

Guterres: Yes, because it's divided. When the world is divided, you lose sight of reality.

Because we don't have the luxury of it, we tend to put off making decisions.

Even when evidence of this was seen in the rapid increase in refugees, Europe remained divided and ill-equipped to deal with this situation.

One million people

It sounds huge, but with a population of 550 million people in the European Union, it's one refugee for every 550 people.

By comparison, Lebanon has a ratio of one refugee for every three.

How are you doing? I'm struggling, but I'm holding on

The question is, could this have been something that could have been dealt with? Leaving aside the idea that the most important thing is to fix the root cause, when we look at the phenomenon itself, what if the nations of Europe could have banded together and set the right amount of admission at the point of entry?

But to do that, we need a lot of support for the reception centers, we have to check people in with security checks and all sorts of other things, and we have to distribute the incoming people to different European countries according to their capacity to receive them.

As usual when you look at the relocation program, the Commission's approval was a little too late, and so was the Security Council.

(Guterres) Our country should accept 4,000 people.

Not a big number for Portugal.

Depending on how you do it, you should be able to deal with it. Right now, the dire situation is the point of entry, where refugees are slogging their way through the Balkans and ending up in Germany, Sweden, Austria.

Because, after all, acceptance is done by these three countries.

Other countries just wait and see

(Giussani) Let me make three points here.

I have a question

Right now, many people in Europe are thinking, first of all, it's a matter of numbers.

1 million for 550 million is not a big deal, but realistically how many can Europe accommodate?

(Guterres) That's an unanswered question. Refugees have a right to protection.

Because of international law, no one can say, "10,000 is enough."

One thing I would like to mention is that in Turkey, at the beginning of this crisis, a minister declared, "We can accommodate 100,000 people."

Currently, Turkey hosts about 2.3 million refugees, including all refugees.

So it's not fair to say how many.

Talking fairly is how we work together to take international responsibility.

Europe, of course, is not yet done. A lack of solidarity prevents unity, and Europe is divided.

It's the same in a number of areas outside of refugee issues.

And frankly, we need Europe more now.

But the less people trust European institutions, the harder it is to convince them that Europe should be more present to solve the problem.

Giussani: Coming here, numbers are driving politics, especially domestically.

I'm back in France this weekend, and I've seen it countless times in other countries, like in Poland, Denmark, and Switzerland, and the numbers have changed quite a bit, but if you look at the numbers alone, it's not that big of a deal.

One Prime Minister -- (Guterres), just a minute, what do you think Europeans who live in villages without immigrants see at home?

What you see on television is that a few months ago, every day, every day, at the top of the news, millions of people, uncontrolled, moving from border to border.

And since no one is doing anything about this - it's happening without any control over it.

Furthermore, thinking that “refugees are coming to my village,”

It's a completely false notion that Europe will be invaded and life-changing. The problem is that if we had done the right thing, if the refugees had been properly received, welcomed, protected at the point of entry, checked at the point of entry, and flown to European countries, there would have been no fear.

Unfortunately, many people are afraid, because Europe has not dealt with it properly.

Giussani: There's a village in Germany where there are 1,000 refugees for every 300 villagers.

What do you think?

How do you think the villagers will react?

(Guterres): If we dealt with the situation well, and shared the distribution of refugees across Europe, as I said earlier, that would mean 1 in 2,000.

I didn't handle it very well, so I ended up in this very unacceptable situation. In many villages in Lebanon, there are more Syrians than Lebanese, but they manage.

I don't want Europe to have the same situation, where refugees outnumber every village.

We're just asking Europe to deal with it, and we just want it to be ready to receive it, as other countries have been forced to do.

(Giussani) Looking at the state of the world (Applause) (Giussani) Exactly!

(Applause) (Giussani) If you look at the state of the world, and not just in Europe, there are many countries that don't raise their hands.

(Guterres) 86% of the world's refugees are in developing countries.

If we take Ethiopia as a country, for example, it hosts more than 600,000 refugees.

borders are open

They have a policy of accepting all refugees, "person to person."

Some South Sudanese, some Sudanese, some Somalis

We accept from all neighboring countries

some Eritreans

In general, African countries are very welcoming to refugees, and the Middle East and Asia tend to open their borders.

Now we see the situation in Syria as a problem because it has turned into a security crisis, but the truth is that for a long time all borders in the Middle East were open.

At that time, the borders of Pakistan and Iran were open to Afghans, and six million fled.

Even now, the trend in developing countries is to say that borders are open.

The trend in the developed world is to make these issues even more complicated, especially when public opinion has a mixed debate about refugee protection on the one hand, and, in my opinion, the wrong view, but on the other hand, security issues.

CA: We'll come back to this later on, about the reduction of subsidies and subsidies from the World Food Programme.

It reflects a general lack of funding for organizations working on these issues.

Now that the world has woken up, are we in a position to get funding and support, or is it the same?

(Guterres) Support is increasing

We are on the same level as last year

Summer was terrible

But it's clearly not enough to meet the needs of the people and the needs of the countries that support them.

We are doing a basic review of the standards, objectives and priorities of development cooperation that are needed at this time.

For example, Lebanon and Jordan are middle-income countries.

As a middle-income country, we cannot get low-interest loans or subsidies from the World Bank.

It doesn't make sense these days, it brings the public good globally.

Despite hosting millions of refugees, frankly, in spite of their difficulties, these two countries have become pillars of regional stability and the first line of security for the entire world.

So why aren't these two countries at the top of the policy agenda for development cooperation?

It's wrong

In these countries, not only are refugees living in precarious conditions, but the communities themselves are in trouble: incomes have fallen, unemployment has risen, prices and rents have skyrocketed.

And if you look at the current index, it's self-evident that living conditions, especially for the poorer parts of the population, continue to deteriorate because of the crisis.

(Giussani) Then who will help?

Is it national or international or European Union?

Who should step up to help?

(Guterres) We must bring it all together

It is clear that bilateral cooperation is essential

It is also clear that multilateral cooperation is essential.

International financial institutions should have the flexibility to make large investments to support these countries.

All the methodologies must be superimposed to understand that in today's protracted climate, it is outdated to distinguish between humanitarian assistance and development assistance and development processes.

Because this involves school-age children, public health, even infrastructure overcrowding.

We need a long-term perspective, a development perspective, not just an emergency humanitarian perspective.

Giussani: I would like to have your comments on the subject of this morning's paper.

That's what Donald Trump, the current leading Republican nominee for president of the United States, said.

yesterday's statement

(Laughter) Listen, it's interesting.

"Until our country's representatives can clarify the facts, Muslims should be completely denied entry into the United States."

how would you react?

(Guterres) Not just Trump

Various people in political roles around the world have also said, for example, that Muslim refugees should not be accepted.

And the reason they say that is because they think they're protecting their country's security by saying that.

I was also in the central government

I agree with the government's intention to ensure the security of the country and its people.

However, in the United States and European countries, saying, "We're closing the country to Muslim refugees," is a perfect way to fuel the propaganda of terrorist organizations.

Because -- (applause) because the language reaches the ears of Muslims in their own countries, and it facilitates the recruitment and other mechanisms by which groups like Da'esh and al-Nusra al-Qaeda use technology to infiltrate our society.

It's like saying, "You're right, we're the enemy."

So in a clearly multinational, multi-religious, multi-cultural society, statements like this actually create a situation in which terrorist organizations' propaganda becomes more effective in recruiting members to commit terrorist acts, especially in countries where such language is prominently displayed.

Giussani: Did the recent attacks in Paris and the reaction to them make your work tougher?

(Guterres) Of course

(Giussani) How?

CA: For many people, the first reaction to a terrorist attack is to say, "Close your borders," but they don't realize that Europe's terror problem is largely homegrown.

There are thousands of European soldiers in Syria and Iraq, so it's not a problem that can be solved by keeping Syrians out.

And I'm pretty sure that the passports that were found belonged to the bomber -- Giussani -- of the suicide bomber.

Guterres: I think that's the intention, because one of Daesh's strategies is against refugees, because people who should be with the caliphate are fleeing to the crusaders.

And I think the response from Europe is also part of Daesh's strategy: closing the door on Muslim refugees and making Muslims hostile in Europe makes it easier for them to operate.

I truly believe that the movement of refugees is not the catalyst for terrorism.

Again, terrorism in Europe is currently a product of its own country in response to world affairs, and what is needed is to accept and integrate refugees from the same country in order to prove terrorist organizations wrong.

I also believe that Europe is paying a price today, in large part, because of the massive migration of the time, the refugee integration model that failed in the '60s, '70s, and '80s. The sense of marginalization that so many people, for example, the Nisei community, have today -- that they're forced to live in neighborhoods that have no jobs, no decent education, and poor public infrastructure.

This frustration, sometimes even anger, that the Nisei feel is often due to failures in acceptance policies and a lack of investment in creating an environment of mutual respect and coexistence.

looks like that to me

(Applause) What is clear is that in the future we will have a multinational, multicultural, multireligious society.

It is my opinion that this is impossible to avoid.

In my opinion, this is a good thing, but we also know that it will require a significant investment in social cohesion in individual societies for it to succeed.

Europe has arguably failed in this investment over the past few decades.

Giussani: I have a question. You will be stepping down by the end of the year, after 10 years in office.

When you look back to when you took office in 2005, what do you see?

Guterres: Look, in 2005, when the conflict ended, we were helping a million people return home safely and with dignity.

last year we helped 124,000 people

In 2005, 38 million people were displaced by conflict.

Now it's even more, more than 60 million people.

At that time, the conflict had just ended.

Today, while new conflicts are doubling down, old conflicts are never over: Afghanistan, Somalia, the Republic of the Congo.

The world is more dangerous than it was then

Unfortunately, the ability of the international community to avoid conflicts and resolve conflicts quickly is much less than it was a decade ago.

The balance of power in the world has become unclear, and there is no way to govern the whole world well, which means that we live in a situation where the unexpected can easily happen, and that means that even more people who are displaced by conflict will suffer.

CA: There's a tradition in American politics that when a president leaves the Oval Office, he leaves a handwritten note for his successor, who will come in a few hours later.

If you were to leave a note for your successor, Filippo Grandi, what would you write?

(Guterres) I don't leave messages

One of the things you shouldn't do when you leave is to steer from behind and meddle with your successor.

so i won't do it

If I had to say something, it would be, "Be yourself and do your best."

(Giussani) High Commissioner, thank you for your hard work.

Thank you for coming to TED.

(applause)

love is?

really what?

what is love

verb?

noun?

cosmic truth?

ideal?

Common theme of all religions?

cult?

Neurological phenomenon?

the answers are endless

Some answers are "everything"

"Love rules all"

"All I Need Is Love"

"Love is everything"

But that's just an analogy, it's just a comparison and a definition.

Love might be more important than a turkey sandwich Love might be more important than a turkey sandwich But more important than safety?

How's your health?

Better than an exquisite turkey sandwich?

No matter what the answer is, it's just a ranking No matter what the answer is, it's just a ranking Not a definition

Another reason that love is hard to define is that you try to define it when you fall in love or when you're heartbroken.

Can you believe the money sense of someone who just won the lottery? Can you believe the money sense of someone who just won the lottery?

Or do you ask someone running away from a bear, "What is a bear?" Or do you ask someone running away from a bear, "What is a bear?"

What's the difference between winning the lottery and romance?

Is a broken heart different from being attacked by a bear?

Bad example?

that's what it is

I can't think properly I'm in love Okay!

Take a step back and cool your head Take a step back and cool your head Take a step back and cool your head Love is the hottest debate in human history Love is the hottest debate in human history

I've been obsessed with it for hundreds of years and I still don't know I've been obsessed with it for hundreds of years and I still don't know

Some say it's a "feeling" or a "magic feeling" or a "feeling you've never felt before"

But emotions are mutable, so there's no hard and fast rule to define them.

sometimes i hate the one i love

I know that feeling, even if it's just a little bit

Family relationships create lover relationships Family relationships create lover relationships

The love you have for your lover is reflected in your relationship The love you have for your lover is reflected in your relationship Wholesome or very strange Just like the love you have for your parents or siblings

Love can be expressed through emotional actions Love can be expressed through emotional actions like holding hands, kissing, hugging, flirting in public, dating, getting married, having children, just having sex

Such behavior is subjective or culturally relevant Such behavior is subjective or culturally relevant

Sometimes you or your partner can't or don't want to have children There are times when you or your partner can't or don't want to have children Some people marry and get divorced Some cultures don't date like we think Some cultures don't date like we think Some people don't like flirting on the bus

If love can be defined, why does it mean something different to so many people Why does it mean something different to so many people

Love is only in your head Spreading through your nerve pathways It's your own secret It brightens up your life Maybe it's a nice nerve reward

maybe this is going to be addicting

Love can be a temporary or permanent addiction, like a drug addiction.

I don't mean to pretend to be a popular song I don't mean to pretend to be a popular song

Studies show that when the brain is stimulated by another person, it can promote dependence on that person.

Physiological needs will be satisfied by that person Physiological needs will be satisfied by that person and you will want more

But sometimes gradually or suddenly it goes away

out of love and out of dependence out of love and out of dependence for a while

what happened?

Are you used to it or have you reached your limit?

Why are some people dependent on others for the rest of their lives? Why are some people dependent on others for the rest of their lives?

To create new life and multiply the seeds? To create new life and multiply the seeds?

Maybe love is the best way for human DNA to replicate.

There are many evolutionary arguments for all human mating practices, ranging from how we present ourselves to potential mates, to how we treat romantic partners and how we raise our children.

That's why I think I feel it in my soul. That's why I think I feel it in my soul.

Nature chose you so that you like attractive people Just like a monkey likes an attractive monkey Like a monkey likes an attractive monkey This is how ecology continues.

Then is it love?

At worst, it could be a fabrication, a concept invented to convince each other to follow a false purpose.

If it's fake, let's find out what it is Let's find out what it is 'Cause love is made out of reality Our experiences, our feelings, the chemicals in our brains, our cultural expectations, our lives...

And this system of love can be viewed from a myriad of perspectives, scientific, emotional, historical, spiritual, legal, or just personal.

If ten people have ten colors, then ten people should have ten colors too

In every relationship of love There's so much to talk about We should open up to each other There's so much to talk about We should open up to each other Or the relationship won't last

love is always controversial and yes it's not finished yet

So what you can't define is evidence that things are going well So what you can't define is evidence that things are going well

That's what I'm doing right now...

No, it's not weird, you know what I mean?

Suppose two people are listening to music

What are the odds of listening to the exact same playlist the exact same playlist

must be very low

We all have different tastes in music

So what are the odds that your body needs the exact same treatment as someone else's?

it's lower

Each of us needs different health care to survive.

Scientists and doctors are trying to create medicines that are more personalized.

One way to do that is to study stem cells.

Stem cells are undifferentiated cells, and their roles have not yet been determined.

Skin cells protect the body Muscle cells contract Nerve cells send signals But stem cells have not yet determined their structure and function

Stem cells can become any cell in the body

The body uses stem cells to replace dead cells

For example, the intestinal lining is completely replaced in four days.

Stem cells under the lining replace old cells

Scientists hope to use stem cells to make replacement parts for body parts from parts of themselves as a personalized therapy.

Stem cell researchers are desperately looking for ways to create new tissue to replace parts of internal organs that have been damaged by injury or disease.

Using stem cells to replace damaged tissue in the body is called regenerative medicine.

For example, scientists are now using stem cells to treat blood diseases like leukemia.

Leukemia is a type of cancer that affects the bone marrow.

Bone marrow is the sponge-like tissue inside your bones that makes blood.

When you have leukemia, more and more cells in your bone marrow push out the stem cells that make up your blood.

Some people with leukemia can still get stem cell transplants.

These stem cells produce new blood cells that the patient's body needs

There are actually several types of stem cells that scientists use for therapy and research.

Adult Stem Cells Tissue-specific stem cells are found in small numbers in most tissues of the body

Tissue-specific stem cells are used to replace existing cells in tissues

Embryonic stem cells are created from embryos provided by patients that were not used during artificial insemination.

Unlike tissue-specific stem cells, embryonic stem cells are pluripotent

So it can become any tissue in the body.

The third type is called induced pluripotent stem cells.

Cells from skin, fat, liver and other normal cells that scientists have changed to look like embryonic stem cells.

Like embryonic stem cells, they can also become any cell.

Scientists and doctors hope to use these stem cells to create new tissues and use them therapeutically, but they are also using stem cells to better understand how the human body works.

Scientists are watching stem cells develop in tissues, trying to understand the mechanisms that control and coordinate when the body makes new tissues.

What scientists want is to do more research, not only to create personalized medicines, but also to learn more about how the body works when it's healthy and when it's not.

Today more than 50% of the world's population lives in urban areas

By the middle of this century, this will rise to around 70%.

But about 100 years ago, only two out of every 10 people lived in urban areas, and before that, even fewer.

How the hell did we get together in such a city What is our future?

In the early days of human history, humans were hunter-gatherers, moving from place to place in search of food.

But about 10,000 years ago, our ancestors began learning breeding techniques and early agricultural techniques.

For the first time humans were able to nurture food rather than forage for it, and this led to the development of semi-sedentary villages for the first time in history.

Why only semi-sedentary type?

The first reason was that we had to move every few years as the land became unusable.

It was only about 5,000 years ago, with the development of agricultural techniques such as irrigation and tilling, that humans could rely on a stable and long-term food supply and settle in one place.

And these technologies produced extra food, so there was no need for everyone to be involved in farming.

This led to the development of other jobs and consequently the development of cities.

And cities could now produce extra food in addition to tools, crafts, and other commodities, allowing them to trade and interact with greater distances.

As trade flourished, so did the technologies that facilitated trade, such as cargo ships, roads and ports.

Of course, it took more labor to build and maintain these things, and because there were more jobs and more opportunities in the cities, more people moved from the countryside to the cities.

If you think modern cities are overpopulated, you'll be surprised to learn that some cities in the second millennium BC were nearly twice as densely populated as Shanghai or Calcutta today.

One of the reasons was that transportation was not widespread at the time, so everything had to be within walking distance, including clean water sources, which were scarce.

And urban land became more limited because walls were needed to defend against enemy attacks.

The Roman Empire developed infrastructure to overcome its scarcity of land, but apart from that, modern cities, as we know them, were not only able to expand and consolidate until the Industrial Revolution saw the massive deployment of new technologies, and organized not only transportation networks and, a little later, electricity, but also police, fire departments, and public health departments.

So what is the future of cities?

The world's population is currently over 7 billion and is expected to exceed 10 billion in the future.

This increase will occur mainly in urban areas of the world's poorest countries.

So how do cities need to change to accommodate this population growth?

First, we'll need to figure out how to provide everyone with adequate food, hygiene, and education.

Second, we must ensure that this population growth does not undermine the land that provides the goods and services that humans need.

The location of food production could also move, with vertical farms, skyscrapers, rooftop gardens and vacant lots in city centers.

More dwellings will be built vertically, instead of one house per family.

There may be buildings where you can get everything you need for daily life. There will also be compact, self-sufficient cities that are more rural and focused on sustainable production.

The future of cities will be diverse, flexible and creative, no longer centered around a single industry, but a more interconnected global world.

What if you could only see one color?

For example, what if you could only see the color red and no other colors at all?

In fact, what we experience on a daily basis is something like this: the human eye can only see a small part of the spectrum of light.

There are many kinds of light all around us, but there are many things that we cannot see, from the radio waves that broadcast music, to the X-rays that doctors use to see inside the body, to the microwaves in microwave ovens that heat food.

In order to understand that all of this is light in the broadest sense, let me briefly explain what light is.

Light is an electromagnetic wave that has properties of both particles and waves.

Waves of light are like waves of the sea

There are big waves, there are small waves, there are waves that crash one after another, there are slow waves.

The length from crest to crest of the wave is called the wavelength, and the frequency at which the waves come is the frequency (vibration).

Let's say you're on a boat in the ocean, rocked by the waves.

If the wave length is long, the boat will bob slowly, which is a low frequency sway.

But if the wavelength is short and the waves are closely spaced, the boat will continue to bob and bob with a high frequency.

All kinds of light are waves, they just differ in wavelength and frequency.

The wavelength and frequency tell us how much energy the light has.

Waves with long wavelengths have low energy and waves with short wavelengths have high energy.

It's easy to remember: on a boat

In rough seas with rippling waves, you'll spend your energy busy trying to keep things from falling into the sea.

But long-wave waves sway, relax, and don't use energy.

The amount of energy that light carries determines how it affects matter, for example, let's look at the cells in our eyes.

We see because light energy stimulates sensors in our eyes, and this part is called the retina.

The light energy range that the retina can sense is very narrow, and the light in this range is visible light.

There are two special types of sensors in the retina, called rods and cones.

Rods sense light and help us perceive light and dark.

Cone discriminates the color of light, and each cone is sensitive to a specific light energy.

Some cones are sensitive to long, low-energy light, some are sensitive to long, low-energy light, some are sensitive to short, high-energy light, and some are sensitive to short, high-energy light.

When light hits the eye, the amount of energy each cone senses is transmitted to the brain, and the combination is perceived as a color.

The rainbows we see are ordered by the amount of energy that visible light carries.

One end of the rainbow is low energy red and the other end is high energy blue.

If the light hitting the eye is outside the energy range that the retina can perceive, it cannot see.

If the wavelength is too short and the energy is too high, the light will be absorbed by the surface of the eye and will not reach the retina. If the wavelength is too long, the retina will not be able to sense it. If the wavelength is too long, there will be insufficient energy for the retina to sense.

The only thing that determines the type of light is the difference in wavelength.

Radio waves have long wavelengths and X-rays have short wavelengths.

Visible light that the human eye can see is somewhere in between.

We can't see light outside the visible spectrum, but we have special sensors that can pick up these wavelengths of light, much like a digital eye.

With a device like this, you can see light that the naked eye can't see.

Let's take a step back and put this together.

It seems like a completely different thing, but the warmth you feel when you hold your hand over a campfire is the same as the sun's rays on a sunny day. It's the same as the sun's rays on a sunny day.

Light like this is all around us on a daily basis on earth, but what's even more surprising is

It is that a wide variety of light reaches from the universe.

When you think of the night sky, you probably think of the twinkling stars that you can see with the naked eye, but this is only the visible part, which is a very small part of the broad spectrum.

If you were to use only visible light to draw a picture of the universe, you would end up with a boring picture, like drawing with a single crayon.

To see a wide spectrum of cosmic light, you need eyes that are adapted to each light, and you need special telescopes to see beyond the visible light.

The Hubble telescope is famous, and the beautiful visible light and ultraviolet photos taken by Hubble have been published.

But what many people don't know is that there are 20 telescopes in Earth's orbit, each looking at a specific wavelength of light.

What you can see with telescopes like this in space and on the ground, with telescopes like this in space and on the ground, it's really amazing.

And the good news is that light of any wavelength and energy, coming from the depths of space, is the same light that we can experience and study here on Earth.

Because we know the physics of X-rays, ultraviolet and microwave X-rays, ultraviolet and microwaves, and we know the physics, we can look at the light of distant stars and galaxies and see what's going on there.

From now on, please think about things other than what you can see in your daily life.

Expanding your knowledge of the natural world just a little bit can help you understand more about the world around you.

In 1977, physicist Edward Purcell calculated that if you pushed and released a bacterium, it would stop after about a millionth of a second.

The distance traveled in between is less than the width of an atom.

The same is true for sperm and many other microorganisms.

It's all because of its extreme smallness.

Microscopic organisms live in a world alien to us, where it's hard enough to get two and a half centimeters under water.

But why does size matter to swimmers?

What's fundamentally different in the sperm and sperm whale worlds?

To find out, let's dive into the world of fluid physics.

Here's how I think

Imagine yourself swimming in a pool

There's you and a huge number of water molecules.

There are 1,000 times more water molecules than you

It's easy to push water molecules away with your huge body, but if you're really small, if you're about the size of a water molecule, you're suddenly in a pool full of people.

What was just pushing through a huge amount of tiny water molecules is now that all the water molecules are people the same size as you, and you have to push them around to get anywhere.

In 1883, physicist Osborne Reynolds discovered that there is a singular number that can predict how fluids move.

This is called the "Reynolds number," and it's determined by simple properties such as the size and speed of the swimmer, the density of the fluid, and the stickiness or viscosity of the fluid.

This means that the worlds inhabited by creatures of very different sizes are radically different.

For example, given their size, sperm whales live in a world of high Reynolds numbers.

Once you flap your tail, you can coast for incredible distances.

Sperm, on the other hand, are in a world of low Reynolds numbers.

If you stop swinging your tail, you won't be able to advance even one atom's distance, and you'll stop.

To imagine how sperm feels, you have to immerse yourself in a low Reynolds number environment.

Imagine moving your arm in a jar full of molasses, moving as slowly as the second hand on a clock.

So how do microbes move?

That said, many microbes don't even want to swim.

I'm waiting for the food to flow by itself

In a way, it's like a lazy cow waiting for grass to grow to its mouth.

But many microbes can swim, and this is where the wonderful phenomenon of adaptation occurs.

One of the tricks that microbes do is transform the fins.

By deftly bending it, it creates more resistance when scratching than when unfolding, allowing single-celled organisms like paramecium to nudge through the tightly packed water molecules that surround them.

Bacteria and sperm have landed there, and there are still many more brilliant tricks.

Instead of swinging the fin in two directions, you rotate it like a corkscrew.

Just as when you open a bottle of wine, the rolling motion of a corkscrew turns into forward motion, the sperm spins its spiral tail to propel itself through a world where water feels as dense as cork.

There are even more bizarre strategies

If it's a microbe that uses a method similar to Batman,

hook and pull itself

You can even use it like a slingshot to propel yourself farther.

some microbes use chemical engineering

The only habitat for Helicobacter pylori is in the sticky, acidic mucus of the human stomach.

The fungus slides through the mucus by releasing chemicals that thin the surrounding mucus.

Perhaps it's no wonder that this bacterium also causes stomach ulcers.

When we look at our bodies and the world around us up close like this, we can see a huge variety of microbes deftly navigating sticky environments (troublesome situations).

Without these adaptations, microbes would never find a host, sperm would never make it to the egg, stomach ulcers would never occur, but you would never be born in the first place.

(Pong!)

For many people, one of the coolest things about Game of Thrones is that the Dothraki sea dwellers have their own language.

Right before Dothraki was the language spoken by the Na'vi in ​​"Avatar," and before that, of course, was the language spoken by the Klingons in "Star Trek," an entirely unique language since 1979.

It did exist, and let's not forget the Elvish language in J.R.R. Tolkien's "Lord of the Rings" trilogy, because it is the official progenitor of fictional artificial languages.

Constructed language stands for "artificially constructed language"

It's more like a language than a cipher like a replacement word, and it's not just a collection of artificial slang.

It's not the size of its vocabulary that makes an artificial language a real language.

Of course it's important to have lots of words

Dothraki has thousands of words

Na'vi originally had 1,500 words,

Fans are steadily adding more words on the website

But the difference between the vocabulary itself and what makes it a true language can be understood from the way Tolkien coined Old Elvish, an artificial language with thousands of words.

After all, even if you learn 5,000 Russian words, you can't really make sentences.

A four-year-old would speak much better.

This is because we don't know how to string words together.

So a real language has a grammar.

Elvish has

In English, to put a verb in the past tense, add "-ed".

"wash" becomes "washed"

In Elvish, "to wash" is "allu" and "to wash" is "allune".

true language changes over time

From a thousand years ago to the present day, no two languages ​​are exactly alike.

As people talk, they move to new uses, discard old ones, make mistakes, and get creative.

In today's parlance, "Give us today the sustenance we need" is

In Old English it was "Urne gedaeghwamlican hlaf syle us todaeg"

Artificial language undergoes various changes

Tolkien created an old form and a new form of the Elvish language.

When the elves first awoke in Kuyvienen, the word for "people" in their new language was "kwendi," but in the language of Tereri, one of the departed groups, over time the "k" changed to "p" and "kwendi" became "pendi."

Like real languages, artificial languages ​​like Elvish split into many languages.

When the Romans spread Latin across Europe, French, Spanish and Italian were born.

As groups move from place to place, the way they speak, like many other things, changes dramatically over time.

So "hand" in Latin is "manus," but in French it's "main," while in Spanish it's "mano."

Tolkien made the same thing happen to Elvish.

While the original word ``kwendi'' became ``pendi'' for the Tereri people, the ``w'' was dropped and became ``kindi'' among the Avari people who spread throughout Middle-earth.

The Elvish languages ​​that Tolkien fleshed out the most were Quenya and Sindarin, and their differences seem to be related to French and Spanish.

The Quenya word for "drink" is "suc," while the Sindarin word is "sog."

As you know, real language is confusing.

It's because it changes, and change happens against order, just like your living room or your bookshelf.

Real language is never completely logical.

That's why Tolkien made a lot of exceptions for Elvish as well.

Many verbs are irregularly conjugated, so you have to memorize them.

Let's take the verb "know" as an example.

The past tense is ``knew,'' which cannot be explained by any of the English rules.

It can't be helped

In Elvish "to know" is "ista" but "to know" is "sinte"

that's how it is

But in reality, Elvish is more of a sketch of a real language than a whole language.

For Tolkien, Elvish was more of a hobby than an attempt to create something people could actually speak.

Much of the Elven language spoken by the characters in the Lord of the Rings movies was created in the post-Tolkien era by die-hard fans thinking, "How would Tolkien have constructed it?"

There are no elves around who really speak Elvish, so that's the best we can do.

Modern artificial languages ​​are more developed

Dothraki, Na'vi, and Klingon are advanced enough to actually speak.

Here's the Klingon translation of "Hamlet," although in real life you'd have to pronounce the "k" sound with something called the uvula, which hangs down the back of your throat.

Believe it or not, many languages ​​around the world do the same thing, like the Eskimo language.

Elvish Pronunciation Is Easier

So let's conclude this introduction to artificial languages ​​with a heartfelt quarrel in four languages ​​using Elvish and other artificial languages: "A na marie!"

“Hajas!” (Drask)

“Kiyevame!” in Na’vi

“Qapla!” (Klingon)

and "Goodbye!"

In 2008, 17-year-old Bahan Hasan boarded a plane from Minneapolis to Somalia.

Barhan was the youngest of the recruits, but he wasn't the only recruit.

Al-Shabaab managed to recruit more than 20 young men in their late teens and early twenties, and they did so using social media like Facebook.

Technologies like the Internet have changed the way we live, but they're also changing the way we recruit recruits and the front lines of radical conflicts today.

What connects Twitter and Google with protesters fighting for democracy?

These numbers, 8.8.8.8, represent Google's public DNS servers, which were effectively the only electronic border crossing points available to the protesters, who used them to communicate and relay their country's situation to the outside world.

Modern conflicts are essentially borderless.

If there is a boundary, it's electronic, not physical terrain.

In such situations, a power vacuum emerges, giving non-state actors, individuals and private organizations an advantage over slow-moving, outdated military and intelligence agencies.

Because in the conflict of the digital age, there is a feedback loop in which new technologies and platforms like the ones I mentioned above -- or even more disruptive -- are being adopted, learned and deployed by individuals and organizations faster than governments can respond.

To see how quickly the U.S. government is picking up on these issues, let's turn to a document aptly titled "The Global Threat Assessment Report." Every year, the Director of National Intelligence takes a look at the threats that exist in the world and says, "Here's the threat, and here's the details, and here's how we rank the severity."

There was no mention of “cybersecurity” in 2007

It barely made headlines in 2011, but it's rated as a lesser threat than things like drug trafficking in West Africa.

It was upgraded in 2012, but still below terrorism and weapons proliferation.

And in 2013, it became the biggest threat, and in 2014, it will continue for the foreseeable future.

What this stuff shows us is a fundamental inability of governments to adapt and learn about digital conflicts, which have no substance, no borders, and are often untraceable.

In addition to the online-to-real flow that we saw in the extremist group example, there is also the opposite pattern.

The terrorist attack in Paris this year is fresh in our minds, the attack on the Charlie Hebdo company.

What a small group of hackers and anonymous people did was tap into a social media discussion with a lot of people participating.

#JeSuisCharlie

On Facebook, on Twitter, on Google, everywhere, millions of people, including me, discussed this event and saw this image: a moving picture of a baby with a wristband that said, "I'm Charlie."

But this image became the lethal weapon.

Hackers turned this photo into a weapon, and the victims were unsuspecting people who were participating in the discussion, and when they saw the photo and downloaded it, they found malware inside.

The moment you download a photo, your computer is compromised.

It only took six days for malware to spread globally.

There's no longer anything separating the physical and digital realms. Real-world attacks, like what happened in Paris, are being exploited for online fraud.

The opposite happens with soldier replacements.

Internet radicalized young people are being sent around the world for actual terrorist activities.

A new war of the 21st century is brewing, and governments aren't necessarily involved.

Another example is the feud between Anonymous and Los Zetas.

In early September 2011, Los Zetas, one of Mexico's most powerful drug cartels, hung two bloggers with a sign reading, "The end of the Internet meddlesome."

A week later, he beheaded another young woman.

I placed the severed head on top of the person's computer, which had a similar sign on it.

The government's inability to comprehend and deal with the situation led Anonymous -- a less positively regarded organization -- to fight back online, threatening to disclose information instead of cyber-attacking.

On social media, they said, "We're releasing information about governors and prosecutors who have ties to Los Zetas."

Things escalated until Los Zetas threatened, "I'll kill 10 people for every piece of information you leak."

It got too gruesome to continue the fight, so it ended there.

But what's remarkable here is the fact that a group of anonymous individuals, not federal police, not military, not politicians, instilled deep terror in the world's most powerful and violent organization.

We live in a time when conflict has lost its former clarity. We don't know who we're fighting, what the motives are for the attacks, what tools and methods are being used, or how quickly it's unfolding.

But the question remains the same: What can individuals, organizations, and governments do?

To answer this question, we have to start with the individual, and I think peer-to-peer security is the answer.

Peer-to-peer security can deal with extremists who recruit young people online.

Individuals have more power than ever before over national and international security.

You can create good peer-to-peer relationships, both online and in person, and you can help people like me, the next generation of hackers, to grow, instead of being forced to say, "I'm either a criminal or I'm in the NSA."

this is an important issue right now

Not only for individuals, but also for organizations and businesses.

It has the advantage of being able to move across borders faster and more effectively than governments, and there are incentives to do so.

Because in the digital age, it's valuable and profitable to be seen as trustworthy, and future generations will be even more so.

But that doesn't mean we can ignore governments, because that's where we're headed when we take collective action to keep us safe.

But what we're seeing is governments that are incapable of adapting and learning from digital conflict. Leaders at the highest levels -- the CIA director, the secretary of defense -- are saying, "Cyber ​​Pearl Harbor is coming." "Cyber ​​9/11 is coming."

This will only make people more afraid, and it won't make them any safer.

If you ban encryption to allow for mass surveillance and mass intrusion, yes the GCHQ and the NSA would be able to monitor everyone.

They're not the only ones who can

The ability to do so is cheap, even free.

Technology is growing all over the world, and it benefits individuals and small groups.

Who can say that if it were just the NSA and GCHQ today, they wouldn't find a backdoor in China?

The next generation of Estonian boys may be able to do it at home.

So I would like to say that this is not what the government should do, but what it shouldn't do.

To keep people safe, governments need to relinquish power and control.

We're going to give up on mass surveillance and hacking, and we're going to block the backdoors, and the government won't be able to monitor the people, but neither will China, nor the Estonian hackers of the future.

Governments should also support technologies like Tor and bitcoin, which will let governments relinquish control so that developers, translators in countries like Cuba, Iran, China, anyone with an internet connection, can sell their skills and products in the global marketplace, and more importantly, communicate their ideas and what's happening in their country.

For governments that fought the great battles of the 20th century for civil rights, free speech and democracy, this should be exciting, not scary. For the first time in human history, we have a unique opportunity to make billions of people around the world safer through the power of technology.

this should be exciting

(applause)

Various aspects of Japanese culture, such as Japanese food and martial arts, are known around the world.

Kabuki is a type of theatrical performance, little known in the West, with a tradition of more than 400 years and still influential and popular today.

The name Kabuki comes from the Japanese word kabuku, which means "unusual" or "strange."

The history of Kabuki began in Kyoto at the beginning of the 17th century. When a shrine maiden named Izumo no Okuni set the Kamo Riverbed as a stage and performed a dance that had never been seen before, the audience found her daring Nenbutsu dance amusing and charming.

Soon others began to imitate, soon others began to imitate Kabuki became the first theater in Japan to entertain the common people.

Kabuki, which applied make-up and expressed itself with its face without using a mask, specialized in historical events and everyday stories rather than folk tales, took a different path from Noh, which was the theater of the upper class, and carried out a unique social criticism in the Edo period.

At first it was only women who danced, this is called 'Onna Kabuki'

It soon developed into a group performance that became a regular routine in teahouses and entertained people of all classes.

At this time, onna kabuki was sometimes risqué, and geisha not only performed songs and dances, but also appealed physically to attract potential customers.

After the conservative Tokugawa family banned women's kabuki in 1629, "wakashu kabuki" emerged, performed by young boys.

However, when this was also banned for similar reasons, it changed to 'Yaro Kabuki', which was performed by grown-up men who came in elaborate costumes and applied make-up to play the role of women, who were called 'onnagata'.

The ban that tried to regulate Kabuki didn't end with just restricting the gender and age of the actors.

The Tokugawa family, the shogunate, used Confucius' ideas as a model, and based on that, they regulated the fabrics of costumes, the weapons on stage, and the themes they performed.

At the same time, Kabuki was an elaborate puppet show that gradually became influenced by Bunraku.

Under these influences, the original improvisational one-act dance developed into a five-act play, and many of them were based on the teachings of Confucius.

Before the fall of the Tokugawa shogunate in 1868 and the restoration of the monarchy by the Meiji Emperor, Japan had restricted exchanges with foreign countries.

Because of this, Kabuki developed independently in Japan.

In the meantime, however, European artists, such as Monet, became interested in Japanese art and were inspired by ukiyo-e and theater.

After 1868, other artists, such as the painter Van Gogh and the composer Debussy, began to incorporate the influence of kabuki into their work, while kabuki continued to change and experiment to adapt to new times.

Like other traditional arts, Kabuki's popularity plummeted during World War II.

However, Kabuki was soon revived thanks to major innovations such as director Tetsuji Takechi.

Even though Kabuki was censored by the U.S. military Despite being censored by the U.S. military, even American soldiers stationed in Japan recognized Kabuki as popular entertainment.

Today, kabuki lives on as an integral part of Japan's rich cultural heritage, and its influence extends beyond the stage to television, film, and animation.

The art that Okuni started continues to entertain audiences It is the elaborate make-up of the actors, the extravagant and delicately embroidered costumes, and the love stories told on stage that everyone can relate to.

Nicholas Steno is not well known outside of introductory geology, but anyone who wants to understand life on Earth should know how he broadened and connected the concepts of earth, life, and understanding.

Born Niels Stensen in Denmark in 1638, he was the son of a goldsmith, a sickly child, and his schoolmates died of the plague.

He survived and worked as an anatomist, dissecting cadavers and studying organs that were common across species.

He found a tube in the animal's skull that carried saliva to its mouth.

He disproved Descartes' theory that only humans have a pineal gland, and he proved that it's not the place where the soul resides, and that was the birth of neuroscience.

Most notable is his method in that era.

What Steno never did was to dismiss empirical and experimental evidence in favor of archival texts, Aristotle's metaphysics, or Descartes' deductive reasoning.

His field of vision, organized by reasoning and rational explanations, expands further.

Steno had seen how gallstones formed inside moist organs by adhesion.

The formation of gallstones follows the principles of mold that I learned from my experience as a goldsmith, and that principle has helped me across disciplines to understand solids from their structure formation.

Later the Grand Duke of Tuscany had him dissect the shark.

The shark's teeth resembled strange stones called lingual stones in rocks in the mountains near Malta and Florence.

Pliny the Elder, the ancient Roman naturalist, said that these things fell from the sky.

In the Dark Ages, people said these were the tongues of serpents petrified by St. Paul.

Steno thought that the lingual calculus and the shark's tooth were the same thing with the same developmental characteristics.

Based on the idea that like things are made in like manner, he argued that the ancient tooth came from an ancient shark, and that a rock formed around the tooth in the ocean, and then a mountain was born.

The layers of rock were once layers of sediment on the ocean floor, and these would have spread horizontally, layer after layer, starting with the oldest.

If those layers are deformed and tilted and cut by faults and canyons, that's a change that happened after the layers were formed.

It sounds simple now, but at the time it was a revolutionary idea.

He invented stratigraphy and laid the foundation for geology.

By discovering the origins of shark teeth in two eras, and by arguing that the natural laws that govern the present also governed the past, Steno sowed the seeds of uniformitarianism that the past was shaped by the same processes we observe today.

In the 18th and 19th centuries, British uniformist geologists James Hutton and Charles Lyell studied the very slow erosion and sedimentation rates of the time and realized that the Earth must be much older than the speculative 6,000-year-old Biblical age.

Their work, combined with plate theory in the mid-twentieth century, led to a better understanding of rock cycles, from massive crustal melting to the occurrence of earthquakes, from the formation of gallstones to 4.5 billion years of geological history, all theories about the Earth.

Now let's take the bigger picture and apply it to biology.

Let's say there's a layer of shark teeth, and underneath that is a fossil of a creature that's never been seen before.

The further down you go, the older the fossils, right?

It means that we have evidence of the origins and extinctions of species over time.

call the uniformists

Processes that are still active today may have caused changes in not only rocks but also life.

It may also explain the similarities and differences between species discovered by anatomists like Steno.

There's a lot to ponder, but Charles Darwin, on his long trip to the Galapagos, read his friend Charles Lyell's book, Principles of Geology, which Steno kind of laid the foundations for.

Sometimes giants sit on the shoulders of curious dwarfs.

Nicolas Steno helped develop the theory of evolution, pioneered geology, and showed how unbiased experimental observations can push the boundaries of the intellect and broaden our horizons.

But his crowning achievement may still lie in his quest for truth, a maxim that seeks the beauty of the unknown that lies beyond our human senses and our present understanding.

"What we see is beautiful, what we know is more beautiful, what we do not know is far and most beautiful."

You may know that everything around you is made of atoms, and that atoms are very, very small.

Every atom has a nucleus, which consists of at least one positively charged proton, plus a positively charged proton, and usually a similar number of uncharged neutrons.

Negatively charged electrons fly around this nucleus.

What kind of atom an atom is is determined by the number of protons in the nucleus.

If there is only one proton, it is hydrogen. If there are six protons, it is carbon. If there are 79 protons, it is a gold atom.

let's go sideways for a moment

How do we know the structure of an atom?

Protons, neutrons and electrons cannot be seen

So experiment and build a model of what you're predicting.

Repeat the experiment to see if the results fit the model

Great if it fits your model

If it doesn't fit, you know you need a new model

Various atomic models have been proposed since Democritus' atomic theory in 400 BC, and many new ones will be born in the future.

Now let's get back to the topic

At the nucleus of the atom, things are stuck together, but electrons are free to move around, which is why chemists love electrons.

I'd love to get married

But electrons have really changed

It's small, but it behaves like a particle like a baseball, or it behaves like a wave of water.

In particular, the electrons have changed because their positions are not clearly known.

It's not the equipment that measures it, it's this uncertainty that's modeled the electrons of today.

so i don't know the exact location

It is possible to indicate by probability whether an electron exists at a particular location around the nucleus.

So I can ask you this question: If you could draw a space around the nucleus where you have a 95% chance of finding a specific electron, what would it look like?

Actually it looks like this

These are called electron orbitals, and the shape of each is determined mainly by the amount of energy in the orbitals.

The higher the orbital energy, the further away from the nucleus the place where electrons are most likely to exist.

By the way, why is it 95% and not 100%?

This also involves a rather unusual model of electrons.

After some distance from the nucleus, the probability of finding an electron there decreases, but it does so in an exponential fashion, meaning that the probability approaches zero, but never quite zero.

This means that there is a faint, but very short, very small probability that an electron belonging to an atom exists at the far end of the universe.

But normally, electrons exist as negatively charged particles near the nucleus, changing over time like a dense cloud.

How electrons belonging to one atom interact with electrons belonging to other atoms determines almost everything.

Atoms can give their electrons to other atoms or share them with other atoms.

It's this relationship between atoms that makes chemistry so interesting.

From pebbles everywhere to complex creatures From pebbles everywhere to complex creatures Everything we see, hear, smell, taste, touch and feel Smell, taste, touch and feel Smell, taste, touch and feel The essence of everything is determined at the atomic level.

What keeps us healthy and happy throughout our lives?

If you could invest in your best future self, what would you do with your time and energy?

In a recent survey of millennials, we asked them what their most important life purpose was, and more than 80 percent of them answered that their primary life purpose was to accumulate wealth.

Another big goal for 50% of those same young people was to become famous.

(Laughter) We live in a world where we're constantly being asked to work, to do more, to do more.

We're all made to believe that in order to have a good life, you have to do it.

It's almost impossible to predict how your choices will shape your entire life.

You can tell a lot about a person's life by asking them to remember their past, but as you know, that's not very reliable.

A huge amount of what happened in the past is forgotten, and sometimes even completely made up memories.

So is it not possible to record a person's entire life as it unfolds?

I started by following people in their teens and into old age to explore what it really takes to stay happy and healthy.

our research

The Harvard Study of Adult Development is the longest-running adult study ever.

For 75 years, we tracked 724 men, tirelessly documenting their jobs, their home lives, their health, and of course, during that time, we had no idea how their lives would unfold.

Such studies are very rare

In less than 10 years, such a project would fall apart because too many people would drop out of the project, because the research would run out of funding, because the researchers would be busy with other things, because they would die, and so on.

In our case, we were lucky, and thanks to the perseverance of several generations of researchers, this work survived.

About 60 of the original 724 are still alive and still participating in the study, most of them in their 90s.

We're including more than 2,000 of their children in the new study.

I am the fourth research director

We've been tracking two groups of men since 1938.

The first group was a sophomore at Harvard University when the study began.

Most of them graduated from college during World War II, and most of them went to war.

A second group of boys who grew up in extreme poverty in Boston were chosen for this study because they came from the most troubled families in Boston in the 1930s.

Most of them lived in cheap apartments with no running water.

As soon as the study began, we interviewed them as teenagers.

had a health checkup

We went to their homes and interviewed their parents as well.

Those boys are now adults and are leading different lives.

He became a factory worker, a lawyer, a bricklayer, a doctor, and one became the President of the United States.

Some have become alcoholics, some have become schizophrenic.

So while some people have climbed from the bottom of society and climbed all the way up, there are others who have taken their lives in the opposite direction.

The originators of this research would never have guessed that I would be standing here today, 75 years later, telling them that research is still going on.

Every other year, our dedicated and patient research staff would call the participants and ask if they could send us a questionnaire about their lives.

Many men in the Boston slums ask back, "Why do you want to keep studying me? I don't think my life is interesting."

It's a question that never comes from the Harvard group.

(Laughter) It's not just my job to send out questionnaires to get a better picture of their lives.

interview in the participant's living room

I also get medical records from their doctor.

I've had blood tests, I've had brain scans, I've heard stories from kids.

I'll film them discussing with their wives about their biggest concerns.

About 10 years ago, when I asked the wives of the participants to participate in the study, many of them said, "I've been waiting for you to say that."

(Laughter) What I learned from this

What have we learned from tens of thousands of pages of information about their lives?

It's not about wealth or fame or working like crazy

After 75 years of research, it's become clear that good relationships are what keep us healthy and happy.

There were three big lessons about relationships from this point on.

First of all, social connection is really good for your health. Loneliness is deadly.

It turns out that people who are more connected to family, friends and community are happier, physically healthier and live longer than people who are less connected.

Research has shown that loneliness is harmful.

People who accept and live in isolation are less happy. They're middle-aged, their health declines faster, their brain function begins to decline earlier, and they live shorter lives than those who aren't lonely.

The sad reality is that at any time in the future, more than 20% of Americans will say they are lonely.

But it's also possible to feel lonely in a crowd or even in a marriage. So it's not just the number of friends you have that counts here, it's not whether you have someone to spend the rest of your life with. It's the quality of your relationships with those closest to you that counts.

I know living in the midst of conflict is bad for your health.

For example, a low-loving, quarrelsome marriage is bad for your health, probably worse than a divorce.

Loving good relationships protect people

We tracked all the participants, and when they were in their 80s, we wanted to look back at them in middle age and try to predict who would be a healthy, happy 80s.

And when you put together all the data that they had when they were 50, there was no correlation with middle-aged cholesterol levels or anything like that, but how they would age.

It turns out that relationship satisfaction at the time predicted it.

People who were the happiest in relationships at 50 were the healthiest at 80.

A good, close relationship seems to provide a cushion that helps alleviate many of the problems of the aging process.

Those who were particularly happy with their partners are reported to be in their 80s and feel emotionally happy despite their physical pain.

But people in unhappy relationships found that on days of physical pain, emotional pain amplified that physical pain.

The third big thing we've learned about relationships and health is that good relationships not only protect your physical health, but your brain as well.

People who have strong, good relationships that stick well into their 80s are protected by those relationships.

On the other hand, people who feel completely unreliable in their partner start having memory problems early on.

Good relationships are not without storms

A couple in their 80s may be nagging each other day in and day out, but as long as they felt they could rely on each other, when they faced hardships, their arguments didn't last long.

This teaching -- that close and good relationships benefit us all inclusively -- is not something we've learned by now.

Why are such relationships so difficult to build and so easy to ignore?

like no one

We love what we can get quickly and keep our lives comfortable.

Human relationships are complicated and complicated. Maintaining good relationships with family and friends is a daunting task.

On top of that, that job will continue until you die.

In 75 years of research, the happiest people in retirement are those who volunteered to make new friends to replace their co-workers.

Like the millennials in our recent survey, many of the participants in this study genuinely believed, when they entered adolescence, that fame, wealth, and accomplishments were what they needed to make a good living.

Over the course of 75 years, our research has shown over and over again that the happiest people are those who rely on relationships, whether it's family, friends, or community.

what about you?

If you are now 25, 40, 60 years old

What does it mean for you to rely on relationships?

There are practically no limits to what you can do

Dedicate time in front of the TV or computer to spending time with people. Engage in something new with your partner to revitalize a relationship that has lost its freshness, such as a long walk or a date. You can also reach out to family members you haven't spoken to in years.

I'll end with a quote from Mark Twain.

More than a century ago, he reflected on his life and wrote, "In such a short life, there is no time for quarrels, apologies, heartbreaks and accountability.

There's only time to make love, even if it's just for a moment

A good life is built on good relationships

thank you

(applause)

Word wonders: A "robot" is a machine that can perform a programmed sequence of actions.

The origin of the word "robot" goes back more than 1,000 years to the days of serfdom in Central Europe, when forced labor was used to pay rent.

At that time, the Old Church Slavonic word "rabota" was used to describe forced labor.

With a few spelling changes, "rabota" became the Czech word "robota", a figurative term for hard labor and hard work of any kind besides the hard labor of serfs.

In 1920, Czech writer Karel Čapek published a science fiction play titled "Robot (R.U.R)," which stands for "Rossum Universal Robot Company."

The story is about an automaton with human features that served the whims of the people of Earth before revolting.

Čapek originally intended to name these laboring machines "labori," the Latin word for labor, but he worried that it sounded silly.

Instead, he emphasized the state of servitude and named it "roboti," or in English, "robot."

"R.U.R" was so successful that when it was translated into English in 1923, the word "robot" was greeted with enthusiasm.

Many of today's robots are very different from Čapek's imagination, but they've become as popular as he predicted.

But unlike R.U.R, our robots don't rebel, and I hope they continue to do so!

oh sorry

Have you ever been contagious from someone else's yawning?

Even though I wasn't tired, I suddenly opened my mouth wide and let out a big yawn.

This phenomenon is known as "contagious yawning."

Why this happens is still not fully scientifically understood, and many hypotheses are currently being researched.

Let's take a look at some of the most common ones, and before we get into the psychological hypotheses, let's start with two physiological hypotheses.

The first physiological hypothesis is that "contagious yawning" is triggered by a specific stimulus, the first yawn.

This is called a fixed behavior pattern.

A "fixed behavior pattern" is like a reflex.

your yawn triggers my yawn

It's like the domino theory: yawning in one person causes yawning in anyone nearby who sees the act.

Once this reflex is triggered, you can no longer go against the flow of nature.

Stopping a yawn that has already started

basically impossible

The second physiological hypothesis is known as the "involuntary mimicry" or "chameleon effect."

This is what happens when you unconsciously imitate someone else's behavior, and you unconsciously imitate someone's behavior to maintain good relationships.

People tend to imitate each other's gestures

When you're sitting across from someone who has their legs crossed, you may also cross your legs.

This hypothesis suggests that when we see someone else yawn, we yawn because we unconsciously imitate other people's behavior.

Scientists believe that this "chameleon effect" is caused by a special neuronal structure, the "mirror neuron."

A mirror neuron is a type of brain cell that responds when you observe someone else's behavior to do the same.

These neurons are important for learning and self-awareness.

For example, by observing other people's gestures like knitting or putting on lipstick, we can learn similar behaviors more accurately.

Neuroimaging studies using fMRI (functional magnetic resonance imaging) show that when we "see" or even "hear" someone else yawn, these mirror neurons, located in certain regions of the brain, tend to fire, which in turn triggers the same behavior: yawning.

Our psychological hypothesis also has to do with the function of mirror neurons.

It's called sympathetic yawning.

Empathy is the ability to understand what other people are feeling and to share those emotions, which is important for social animals like us.

Neuroscientists recently discovered that some mirror neurons enable us to empathize with other people's emotions on a deeper level.

Scientists found this empathic response to yawning when testing the first hypothesis, the fixed behavioral pattern I mentioned earlier.

This study was done to test the hypothesis that human yawning is contagious to dogs.

Their research not only substantiated this, but they also discovered something even more interesting.

Dogs yawned more often at familiar yawns like their owners than at unfamiliar yawns from strangers.

Another subsequent study of humans and primates explained that "contagious yawning" occurs more frequently among friends than among strangers.

In fact, "contagious yawning" begins around the age of four or five, when children develop the ability to appreciate other people's emotions.

Moreover, while the latest scientific research seeks to prove that "contagious yawning" is based on this ability to empathize, more research is needed to provide clues as to what's really going on.

The answer may be compounded with other hypotheses.

Just think about what happened the next time you were yawned.

were you thinking of yawning

Did someone yawn nearby?

Was the person a stranger or someone familiar?

Now are you yawning?

I once said, "With the Internet, we can liberate society."

but it was a mistake

This statement dates back to 2011, when I anonymously created a Facebook page that triggered the Egyptian Revolution.

The "Arab Spring" showed social media's great potential, but it also revealed serious flaws.

The tools that brought us together to overthrow a dictator have led us to division.

Today, I'm going to talk to you about my own experience in using social media for social activism, the challenges I've faced personally, and how I've dealt with them.

In the early 2000s, the web was full of Arabs.

New knowledge, new opportunities, strange people in strange worlds, these are the things we crave so much that we find ourselves immersed in virtual alternate worlds, escaping the infuriating political realities.

Like those people, I was apolitical until 2009.

At the time, when I logged into social media, I saw more and more Egyptians wanting political change in their country by the day.

I felt that I was not alone anymore

June 2010 Internet changed my life

One day, when I was browsing Facebook, I saw a horrifying picture of the corpse of an Egyptian young man who had been tortured.

The young man's name is Khalid Said

A 29-year-old man from Alexandria was killed by police.

his appearance overlapped with mine

"I could have been Khalid."

I couldn't sleep that night and decided to take action.

I created an anonymous Facebook page called "We are all Khalid Said."

And in just three days, we received over 100,000 hits from many Egyptians with the same fears.

I thought it would be too late if we didn't act now.

Appointed Abdelrahman Mansoor as Deputy Manager

We worked together for hours and hours.

crowdsource ideas from people

encouraged their participation

Calling them to act together, they continued to share information that the administration didn't want the public to know.

This page has grown to become the most followed page in the Arab world.

We've gained a fan base that can't even be reached by traditional media outlets or even the pages of top celebrities.

On January 14th, 2011, President Ben Ali fled Tunisia as protests against his regime intensified.

i felt a glimmer of hope

On social media, people in Egypt thought, "If Tunisia can do it, so can we."

I posted an event on Facebook, titled "Revolution Against Corruption, Injustice and Dictatorship."

And I asked the 300,000 users at the time, "Today is January 14th.

January 25th is Police Day.

it's a national holiday

If 100,000 people occupy the streets of Cairo, no one can stop them.

Can't you act?"

In just a few days, over a million people were invited, and over 100,000 people said they were "going."

Social media was key to this campaign.

Social media fueled the decentralized movement.

Through it people realize they are not alone

It made it impossible for the regime to stop the flow.

What's more, at the time, the government didn't even know what was going on.

And then on January 25th, Egyptians flooded the streets of Cairo and other cities, demanding change, tearing down the walls of fear and calling for a new era.

But this had terrible consequences.

Hours before the regime cut off the internet and telecommunications, near midnight, I was walking down the dark streets of Cairo.

I just tweeted, "Let's pray for Egypt

The government must be planning tomorrow's massacre."

I suddenly felt a strong impact on my head.

As I lost my balance and fell to the ground, I noticed four armed men surrounding me.

One blocked my mouth, the other paralyzed me.

I understand that you were kidnapped by public security

I found myself in a cell, handcuffed and blindfolded.

I was appalled

My family was terrified, they went to the hospital, to the police, and even to the morgue, looking for me.

After I went missing, several of my colleagues who knew me as the administrator of that page told the media about my connection to the page and that I was likely arrested by public security.

My colleagues at Google started a campaign to find me, and fellow activists in Tahrir Square demanded my release.

After 11 days of being held captive in the dark, I was finally released.

And three days later, President Mubarak was forced to step down.

the most moving and inspiring moment of my life

It was a moment of great hope

The utopia given to the Egyptian people lasted 18 days of the revolution.

A whole nation believed that we could overcome our differences and coexist, and that Egypt, with Mubarak gone, would belong to the people.

But unfortunately, what happened after the Revolution was shocking.

The euphoria has faded, consensus has failed, and political struggles have led to significant polarization.

Social media has only made things worse by promoting hoaxes, mere rumours, blocking of exchanges and hate speech.

in the very worst

My online world has become a battlefield of trolls, lies and hate speech.

Even my family's safety came to be in danger

But it wasn't just my problem

The conflict between the two main factions, the pro-military forces and the Muslims, was reaching its climax.

People like me at the center of the movement felt helpless.

Both sides pressed for support, and there was only one choice: support or confrontation.

On July 3, 2013, Egypt's first democratically elected president was ousted by the military after three days of civil protests demanding his resignation.

I made a tough choice that day

It was a choice to remain silent, not to say anything.

It was a moment of defeat

Over the next two years, I remained silent, using that time to relive what had happened and try to understand what had happened.

And it turns out that, while human behavior is indeed the main driver of this polarization, it's social media that shapes and amplifies that behavior.

For example, let's say you want to talk without any basis, want to pick a fight with someone, or want to ignore someone you don't like.

These are all natural human impulses, but with technology, you can turn those impulses into action with a single click.

In my opinion, social media today faces five major challenges.

First, we don't know how to deal with rumors.

Rumors expose human prejudices, but are now trusted and circulated by millions.

Second, the progress of “echo chamberization”

We tend to only interact with people with whom we agree, but social media allows us to unnotify and even block people who disagree with us.

Third, online discussions can quickly turn people into mobs.

everyone has experience

It's almost as if we forget that there's a real person behind the screen, not just an avatar.

Fourth, it has become very difficult to change one's opinion.

The brevity and speed of social media force us to jump to conclusions, forcing us to write incisive 140-character statements about complex world affairs.

What's more, once you write something, it stays on the internet forever, so even if new evidence emerges, it's unlikely to motivate you to change your mind.

Last but not least, this is the most important of my observations: our experience with social media today is designed to encourage the spread of our opinions over participation, posting over discussion, light commenting over deep dialogue.

It's almost as if we think social media is more about talking to ourselves than talking to each other.

I've seen how these important issues have affected an already polarized Egyptian society, and this is not just an Egyptian problem.

Conflict is happening all over the world

What we need to figure out is how we can turn technology into a solution rather than a problem.

There are many such discussions about how to combat online harassment and slander.

certainly an important topic

there is no one to argue

But on the other hand, we need to think about how to design social media experiences that respect civility and respect thoughtfulness.

It's true that the more sensational, biased, sometimes emotional and offensive a post is, the more people will see it.

you will be able to attract attention

But what if we could focus on quality?

Is it the number of people who read the post that matters, or the question of who read the post?

Couldn't we encourage participation in the dialogue, rather than just pouring out opinions?

Or can't we appreciate reading and responding to objections?

And can we make it socially acceptable and valued to change our minds?

What if there was an environment that represented how many people changed their minds and that became part of the social media experience?

If I could track the number of people who changed their minds, I would choose my words more carefully, and I would try to do so, so I could avoid flirting with people who already agreed with me, and avoid promoting prejudice with my likes.

We also need to think about an effective crowdsourcing mechanism that verifies the authenticity of information circulating on the Internet and evaluates the people who work on it.

In short, we need to re-examine our current social media environment and redesign our experiences so that we can measure thoughtfulness, courtesy and mutual understanding.

As someone who believes in the power of the Internet, I teamed up with a few friends to start a new project to find answers and explore possibilities.

The first thing we created was a new media platform for dialogue.

We are creating a forum for dialogue that promotes mutual understanding and allows us to change our minds.

I'm not going to say I know the answer. I've just started experimenting with ways to debate controversial issues, such as race, gun control, refugees, Islam and terrorism.

Dialogue is the key

We are living in a time when at least one in three people on the planet has access to the Internet.

But part of the internet is caught up in the less-than-benevolent aspects of our human behavior.

Five years ago, I said, "With the Internet, we can liberate society."

Now I'm thinking, "If you want to liberate society, you have to liberate the internet first."

thank you

(applause)

Time-lapse footage looks like a monster waking up from its slumber.

Even though I was still at first

ripples on the surface

It swells, and when a mysterious bubble rises

three times the volume

It turns eerily brown, its surface hardens, and it takes on strange crater-like shapes of mountains and valleys.

When the kitchen timer rings here

Cookies are ready

what happened in the oven?

Don't be fooled by the apron!

The people who bake sweets are great scientists.

When you put the baking sheet in the oven, it induces a number of chemical changes that turn it from a substance called "dough" into a "cookie."

When the dough reaches 92 degrees Fahrenheit (33 degrees Celsius), the butter inside melts and the dough begins to spread.

Butter is an emulsion, meaning it's made up of two immiscible substances, in this case water and fat, held together by dairy solids.

As the butter melts, the trapped water is released.

And when the cookie gets hot, the water spreads out as steam.

You push it up from the inside of the dough, like an alien in a Ridley Scott movie trying to escape through the cookie wall.

By the way, eggs in your home are a treasure trove of salmonella.

About 142,000 Americans are infected with it each year.

Salmonella can live for weeks outside of an organism and can survive freezing, but 136 degrees Fahrenheit (57 degrees Celsius) is too hot.

When your dough reaches that temperature, the fungus dies.

So it's dangerous to sneak a bite into raw dough It's dangerous to sneak a bite into raw dough

At 144 degrees Fahrenheit (62 degrees Celsius), the proteins begin to change, and this is due to the eggs in the dough.

Eggs are made up of different types of proteins, each of which responds to different temperatures.

The protein in a freshly laid egg from a hen looks like a coiled spring.

When exposed to heat energy, the protein unwinds and sticks to nearby objects.

This change in bond structure causes the egg, which was once fluid, to become almost solid, making the squishy dough firmer.

At 212 degrees Fahrenheit (100 degrees Celsius), the water evaporates, leaving the cookies dry and hard, like mud in the sun.

surface cracks spread

The steam that was bubbling inside disappears, but leaves an air hole, which makes the cookie lightly crisp.

Helping with this is sodium bicarbonate or baking soda, which is a leavening agent.

The sodium bicarbonate reacts with the acids in the dough, producing carbon dioxide and creating air holes in your cookies.

It's time to prepare a drink to dip the cookies in. Pour the cold milk into the glass.

One of the most delicious chemical reactions occurs at 310 degrees Fahrenheit (154 degrees Celsius).

This is the temperature at which the Maillard reaction occurs

In the Maillard reaction, proteins and sugars break down and stick together to form ring-like structures.

When this reaction occurs, it creates a variety of odors and also produces flavor compounds that interact with each other, adding even more flavor and aroma.

The final reaction is caramelization, which happens inside the cookie.

Caramelization is the breaking down of sugar molecules at high temperatures, producing sweet nutty flavors and bittersweet flavor compounds. This is caramel.

If the recipe says the oven is set to 350 degrees Fahrenheit (176 degrees Celsius), this won't happen, because caramelization starts at 356 degrees Fahrenheit (180 degrees Celsius).

If the cookies you've been looking forward to look like someone on the beach with no tan, maybe the oven was at 310 degrees Fahrenheit.

If you want your cookies to have a nice tan, try increasing the heat.

Caramelization continues to 390°F (198°C)

Another tip: you don't need a kitchen timer, because your nose becomes a sensitive scientific instrument.

When the Maillard reaction and caramelization give off a nutty, toasty aroma, your cookies are ready.

Sit back with a glass of milk in your hand Let's have a sweet cookie Science is so delicious

What is the worst insect on earth?

You might say it's a horsefly, or maybe a paper wasp, but for many people, it's the mosquito, after all, that's the biggest nuisance.

Buzzing sting Buzzing sting Itchy guy Mosquitoes are one of the most commonly hated pests in the world.

In Alaska, dense swarms of mosquitoes can actually choke caribou.

Mosquito-borne diseases kill millions of people each year.

Mosquitoes have long been a problem

Mosquitoes have been around for hundreds of millions of years, and during that time mosquitoes have evolved with humans and other species.While mosquitoes have evolved with humans and other species.While mosquitoes have evolved with humans and other species.

There are thousands of mosquito species in the world, thousands of mosquito species in the world, but the one thing they all share is that they suck blood, and they're really good at sucking blood.

this is how you suck blood

After landing on the victim's skin, the mosquito deposits a large amount of saliva, which acts as an anesthetic and paralyzes the area, leaving us unaware of the attack.

By the way, this is the cause of itching and redness.

Then use your saw-like jaws to pierce the skin Searching for blood vessels with your proboscis Searching for blood vessels with your proboscis

Once spotted, a lucky nuisance can absorb two or three times its own weight in blood.

it will not be very pleasant

The fact is, people hate mosquitoes, and they spend billions of dollars around the world trying to avoid them, from citronella candles to bug sprays to harsh pesticide pesticides.

But mosquitoes aren't just a nuisance, they're also killers.

Mosquitoes carry everything from malaria to yellow fever to West Nile virus to dengue fever.

More than a million people around the world die each year from mosquito-borne diseases, not just humans.

Horses, dogs and cats can also get sick from mosquitoes.

If this bug is such a ruthless killer, why not just eradicate it?

We humans have been pretty good at eradicating all species, haven't we?

But it's not that easy

Eradicating mosquitoes will deprive many other organisms of food such as frogs, fish and birds. You will deprive many other organisms of food such as frogs, fish and birds.

The plant loses one kind of pollinator.

But some scientists say mosquitoes aren't all that important.

Even if we eradicated the mosquito, other species would simply replace it, and we might end up with far fewer deaths from malaria.

The problem is that no one knows what will happen if we eradicate the mosquitoes.

Something better might happen instead, or something worse might happen

The question is, do you want to take that risk?

In late January 1975, a 17-year-old German girl named Vera Branders walked onto the stage of the Cologne Opera House.

the seats were empty

It was just the green emergency exit sign glowing dimly.

It was the most exciting day of Bella's life.

She was Germany's youngest concert organizer, winning over the Cologne Opera House to hold a late-night jazz concert for American musician Keith Jarrett.

1400 people were to come

In just a few hours, Jarrett would be on stage, sitting at the piano and playing without any rehearsal or sheet music.

But here something went wrong when I showed Keith the piano that Bella had arranged.

Jarrett looked at the piano a little more closely, tapped a few keys, walked around the piano, played the piano again, and muttered something to the producer.

The producer came up to Bella and said

"Keith can't play unless he gets a new piano."

there was a mistake

The Opera House provided the problematic piano.

Because the high register on this piano was harsh and low volume, and the hammer felt was worn out.

The black keys got stuck, the white keys were out of tune, the pedals were useless, and the piano itself was too small.

That would be too quiet to fill a large space like the Cologne Opera House.

Keith Jarrett left the hall

Left behind after getting into a car outside the venue, Bella called in hopes of finding a replacement piano.

I found a piano tuner, but I couldn't get a new piano.

So she went out and stood in the rain and talked to Keith Jarrett and begged him not to cancel the concert.

He saw this shabby, soaked German girl in the car and felt sorry for him, and he said, "This is what you do."

And a few hours later, Jarrett stood on the stage of the opera house, and he sat down at the unplayable piano and started playing.

(music) It soon became clear that a miracle was taking place.

Jarrett eschewed the high register and used only the midrange to produce a mesmerizing and pleasing sound.

And to make up for the piano's lack of volume, I had to arrange the low-pitched repetitive passages in the bass.

I also stood up from my chair, twisted my body, and slammed into it, doing my best to make sure the audience in the last row could hear me.

It was a numbing performance

The performance was calm, yet powerful and dynamic at the same time.

This performance continues to this day

It's been a long-time favorite, and that's why "The Cologne Concert" became the best-selling piano album of all time and the best-selling jazz album of all time.

Keith Jarrett was put in a terrible situation.

He took the pinch and turned it into an opportunity.

But what was Jarrett's first intuition?

he said he didn't want to play

Of course, everyone would feel the same way if they were put in the same situation.

You don't want to be told to get good results with bad tools.

I don't want to jump over unnecessary hurdles

But Jarrett's intuition was wrong, and I'm glad he changed his mind.

And I think our intuition is wrong, too.

I think we need to be more aware of the unexpected benefits that come with being forced to deal with a few obstacles.

Let me give you a few examples, from cognitive psychology, from the science of complex systems, from social psychology, and from rock and roll.

Let's start with cognitive psychology

As I showed earlier, certain problems and certain impediments can improve performance.

For example, psychologist Daniel Oppenheimer worked with a high school teacher several years ago.

He asked his teachers to change the typeface of handouts they gave out in class.

Handouts are usually set up in easy-to-read fonts such as Helvetica and Times New Roman.

In the experiment, half of the students would be given a quirky font, such as Hetten Schweiler, or a flavorful font, such as Comic Sans Italic.

Now it's a handout that's hard to read with a funny font.

But at the end of the semester, when the students were tested, the results showed that the students who received the handouts in the hard-to-read handouts did better in a variety of subjects.

One possible reason is that you're reading slower because of a hard-to-read typeface, and you're working a little harder, a little more thoughtful, a little more interpretive of what you're reading...

I learned a lot because of that

Here is an example

Psychologist Sherry Carson conducted an experiment on undergraduate students at Harvard University to measure their ability to filter external information.

What is it about?

What this means is that if you're in a restaurant and you're having a conversation, there are other people in the restaurant having different conversations, and you want to block out other people's conversations so you can focus on your own.

can you shut it off?

If you can, you have good filtering ability.

But some people have a hard time

Some of the student subjects also struggled.

The filter ability is weak and full of holes, so outside information flows in endlessly.

So they're constantly being blocked by all the sounds and visuals around them.

If the TV is on while they're writing their essay, they can't ignore it.

You may find this to be a disadvantage, but...

it's actually different

When Carson looked at students' past grades, he found that those with less filtering ability generally achieved more creative life goals, such as publishing their first novel or releasing their first album.

The distractions yielded creative results.

Because filters are full of holes, they were able to think outside the box.

Now about the science of complex systems.

How to solve really complex problems - The world is full of complex problems How do you solve complex problems

For example, when trying to build a jet engine

There are many uncertainties: operating temperatures, materials, different sizes and shapes.

You can't solve them all at once, it's very difficult

Then what should we do?

One is to go step by step

Prototype first, tweak, test and improve

And then adjust and test and improve

The idea of ​​small stacks will eventually lead to good jet engines.

And this idea is being widely implemented around the world.

So, for example, a web designer might talk about optimizing a page to go through this cycle very quickly, looking for ways to improve it little by little.

Because it's a great way to solve complex problems.

But what could be added to make it a better way?

a little impediment

Adding randomness in the early stages will lead to anomalous behavior, stupid attempts that are unlikely to help, and those attempts will improve our problem-solving efforts.

Because if you take trouble step by step, you can slowly find yourself in a dead end.

But if it starts out random, that's less likely to happen, and it gives you a clearer path to solving the problem.

Let's move on to social psychology.

Psychologist Catherine Phillips and her colleagues gave students a murder mystery problem. The students were divided into groups of four, and each group was presented with a criminal case file: alibi, evidence, witness statements, and three suspects.

And the four students were asked to identify who killed and who committed the crime.

In this experiment, two groups were created.

One is a group of four people who are friends and know each other well.

The other is a group of three friends and one stranger.

you know what i'm talking about

That's right, a group of three and one stranger solved the case more effectively, it's true.

it's been very effective

By contrast, half of the groups of friends were able to correctly identify the perpetrator.

I can't say this is a good result.

(Laughter) In the group of three people and one ignorant, it's not that one of them had any additional information, but the conversation was just changed to make up for the awkwardness of having someone else there.

I can say that there has been a significant improvement in performance.

But what I find interesting is not just that they did better, but how they felt.

When Katherine Phillips asked a group of friends what they thought, they said they had fun, and they said they did a good job.

they were satisfied

On the other hand, in a group of three and one stranger, they said they didn't enjoy it, they said it was an awkward and awkward time.

and filled with distrust

They didn't say they did a good job, contrary to the facts.

I think what this demonstrates is the obstacles we're talking about.

Because- hard-to-read fonts, awkward strangers, random behavior, etc.

Obstacles that guide us to problem solving. These obstacles make us creative.

But we don't think disability helps

Obstacles feel in the way

unwilling to accept

So the last example is really important

I'd like to tell you the story of someone who's been behind the scenes in the rock world.

As you may know, he's also appeared at TED.

Brian Eno

he is a talented composer of ambient music

He's been a catalyst of sorts, behind the scenes in making hit rock albums for 40 years.

I've worked with David Bowie's 'Heroes', U2's 'Achton Baby', 'The Joshua Tree', Devo, Coldplay and many other artists.

What is he doing to make a great rock band even better?

yes you are in the way

It's disrupting album production.

His role is to be an awkward stranger.

His job is to get the band to play the unplayable piano.

One of the methods he uses to create this kind of chaos is this amazing set of cards, signed here -- thanks to Brian.

It's Oblique Strategies, which he made with a friend.

When he gets stuck in the studio, Brian draws a card from this card.

Draw a random card and have the band do what the card says.

For example this...

"Change the role of the instrument"

Yes, everyone swaps instruments, the drummer plays the piano -- that's a really cool idea.

"Scrutinize the most embarrassing things you've ever done and talk them out loud."

"Capture sudden, destructive, unpredictable behavior"

Any Card Confuses

But the card's value was proven with album after album.

the artist hates this card

(Laughter) Phil Collins, who played drums on Brian Eno's early albums,

I was so frustrated that I threw beer cans all over the studio.

The great rock guitarist Carlos Alomar once said to Brian, while working with Brian on David Bowie's "Roger" album, "Brian, this experiment is ridiculous."

But the album that came out was really good, and 35 years later, Carlos Alomar still uses Oblique Strategies.

He teaches his students to use this too, because he's noticed.

Just because I hate it doesn't mean it's not good for me

These strategies weren't originally a set of cards, they started out as just a list that hung on the walls of the recording studio.

As a list to try when you get stuck

But the list didn't work

I wonder why?

there wasn't enough confusion

Because everyone would read the list from top to bottom, and they would end up choosing the easiest, most innocuous one, which would throw off the focus.

That's where Brian Eno realized that you need to do silly experiments, you need to play nice games with strangers, and you need to make an effort to read hard-to-read fonts.

These things help

that we can solve problems and be creative

not only that-

Accepting this realization requires a certain kind of belief.

whatever the reason

Whether it's sheer willpower, a card draw, or pity for a teenage German girl, we all need to sit at a useless piano sometimes and play.

thank you

(applause)

When we look up at the night sky, we marvel at its seeming eternity.

What will it be like billions of years from now What will it be like billions of years from now

Scientists like me, called space scientists, scientists like me, called space scientists, are thinking about that question.

The end of the universe is closely related to the composition of the universe.

More than 100 years ago, Einstein constructed "General Theory of Relativity" and derived an equation that shows the relationship between the composition of the universe and its shape.

The universe may be curved like a sphere by it The universe may be curved like a sphere by it

This is called "space with positive curvature" or "closed space".

Or maybe it's shaped like a horse's saddle

We call this "negative curvature space" or "open space."

or may be flat

Its shape determines the life and death of the universe.

The universe is now thought to be nearly flat.

The composition of the universe can also play a part in its fate.

We can predict how the universe will change over time from the amount and energy density of the universe's current composition.We can predict from the amount and energy density of the universe's current composition.

So what is the universe made of?

Space contains everything we see—like stars, gas, and planets.

We call these "ordinary matter" or "baryons."

These are all around us, but the sum of these energy densities is actually very small, about 5% of the total energy in the universe.

So let's talk about what the other 95 percent is.

Less than 27% of the energy density of the universe is made up of something called dark matter.

Dark matter reacts very little to light, so it doesn't emit or reflect light like stars or planets.

In fact, the only method used to discover dark matter is through gravitational interactions, from orbits and the way light refracts through curved space.

We haven't found a particle of dark matter yet, but scientists around the world are trying to find this elusive particle and what it does to the universe.

But it's still not 100%

68% of the remaining cosmic energy density, 68% of the remaining cosmic energy density, is made up of dark energy, which is even more mysterious than dark matter.

Dark energy works like a repulsive force unlike anything else we know of.

We call this "negative pressure," and it's something that dark matter and "ordinary matter" don't have.

Gravity is supposed to shrink the universe, but that's not the case. The universe seems to be expanding at an accelerating rate. The universe seems to be expanding at an accelerating rate.

A leading idea to explain dark energy is the cosmological constant.

It has the strange property that as it expands, the energy increases, keeping the energy density constant.

So as the universe expands -- as it does now -- there's more and more dark energy.

Dark matter and baryons, on the other hand, dark matter and baryons, on the contrary, dilute rather than increase with the universe.

Due to the nature of this "cosmological constant", due to the nature of this "cosmological constant", the future universe will gradually be dominated by dark energy.The future universe will be gradually dominated by dark energy.

Eventually, the universe will run out of star-forming gas. Eventually, the universe will run out of star-forming gas.

Given enough time, even the black hole will disappear, leaving only a cold, completely empty universe.

This is called "heat death"

It may be depressing to say that the universe we live in is coming to a cold, lifeless end.

This accelerated final state of the universe is called the "de Sitter expansion period" This accelerated final state of the universe is called the "de Sitter expansion period" It is named after the Dutch mathematician Willem de Sitter.

But it's believed that there was another de Sitter expansion in the universe. It's believed that there was another de Sitter expansion.

This is called "inflation" in the early days of the universe, right after the big bang, the universe expanded rapidly in an instant.

The universe will end at an accelerated pace, just as it began at an accelerated pace.

We are living in a special era in the history of the universe.

Smell is the first sense you experience at birth.

1 in 50 genes are involved in the sense of smell.

Don't you think it's an important feeling?

First, take a deep breath through your nose

That's your sense of smell. Smell is an amazing power.

Adults can distinguish about 10,000 different odors.

This is how the nose works

When you breathe air molecules into your nostrils, you start smelling.

95% of the nasal cavity is responsible for filtering air before it enters the lungs.

At the very back of the nose, there's an area of ​​skin called the olfactory epithelium, which is key to smell.

The olfactory epithelium has a layer of olfactory receptor cells that, like the taste buds in your nose, sense odors.

When scent molecules reach the back of the nose, they become entangled in the mucus layer that covers the olfactory epithelium.

It dissolves and binds to olfactory receptor cells, which emit a signal that travels from the olfactory tract to the brain.

By the way, you can tell how good an animal's sense of smell is by the size of its olfactory epithelium.

The dog's olfactory epithelium is 20 times larger than the human one.

But there's still a lot we don't know about these cells.

For example, the olfactory epithelium is colored, and scientists don't really know why.

So how do you actually tell the difference?

There are 40 million different olfactory receptor neurons in the brain. For example, scent A responds to neurons 3, 427 and 988, and scent B responds to neurons 8, 76 and 2,496,678.

It finds many odors over a wide area, depending on the combination of responding neurons.

Olfactory neurons are always ready

It's the only neuron that gets replaced every four to eight weeks.

Once stimulated, it is sent through a bundle called the olfactory tract to various destinations in the brain, such as the amygdala, the thalamus, and the neocortex.

This is different from the visual and auditory processes.

These signals first go to a relay station in the center of the cerebral hemisphere, then spread to other parts of the brain.

But because the sense of smell is more developed than the other senses, it travels directly to different parts of the brain, where it triggers the fight-or-flight response, triggers memories, and brings saliva into the mouth.

But having two nostrils that are physiologically identical in structure and a vast array of olfactory neurons doesn't mean that you smell the same way.

A famous example of the difference in olfactory abilities is "asparagus pee".

A quarter of the population say their urine has a distinctive smell after eating asparagus.

The other 75% of people don't know

This is not the only example of differences in olfactory abilities.

Androsterone is a compound that some people say smells like vanilla, others say it smells like sweaty urine.

Thinking about people who smell sweaty urine, farmers castrate male pigs to reduce androsterone production.

The inability to smell is called anosmia, and there are about 100 known types.

People with allicin anosmia cannot smell garlic.

People with eugenol anosmia can't smell c.

Some people can't smell anything at all.

There are several causes for this sense of smell loss.

Some people don't have a congenital sense of smell

Some die from accidents and illness

If the olfactory epithelium becomes swollen or infected, it interferes with your sense of smell, a sensation similar to what you experience when you're sick.

When you can't smell anything, your other senses are affected.

People who have no sense of smell cannot taste like we do.

Because smell is closely related to taste.

When you chew food, air moves up your nasal passages along with the smell of food.

These scents reach the olfactory epithelium and convey information to the brain about what you're eating.

If you don't have a sense of smell, you can't even taste complex things.It's the five tastes that our taste buds detect: sweet, salty, pungent, sour, and umami.

The next time you smell the fumes, the tide, the smell of roast chicken, you'll know how you felt, and you'll be even more grateful to have smelled it.

For centuries, humans have eaten a wide variety of insects, including beetles, caterpillars, locusts, grasshoppers, and termites.

Dragonflies, etc. This habit even has a name: entomophagy.

Early hunter-gatherers probably learned from animals how to hunt for protein-rich insects and followed suit.

As we evolved, insects became part of our traditional diet and played a role as a staple food and then.

As a treat, cicadas were a luxury snack in ancient Greece.

Even the Romans enjoyed beetle larvae.

why have we forgotten the taste of insects

The reason for the rejection was historical: the story probably began in 10,000 BC in the Fertile Crescent, which was the birthplace of a major agricultural culture located in the Middle East.

Around that time, our once nomadic ancestors began to settle in the Crescent.

As they became more agriculturally savvy and domesticated animals, their attitudes changed, and it spread to Europe, and then to the West.

As agriculture prospered, people probably rejected insects that caused damage to their crops as mere pests.

As the population grew and the West became urbanized, our relationship with the hunter-gatherer way of life grew weaker.

People forgot their insect-rich history.

Today, insects are just a nuisance to people who don't eat insects regularly.

They sting us, they bite us, they destroy our food.

We are disgusted by entomophagy, and even the thought of entomophagy makes us disgusted.

About 2,000 species of insects are cooked to feed the stomachs of 2 billion people worldwide.

In the tropics, eating insects is culturally acceptable and highly consumed.

The insects in this region are large -- they're diverse, they move in groups, they form swarms, so they're easy to collect.

In Southeast Asia, in Cambodia, giant tarantulas are collected, fried, and sold at markets.

In southern Africa, juicy moth larvae are a staple food, boiled in hot sauces or dried and sprinkled with salt.

In Mexico, chopped humiles are fried with garlic, lemon and salt.

The insects themselves can be used as a side dish, ground up and mixed with flour, or powdered or pasted.

It's used as a seasoning, not just delicious.

it's healthy

In fact, scientists are proposing that eating insects is a promising food source for food-scarce developing countries.

It's an important building block for the human body - up to 80% protein, high-energy fat and fiber, and trace amounts of vitamins and minerals.

Did you know that? Edible insects contain as much or more inorganic iron than beef, a fertile, untapped resource for iron deficiencies in the world today.

We can put insects to good use. Mealworms are another nutritious insect.

It is a yellow beetle insect native to America that is easy to keep.

High in vitamins and minerals, it contains up to 50% protein, roughly equivalent to beef.

It is prepared sautéed in butter and salt, or roasted and sprinkled with chocolate for a crunchy snack.

You have to nourish it, you have to taste it, you have to overcome the "disgust."

Yes, insects can be delicious.

Mealworms look like roasted nuts

Locusts look like shrimp

Some people say that crickets smell like popcorn.

Raising edible insects is less costly to the environment than raising livestock: it emits far fewer greenhouse gases and requires less land, less water, less fertilizer.

From a socio-economic perspective, insect production may also improve the livelihoods of people in developing countries because it's small, efficient, and relatively inexpensive to maintain.

Insects could also serve as sustainable fertilizer for livestock, or organic waste such as vegetable peels that go to waste in burial could become food for insects.

Are you hungry?

When faced with a side dish of fried crickets, most people still back off because they don't want the insect's legs or antennae getting stuck in their teeth.

But what about lobster

Doesn't it look like a giant insect? It has legs, it has excellent antennae, and was once considered a crude and disgusting food.

Lobster is now a feast

Could a similar paradigm shift occur in insects?

Let's try it!

Just pop the insect into your mouth and enjoy the texture.

In the world of J.R.R. Tolkien, Gandalf is one of five wizards sent by the Valar to guide the inhabitants of Middle-earth who are suffering from the dark forces of Sauron.

Gandalf's body is not immortal, but is governed by the laws of physics in Middle-earth, but his spirit is immortal, and he died as Gandalf the Gray and was resurrected as Gandalf the White.

According to the Wachowskis' script, an awakened human can learn to fly a helicopter in a matter of seconds by connecting to and hacking into the Matrix's glowing binary code.

If you're one of those people called the Savior, you don't even need a helicopter, all you need is a pair of cool sunglasses.

The Cheshire Cat can control its own head

The iPad's interface is old-fashioned

A Quidditch match isn't over until you catch the Golden Snitch.

And the answer to the ultimate question about life, the universe, and everything is, of course, 42.

Like the real world, the fictional world operates according to consistent physical and social rules.

It makes a complicated world believable, understandable, and worth exploring.

In the real world, the law of gravity is what keeps the seven Harry Potter books on millions of bookshelves around the world.

We all know that, but at the same time, since J.K. Rowling wrote those words -- "Wizard," "Wand," "Wingardium Leviosa," among the trillions of pages on that shelf, the law of gravity has ceased to exist.

Science fiction and fantasy writers literally build worlds.

Rules, maps, genealogies, languages, cultures, and the universe Create a parallel universe within the universe, and from that world the stories will spread out one after another.

If done well, the reader will be able to understand the fictional world, the laws of that world, the behavior of its inhabitants, and sometimes that is better than the world outside the book.

But how?

What is it that, when the squiggles of a person's handwriting on a page—the light reflected through the eyes and the signals that reach the brain—are deciphered logically and emotionally as complex stories that force us to fight, weep, sing, and think, and not only become so powerful that the author's creation is so solid, but that we are drawn back again when the squiggles end, and even change the reader's perspective on the real world?

I don't know if anyone can answer this question.

The truth is, imagination and the desire to live in your own world, imagination and the desire to live in your own world, is all it takes to start writing a novel.

I couldn't think of Hogwarts or a Star Wars saloon, but science fiction for children and young adults.

I've written a few books, and I'm going to share with you the questions and methods I used to create the worlds in which they were set.

For me, I start with the basic time and place.

Whether it's a fantasy world or a real world set in the future, it's important to know where it is and when it's past, present, or future.

I like to create timelines through which the world has gone.

What happened in the past that brought you to where you are today?

Then we brainstorm to answer questions that map out the world.

What are the rules?

This includes the laws of gravity, which includes the laws of gravity, the rules of society, and the penalties for those who break them.

What kind of government is there in that world?

Who has power and who doesn't?

What do the people there believe?

What is most respected in that society?

Then think about everyday life

What is the weather like in that world?

where people live and work

where do you learn? What do you eat and what do you play?

How are children and the elderly treated? How are children and the elderly treated?

What is the relationship between humans and animals and plants in that world?

What do animals and plants look like?

What kind of technology exists?

What about transportation?

How do we communicate?

How do I obtain information?

there's a lot to think about

If you've spent some time doing this work, and you've found the answers to your questions, you've come a long way in creating fictional worlds.

Once I've got my world under control, and I feel like my readers can understand it, I'll throw the characters into it and see what happens.

And ask, "How does this world shape the people who live in it?

What kind of conflict could arise? ”

Answering these questions tells a story.

Good luck, future creator!

I'm searching the universe for planets that have life.

Such a planet would be invisible to the naked eye, not even with the most advanced astronomical telescopes available today.

But such a planet must exist.

Understanding nature's hidden surprises will help us discover life.

Where there is water on our planet, there is life

So we're looking for planets that are exactly the right distance from the star.

At the distance shown in blue on the graph of stellar temperature, the surface of the planet would be warm enough to have water in its liquid phase that forms lakes and oceans for life to live on.

Some astronomers are working hard to find planets in this range of distances from their stars.

I'm taking up the theme that lies ahead

We're building plausible climate models for exoplanets.

Here's why it's important: There are many factors other than distance from a star that make a planet capable of supporting life.

Take Venus for example

Venus takes its name from the ancient Roman goddess of love and beauty, for her serene and otherworldly figure shining in the sky.

But spacecraft observations revealed something completely different.

Its surface temperature will be close to 900°F to 500°C

It's hot enough to melt even lead

It's the thick atmosphere, not the distance from the sun, that causes the heat.

Its atmosphere, like doping for the greenhouse effect, traps the sun's heat and scorches the planet's surface.

The first impression of this planet is a completely different reality.

Findings like this from our solar system have taught us that a planet's atmosphere has a profound effect on its climate and the viability of life.

Exoplanets are so far away, so small, so dim compared to their stars, that we don't know much about their atmospheres.

For example, one of the closest planets that could possibly have water on their surface is called Gliese 667 Cc -- whose glorious name fits the phone number -- 23 light-years away.

more than 200 trillion kilometers

It's difficult to measure the composition of an exoplanet's atmosphere as it passes in front of its host star.

It's like watching a fruit fly cross in front of your car's headlights.

Imagine the stars 200 trillion kilometers away as a car and knowing the exact color of a fruit fly.

So I created a computational model to calculate the atmospheric composition of a planet that would give a climate suitable for the existence of water and life.

Here's an image of the planet Kepler-62f, with the Earth next to it for size comparison.

It's about 1,200 light years away and about 40 percent larger than Earth.

Our research, funded by the National Science Foundation (NSF), shows that given a variety of atmospheric compositions and orbital tilts, the planet can reach temperatures at which ice-free water exists.

So I hope future telescopes will continue to monitor this planet for signs of life.

Ice on the planet's surface also has a significant impact on climate.

Ice absorbs redr, longer-wave light and reflects bluer, shorter-wave light.

This is why the iceberg looks blue in this picture.

The reddish light in sunlight is absorbed as it travels through the ice.

Only blue light goes to the bottom of the ice

It reflects back into our eyes, which is why ice appears blue.

My models show that planets orbiting cooler stars get hotter than planets orbiting hotter stars.

This was another surprising finding: Ice absorbs the longer-wavelength light from cooler stars, and the energy from that light heats the ice.

Exploring the impact of these surprises on planetary climate through climate models is critical to the search for life.

It's no surprise that this is my area of ​​expertise.

I'm an African-American female astronomer, and as a trained actor, I love wearing makeup and reading fashion magazines.

I founded Rising Stargirls, which teaches middle school girls of color astronomy through drama, writing and visual arts.

There are other surprises, too. Science and art don't often go hand in hand, but their interweaving will help them to study hard, and one day they'll join the ranks of astronomers from different backgrounds, and use their backgrounds to finally discover that we're not alone in the universe.

thank you

(applause)

Can you read a book in your car?

you are very lucky if you can read

One in three people get an immediate stomach upset when reading a book in a moving car, boat, train or plane.

But why does motion sickness occur?

Incredibly, even scientists don't quite understand

The most common explanation is a discrepancy in sensory signals.

When you travel by car, your body gets two different messages.

The eyes are looking inside the car and they don't seem to be moving.

Meanwhile, the ear tells the brain that it's accelerating.

wait, ears?

Ears have an important function other than listening.

The deepest part of the inner ear, the vestibular apparatus, is responsible for balance and kinesthetic senses.

It has three semicircular canals inside that sense rotational motion in three dimensions.

In addition, the two sacs with hair cells are filled with fluid.

When you move, the fluid flows and tickles your hair, telling your brain whether you're moving horizontally or vertically.

All of this tells your body the direction of movement, the degree of acceleration, even the angle.

In the car, your vestibular system accurately senses your movements, but your eyes can't see them, especially if you keep your eyes on your book.

vice versa also happens

If you're watching a movie and the camera makes a crawling motion,

The eyes think the body is moving, the ears feel still.

So why does conflicting information make you feel sick?

We don't know exactly, but scientists think there might be an evolutionary reason.

Fast-moving vehicles and video recordings have only existed for the last two hundred years or so, which is a fraction of a second in the evolutionary process.

For most of human history, poisons were the only thing that caused this kind of sensory disruption.

Poisons are not good for survival, so our bodies have evolved to expel messed-up food in a direct and unpleasant way.

It's a sensible explanation, but there are still things we can't explain, such as why women are more susceptible to motion sickness than men, or why passengers are more prone to nausea than drivers.

Other theories explain that motion sickness is caused by the difficulty of maintaining a natural posture when placed in an unfamiliar environment.

Studies have shown that even being immersed in water or changing your position can significantly reduce the effects of motion sickness.

But I don't know how it works

Some of the more popular remedies for car sickness, such as looking at the horizon, over-the-counter medications, and chewing gum, are not perfect, and not only do they fail to deal with severe motion sickness, and sometimes the cost is more than boredom on long drives.

At NASA, motion sickness is a serious problem for astronauts launched into space at 27,000 kilometers per hour.

In addition to researching cutting-edge space-age technology, NASA spends a lot of time trying to keep astronauts from vomiting space food.

Like solving the mystery of sleep or treating the common cold, motion sickness is one of those seemingly simple problems that, despite the incredible advances in science, remain largely unknown.

Perhaps one day we'll discover the exact cause of motion sickness and a perfect way to prevent it, but that day is still a long way off.

In the 1920s, German mathematician David Hilbert conducted a famous thought experiment to show how difficult it was to understand the concept of infinity.

Imagine a hotel with an infinite number of rooms, where you have a very hard-working night manager.

One night, the Mugen Hotel is completely full.

A man walked into a hotel and asked if there was a room available.

Without even refusing, the night shift manager decided to make a room available.

how?

It's easy. Have the guest in room 1 move to room 2, and have the guest in room 2 move to room 3, and so on.

The guest in room n moves to room n+1.

Since there are infinite rooms, each guest gets a new room.

Room 1 then becomes the new guest's room.

If you keep doing this, you can welcome a finite number of new customers.

For example, if a tour bus brought in 40 guests looking for a room, and the guests who already had rooms moved from room n to room n+40, the first 40 rooms would become available.

But what if an infinitely long bus brought in an infinite number of guests to stay overnight?

Countable to infinity (countable infinity) is the key

The "infinite bus" brings in an endless number of customers, which is a bit of an annoyance to the night shift manager, but he finds a solution that gives everyone a room.

Ask the guest in room 1 to move to room 2.

The guest in room 2 is moved to room 4, the guest in room 3 is moved to room 6, and so on.

When a guest in room n moves to room 2n, the infinite number of even-numbered rooms fills up.

But by doing this, an infinite number of odd rooms become available, and every guest brought in by an "infinite bus" is assigned a room.

Everyone is happy, and hotel business is booming like never before.

But the truth is, it's just like any other day, and you're making an infinite number of dollars overnight.

Rumors about this amazing hotel spread all at once

people pour in from far and wide

One night the unimaginable happened

The night shift manager looks out and sees an endless line of "infinite buses", each with a countable number of customers.

What should I do?

If he can't get a room ready, the hotel will miss out on endless revenue, and he's sure to lose his job.

Luckily, he remembers what Euclid proved around 300 B.C. that there are an infinite number of prime numbers.

To solve the seemingly impossible problem of providing an infinite number of beds for an infinite number of weary travelers on an infinite number of buses, the night shift manager asks the occupants to move to rooms with the first prime number, 2, raised to the power of the room number.

For example, a guest in room 7 moves to 2 to the 7th power, or room 128.

The night shift manager then guides the first "infinite bus" passenger this way: 3, the next prime number after 2, is raised to the power of the number of seats on the bus.

For example, a customer sitting in seat number 7 would move to 3 to the 7th power, or room 2,187.

The first bus goes like this

For the second bus, we raise the next prime number, 5, to successive powers.

The next bus is a power of 7

Further buses are powers of 11, powers of 13, powers of 17, and so on.

The resulting numbers only have divisors of 1 and powers of prime numbers, so the rooms don't overlap.

Every bus passenger is split into a different room based on a prime number assigned to them.

In this way, the night shift manager can have a room for every passenger on every bus.

But there will be a lot of empty rooms, like room 6, because 6 is not a prime power.

Luckily, his boss doesn't seem to be good with numbers, so he doesn't lose his job.

There's no doubt that the set-up in the "infinite hotel" is a nightmare, but the only way a night shift manager could do this is because it's the lowest level of infinity.

Georg Cantor named this level of infinity aleph zero (ℵ.)

We use natural numbers for room numbers and bus seat numbers.

If you're trying to deal with higher-level infinity, like the real numbers, the methods I've just discussed don't work very well, because you can't systematically incorporate all the numbers.

I suspect that the "Real Number Infinite Hotel" has negative number rooms and fraction number rooms in the basement, and that the guests in rooms 1/2 are smaller than room 1.

In the square root room, like Route 2, and the pi room, customers expect free desserts.

Would a self-respecting night shift manager want to work there for an infinite salary?

But at Hilbert's "Infinite Hotel," where there are always no rooms available and always more available, when you hear the story of a very hardworking, even excessively hospitable night shift manager, you realize just how difficult it is for us, with our finite intelligence, to understand the concept of infinity.

A good night's sleep may give you a good solution.

But I'm sorry, but I might ask you to move your room at 2 o'clock.

What speed are you moving now?

To this seemingly simple question—

The first thing you're likely to say is, "I'm not moving."

But if you think about it, you'll realize that the motion of the Earth might also come into play.

So my next thought was, "We're moving around the sun at about 30 kilometers per second."

But I remember what I learned in school, that the Sun orbits around the center of our Galaxy, and that our Galaxy moves within the Local Group of galaxies, which in turn moves within the Virgo Cluster, and the Virgo Cluster is...

"What is your current speed?"

it's not an easy problem

Whenever the control center communicates speed to astronauts, it always assumes a reference frame of reference.

At the start of space travel, the rocket launch pad is the reference for speed.

After it's launched, the launch pad is just one point on the spinning Earth's surface, just one point on the spinning Earth's surface.

While flying to the moon, the Apollo astronauts would have a hard time answering the following question: The Apollo astronauts would have a hard time answering the question, "What is your current flight speed?"

The speed away from the earth and the speed approaching the moon are completely different.

because the earth and moon are moving relative to each other

yes! of course

speed is a relative quantity

If Captain Kirk asks Captain Sulu if the Enterprise has reached Warp 7, Captain Sulu should answer, "What against what, Captain?"

Starfleet NCOs would be in trouble for such a cheeky reply, but that's the only correct way to answer the question, "What's your current speed?" That's the only correct answer to the question, "What's your current speed?"

This is the principle of relativity

It doesn't have to be high Einstein's relativity, but good old (and still correct) Galileo's relativity.

Galileo seems to have been the first to realize that there is no such thing as absolute speed.

speed is relative

So velocity only makes sense if you define a frame of reference.

The frame of reference itself is considered stationary.

And then you're going to ask yourself, "What am I standing still against?"

Even the concept of stillness loses its meaning unless the "absolute" is defined.

Both speed and the concept of rest are relative.

The speed of the earth relative to the sun is about 30 kilometers per second.

Velocity Warp 7 on the Enterprise is to the center of the galaxy.

you have zero velocity to the easy chair

But depending on where you're sitting, it's moving at about a few hundred kilometers per hour relative to the center of the earth.

I wrinkle my forehead and ask, "But what is the actual speed of the Earth?"

Imagine Earth following its orbit around the Sun, navigating the ocean of space.

But outer space isn't really an ocean.

because there is no substance like water

Outer space is not a thing Outer space is nothing

there is nothing

You can travel between two points in space, say, between Earth and Mars, but you can't push your way through something.

because there is nothing

It's like arguing about the weight of a hole

The weight of the hole is exactly zero, because it's nothing.

Void, that's outer space

It's pointless to discuss motion relative to nothingness.

The concepts of speed and rest only make sense relatively.

"absolutely" has no meaning

It only has meaning for an arbitrarily chosen frame of reference.

In the future, when you're sitting in your spaceship and looking out the window, a space station passes by quickly and at a constant speed, and you can't tell which one is moving.

You could even say that neither of them are moving. Constant speed is unrealistic.

Uniform motion on a straight line only has a relative meaning Can we call it a "relative reality"?

Is all movement relative?

no! Some movements are only relative, but some movements are absolute, and they are "absolute reality."

For example, uniform motion is relative, but velocity change is absolute.

In science, when something is absolute, it doesn't depend on any standard to measure it, it doesn't depend on any standard to measure it.

it is clearly measurable

When the spacecraft revs its engines and changes its speed, no doubt

Your stomach can guzzle it, and the spacecraft's sensors can measure the change.

If you look out the window, the space station passing by seems to change its speed, but the people inside the space station don't feel the change.

The sensor doesn't detect any change either

It's just the spacecraft changing its speed, the space station stays the same.

Changes in speed come with absolute realities that you can feel.

Rotational motion is similar.

When the spacecraft spins, you can feel it, and the sensors on board pick it up too.

It looks like the space station outside is orbiting the spacecraft, but it's you who makes me nauseous.

You're the one who's actually spinning They're not circling You're the one who's actually spinning They're not circling

Rotational motion has an absolute reality

Yes, some movements are relative and others are not.

Uniform motion is unrealistic, but changes in velocity are accompanied by tangible events, and so is rotational motion.

We must carefully determine what is true when we analyze everyday experience.

Even something as basic as speed can be deceived by our senses, so we should be vigilant about any sensory information.

Einstein's inspiration came from here to come up with the amazing relationship between the speed of light and time travel into the future.The amazing relationship between the speed of light and time travel into the future.

Determining what is real is both difficult and important.

If a cop stops you for speeding and asks you, "Do you know how much you were speeding?," it's probably not wise for you to be knowledgeable and say, "Speed ​​for what?"

If you do that, you'll be forced to sit in the back seat of a police car, feel the acceleration, drive straight to prison, and mutter, "There are absolutes!"

There's a persistent myth that humans only use 10 percent of their brains, leaving the other 90 percent in reserve, doing nothing.

Some people touted that they would unlock that potential in a "neuroscience-based" way, but what they really unlocked was your wallet.

Two-thirds of the general public and nearly half of science teachers mistakenly believe this 10% myth.

In the 1890s, William James, the father of American psychology, said, "We are not living up to our brain's potential."

He was just trying to challenge us, not accusing us of poor use of our brains.

The misconception has taken hold

Also, scientists have long been unable to identify the role of large regions of the human frontal and parietal lobes.

It was concluded that damage to that part did nothing because there was no loss of movement or sensation.

For decades, these areas were called silent fields, and their function was mysterious.

Later, the importance of the control tower role of this domain and the ability to integrate was revealed. Without this ability, no human being is human.

These domains are essential for abstract reasoning, planning, decisiveness, and flexible adaptation to the environment.

The idea that 90% of your brain is doing nothing in your head seems absurd when you calculate the energy expenditure of your brain.

The brains of rodents and canines consume 5% of the body's total energy.

monkey brain uses 10%

The adult human brain, which weighs only 2% of the body weight, consumes 20% of the glucose burned in a day.

For children it's 50%, for toddlers it's 60%.

That's a lot more than you'd expect, given the ratio of brain size to body size.

A human brain is 1.5 kilograms, an elephant brain is 5 kilograms, and a whale brain is 9 kilograms, but per weight, the human brain packs more neurons than any other animal's brain.

It's this density that makes us so smart.

There is a trade-off between body size and the number of neurons that primates, including humans, can sustain.

A 25-kilogram ape must eat eight hours a day to sustain a brain with 53 billion neurons.

The invention of cooking 1.5 million years ago, the invention of cooking 1.5 million years ago, gave us great benefits.

Cooked food is softer and easier to digest before it enters the body.

Energy is absorbed more easily

Cooking gives us more energy in less time than eating raw food, which is why humans maintain a densely packed brain of 86 billion neurons.

This amount is 40% higher than in apes.

Let me explain how it works

Half of the calories your brain burns is used simply to keep your brain functioning, moving sodium and potassium ions across cell membranes to maintain electrical charge.

Because of this, the brain has to consume a lot of energy.

It consumes a staggering 3.4 x 10²¹ per minute of ATP, which is the fuel in the body's energy furnace.

The high cost of maintaining the resting membrane potential of 86 billion neurons means that there is very little energy left to send electrical signals to the axons and synapses that actually translate them into action.

Even if only a few neurons in a given region were activated at any given time, the energy load that would spike the entire brain would be unsustainable.

This is where energy efficiency comes into play.

By using sparse coding, which lets only a few cells emit signals at a time, we can carry the most information with the least amount of energy.

Because that small amount of electrical signal travels along thousands of paths.

The downside of using sparse coding in a huge number of neurons is the cost.

In fact, if many cells were inactive all the time, they would have been rendered superfluous and discarded by evolution long ago.

The solution is to find the optimal proportion of cells that the brain can activate at once.

The most efficient is when 1 to 16% of the cells are activated at any given time.

This is the energy limit that we must accept in order to remain conscious.

To conserve resources, most of the brain's work takes place outside of consciousness.

That's why multitasking is a waste of effort.

You don't have the energy to do two things at once, let alone three or five.

I do worse on each task than when I focus on just one.

Increasing the number is disadvantageous to humans

your brain is smart and powerful

to keep it powerful

It takes a lot of power, and because it's smart, it has an efficient way of using energy.

So don't feel guilty thinking your brain is lazy because of false myths.

Feeling guilty is a waste of energy

Now you know that wasting energy is silly, right? You know that wasting energy is silly, right?

We have to sustain billions of power-hungry neurons We have to sustain billions of power-hungry neurons

Let's get started!

Few people know Roy Price, but he's the man who must have bored you for 22 minutes on April 19th, 2013.

Some of you may say that that time was "fun," but not many.

It all goes back to a decision Roy made three years earlier.

Roy Price sits on the board of Amazon Studios, i.e.

TV production company for Amazon

He's 47 years old, slender, with bristling hair, and describes himself on Twitter as "I love movies, TV, technology and tacos."

It's his job to select the original shows produced by Amazon, so it's a big responsibility.

It's a highly competitive industry

There's already a ton of TV shows, and it's not like you can choose anything.

I have to find a really great show.

So I need to find the shows that fall on the far right of this graph.

This graph shows the distribution of ratings for about 2,500 programs posted on the site IMDb, where the ratings are from 1 to 10, and the vertical axis is the number of programs with that rating.

If the show you choose gets a rating of 9 or higher, it's a success.

to be in the top 2%

"Breaking Bad," "Game of Thrones," and "The Wire," all of those shows are so addictive that after one season, your brain is asking, "Where can I watch more?"

It's a program

To give you an idea, on the far left is the beauty pageant reality show Toddlers & Tiaras.

But Roy Price isn't worried about the far left, because it takes a lot of wits to get below "Toddlers & Tiaras."

So what he's worried about is near the peak of the graph, which is the average number of shows, not too bad, not particularly wanting to watch.

So we have to go to the far right of the graph anyway.

There's a lot of pressure, and it's Amazon's first time doing something like this, so Roy Price isn't going to bet on it.

Think of a way to be absolutely successful

Open a contest to ensure success

We collect a bunch of program proposals, we evaluate each one, we select eight of them as candidates, and then we publish one episode of each online for everyone to see.

If Amazon distributes it for free, everyone will see it, right?

As a result, millions of people will watch the show.

But what viewers don't realize is that while they're watching the show, they're actually being watched.

Roy's team records everything and observes the audience.

It records when it played, when it paused, where it skipped, and where it revisited.

So we collect millions of data points, and we use those data points to decide which shows to produce.

When I collected all the data and analyzed the data, the answer came to me, and the answer was, "The show that should be made is a sitcom starring four Republican senators."

and made

Do you know which program?

Audience: "Alpha House," yes, "Alpha House."

It's literally an average show. The average on this graph is 7.4, but "Alpha House" was 7.5.

Around the same time, another executive at another company was using data analytics to create hit shows. His name is Ted Sarandos, and he's the head of content at Netflix. Like Roy, his job is to find the best shows.

Instead of running contests, his team analyzed all the data about Netflix viewers: ratings, viewing history, what shows they liked.

And from there, we're going to explore the nitty-gritty details about the audience, about the shows they like, about the producers, about the actors.

And then, putting all the information together, and putting it all together, we settled on a licensing deal, not a comedy about four senators, but a drama series featuring one senator.

you know

(Laughter) Yes, with "House of Cards," Netflix had at least two successful seasons.

(Laughter) (Applause) "House of Cards" has a 9.1 rating, which is exactly what we expected.

This naturally raises questions.

There are two companies that are highly competitive and strong in data.

They're both combining millions of data points, but one works really well and the other doesn't.

I wonder why?

Logically it should always work

So when you're trying to make a decision, if you have millions of data points, you should be pretty good at it.

Statistics with 200 years of history and

high-performance computers help

There's no way it'll end up being a mediocre show

But if data analysis doesn't turn out the way you want it to, it's terrifying, because we're living in an age where we rely more and more on data to make all kinds of important decisions, not just television.

Anyone know of a company called Multi-Health Systems?

I'm glad you're not here

Multi-Health Systems is a software company, but I hope there's no one here to help me, because if I do, it's an inmate.

(Laughter) When people in prison in the United States apply for parole, they often use this company's data analysis software to decide whether or not to grant it.

It's the same principle as Amazon and Netflix, but instead of deciding whether a TV show is good or bad, you decide whether a person is good or bad.

Watching 22 minutes of a boring show might be painful, but spending a few more years in prison would be much harder.

Unfortunately, there's evidence that in data analysis, even when you have a lot of data, you don't always get the best results.

It's not because companies like Multi-Health Systems don't know what to do with data.

Even the most data-savvy companies make mistakes

yes even google gets it wrong sometimes

In 2009, Google announced that it was able to predict the epidemic of a highly contagious flu by analyzing search data.

The prediction worked pretty well, and it made big news, and it even got published in Nature, one of the biggest accolades in science.

The prediction worked well the year after, and the year after that, but it failed one year.

no one knew for sure why

All of a sudden it failed, and of course it was big news, and the Nature paper was retracted.

Even very data-savvy companies like Amazon and Google get it wrong sometimes.

On the other hand, despite these failures, data is moving at breakneck speed into everyday decision-making, into the workplace, into law enforcement, into healthcare.

So we should make sure that the data is really useful.

I've seen the struggle with data myself. I work in computational genetics, and here too, smart people are using unimaginable amounts of data to make big decisions, like treating cancer or developing new drugs.

Over the last few years, I've noticed a pattern, a sort of regularity, between the successes and failures of data-based decision-making, and I think this pattern is worth sharing.

When we solve complex problems, we do two main things.

First, break the problem down into pieces so that you can analyze the elements in depth, and then move on.

Put all the elements together again and draw a conclusion.

Sometimes it's the same thing over and over again, but what I always do is split those two and put them back together.

The point here is that the data and its analysis are valid only at the beginning.

No matter how powerful your data and analytics, they only help you break down the problem and understand the pieces.

It's just not a good place to put the pieces back together and come to a conclusion.

We have another tool for drawing conclusions: the brain.

The brain has something that it's good at: putting the pieces together and making sound conclusions, even when you have incomplete information, especially the brain of an expert.

I think Netflix's success is because it puts data and brains to good use.

First, we used data to understand information about our audience, otherwise we wouldn't have been able to understand it so deeply. On the other hand, we took all the pieces together and reassembled them to create shows like "House of Cards," which didn't come out of the data.

It was Ted Sarandos' team who made the decision to give the go-ahead, so they took a huge personal risk with this decision.

Amazon got it wrong

We used data throughout the entire decision-making process, both when we first held a design contest and when we chose to create "Alpha House."

Of course, this was a safe decision, because we could just say, "The data tells us."

But that didn't give them the extraordinary results they wanted.

Yes, data is a very useful tool for making better decisions, but I think the problem arises when data forces decisions.

Data, no matter how powerful, is just a tool, and I've found that this device helps me to become conscious of it.

Many people would agree

(Laughter) Before the advent of data, this was the way to make decisions.

(Laughter) Many of you probably know

This is the "Magic 8 Ball." It's a really cool device. If you have to make a yes or no decision, just shake this ball and you'll get an answer, like, "Most likely."

Let's display it in the demo hall later

(Laughter) Now, the bottom line is, some of the decisions I've made so far, in hindsight, would have been better off asking Ball.

But if you have the data, you'll want to use more sophisticated tools, like data analysis, to make better decisions instead of these toys.

But that doesn't change the basic mechanics.

Ball may be getting smarter and smarter, but if we want to achieve something amazing that's on the far right of the graph, our own decisions still matter.

I think it's a very encouraging lesson that in the face of so much data, still making decisions and taking risks as an expert in the field can lead to success.

After all, it's not the data that you need to get to the right end of the graph, it's the risk.

thank you

(applause)

In the early 1960s, Dick Fosbury tried out different sports, none of which he excelled in, until he turned 16 and took up the high jump.

When he couldn't beat other good players in college the way that was popular at the time, when he couldn't beat the way that was popular at the time, Fosbury tried something else: he turned it around.

Instead of jumping with his face to the bar, he took his feet and straddled them like before, but he took his legs and straddled them like before, but he flew with his back facing the bar.

Fosbury improved his record by more than 15 centimeters, and his coaches were amazed by this new high jump technique.

Over the next few years, Fosbury perfected the leap, winning a national championship and qualifying for the 1968 Mexico Olympics.

At the Olympics, Fosbury surprised the world with his new technique and won the gold medal, setting a new Olympic record of 2.24 meters.

By the next Olympics, all the competing jumpers in the high jump had adopted a technique called the "Fosbury Flop."

What's the secret behind this leap?

It's in the concept of the center of gravity in physics.

Every object has a point where the average position of all its mass is. That's determined by the distribution of mass. That's determined by the distribution of mass.

For example, the center of gravity of a homogenous flat rectangular shape is, for example, the center of gravity of a homogeneous flat rectangular shape is at the intersection of diagonals equidistant from the four corners at the intersection of diagonals equidistant from the four corners.

You can find the center of gravity of other objects with similar calculations, but if you look for a point where the mass is balanced, that point is directly below the center of gravity.

Grab a broom and try to balance it like this Slowly move your hands apart until they meet.

This point of equilibrium is exactly the center of gravity of the broom This point of equilibrium is exactly the center of gravity of the broom.

Our bodies also have a center of gravity

When we stand, most people's center of gravity is around their stomach.

center of gravity rises

It moves with us all day, depending on what position your body is in.

can even be outside the body

When you bend forward, your center of gravity is under your flexed abdomen, where you have no mass at all.

It's funny, that's where the mass is on average. It's funny, but that's where the mass is on average.

In many cases the center of gravity is outside the object.

Like donuts and boomerangs

Now look at the Fosbury Flop and follow the movement of the player's center of gravity.

Athletes run, change their speed from horizontal to vertical, and jump.

wait... it's here

When the athlete's body arches backward, look at the center of gravity When the athlete's body arches backward, look at the center of gravity

under the bar

This is the secret of this jump

Before the Fosbury technique, jumpers had to apply enough force to lift their center of gravity several inches above the bar.

You don't have to do that at the Fosbury Flop.

The advantage of the back jump is that the athlete can lift the body much higher than in a conventional jump with the same force.

So even if you set the bar higher than your center of gravity can rise, you can still jump over your arched body.

The back jump has set a new height standard in the high jump.It moves the athlete's body away from the center of gravity, giving them more space and allowing them to jump much higher.

The back jump may have been the biggest leap forward in sports history, but it's also the biggest backward leap.

Everything around you is made up of something called molecules that are much smaller than you can see with a microscope.

Molecules, in turn, are made up of individual atoms.

Molecules frequently break apart and new molecules are created

On the other hand, almost every atom you'll encounter in your lifetime has existed for billions of years as the building blocks of life, in the earth beneath you, in the air you breathe, in the food you eat, in yourself, and in places like Earth.

I want to tell you about the birth of the atom.

It all started 14 billion years ago, in an event called the Big Bang, which created the universe with nothing but gas.

There were no stars or planets yet

Gases were made of only the simplest elements Gases were made of only the simplest elements

75% was hydrogen, the rest was mostly helium.

There was no such thing as carbon, oxygen, or nitrogen.

There was no iron, no silver, no gold

The density of the gas is slightly higher in some places than in others

Gravity attracts more gas, and gravity gets stronger, attracts more gas, and so on.

Eventually, many large, dense gas balls formed and contracted under their own gravity, generating heat inside.

At some point, the center of the gas ball becomes hot enough to cause nuclear fusion.

The hydrogen atoms collide with each other to form helium, releasing an enormous amount of energy in this process, enough to overcome the contraction force of gravity.

Equilibrium is reached in which the repulsive force of nuclear fusion and the gravitational force that draws the gas inside are balanced

this is the birth of a star

During its lifetime, nuclear fusion occurs in the massive core of the star, producing not only helium, but all the elements of the periodic table, including carbon, oxygen, nitrogen, and even iron.

But eventually the nuclear fuel runs out and a complete gravitational collapse occurs.

And then an unbelievably powerful explosion occurs, called a supernova explosion.

Let's talk about two mechanisms by which supernova explosions create elements Here, let's talk about two mechanisms by which supernova explosions create elements

First, this explosion releases a lot of energy, and nuclear fusion becomes ferocious, creating atoms that are heavier than iron, like silver, gold, and uranium.

Second, all the elements that were stored in the core of the star, carbon, oxygen, nitrogen, iron, etc., along with the elements created by the supernova explosion, are expelled into the interstellar space and mixed with the gas already there.

history repeats itself

Gas clouds contain more elements than just the original hydrogen and helium, and where they become denser they attract more matter.

And just like before, a new star is born

Our sun was born this way about 5 billion years ago.

In other words, after the universe was born, the gas that was diversified by the supernova explosion became the material for our sun.

This is why the sun contains all the elements

Most of it, though, is hydrogen at 71%, and the rest is mostly helium at 27%.

But be careful, when the stars were first born, they only had hydrogen and helium, but even the sun contains only 2% of the other elements.

What about Earth?

Planets are formed in an accidental process from the same gas clouds when stars are born.

A small planet like Earth has such a weak gravity that it can't hold enough hydrogen or helium, both of which are very light.

So carbon, nitrogen, oxygen, etc., were only 2% in the gas clouds that formed the Earth, and these heavy constituents make up the majority of the Earth's body and everything on it.

Think about this: Except for hydrogen and some helium, the ground you walk on, the air you breathe, yourself, everything is made of atoms made inside stars, everything is made of atoms made inside stars.

When scientists in the first half of the 20th century were figuring this out When scientists in the first half of the twentieth century were figuring this out, the famous astronomer Harlow Shapley said, "We are the brothers of the stone, the cousins ​​of the gas cloud."

This is the story of a girl named Iris.

she is very sensitive

always in tears

Whether you're sad or happy, you cry.Even if trouble happens, tears come out.

She has special lacrimal glands that produce new tears and special tubes called puncta that drain old tears.

She cries so much that she produces 300 mL of tears per day, 120 mL per year.

In fact, if you look closely, you can see that she's crying a little bit all the time.

The basal tears that Iris is constantly producing form three thin layers that cover her and protect her from dust and debris.

The mucus layer (mucin layer) in contact with the iris holds the three layers together.

Above that is a layer of water that keeps the iris moist, repels invasive bacteria, and protects the surface of the iris and the cornea from damage.

Finally, there's the oil layer, and that outer film of oil keeps the surface smooth, allowing the iris to be seen well, and preventing the other layers from drying out.

Normally, Iris spends her days unaware of the role of basal metabolic tears.

I have to be

One day Iris meets a girl named Onion.

immediately fell in love

Onion in a purple jacket was gorgeous and smelled good.

So Iris invited Onion to dinner.

But when she entered the house and took off her jacket, something terrible happened.

You see, when Onion takes off her jacket, there's going to be a chemical reaction that turns her sweet-smelling sulfoxide into a nasty chemical called sulfenic acid, whose long name is syn-propanethial-S-oxide.

The gas stimulates Iris, and suddenly, she bursts into tears without help.

These "reflex secretory tears" are different from the "basal secretory tears" that Iris always produces.

Because it's designed to remove harmful substances and foreign substances, it releases much more, and the water layer contains more antibodies, and those antibodies also stop microbes before they get in.

Iris and Onion are totally depressed.

They both know they can't keep their friendship going, because every time Onion takes off his jacket, he makes Iris suffer and cry.

So they gave up on dating

When the onion leaves the house

Iris stopped crying, but soon she started crying again.

But this time, instead of "reflex tears," they're "emotional tears."

When a person is too sad or too happy, it can feel out of control, and it can be dangerous.

So, it produces "emotional tears" to calm you down as quickly as possible, while at the same time normalizing your physiological response -- your increased heart rate, your decreased breathing rate.

But scientists aren't quite sure how useful tears are.

It may have a social function of gaining sympathy and showing submission, and it may have a social function of gaining sympathy and showing submission.

One study found that emotional tears are high in stress hormones, which are natural pain relievers like adrenocorticotropic hormone, enkephalins, and endorphins.

That's why Iris' emotional tears are both an expression of her emotions and a direct quenching of her emotions.

I'm sorry it didn't go well with Onion, but don't worry Iris.

As long as the three types of tears keep you in balance and healthy

I have something good to see

Our grandparents' generation created an amazing system of canals and reservoirs that made it possible for people to live in lands where water was scarce.

For example, during the Great Depression, we built the Hoover Dam to create Lake Mead, which made it possible to supply water to people living in very arid places like Las Vegas, Phoenix, Los Angeles.

We spent literally trillions of dollars in the 20th century building the infrastructure to bring water to our cities.

It's been a great investment from an economic development perspective.

But over the past decade, we've seen these lifelines and water resources threatened by climate change, population growth and competition for water.

This graph shows how the water level of Lake Mead has changed over the past 15 years.

From around 2000, we can see that the water level of the lake has started to fall.

Water levels dropped at such a rate that the drinking water intakes in Las Vegas could potentially be above water level.

Las Vegas is so concerned about this that it recently built a new water intake, called the "third straw," which sucks water from the deeper part of the lake.

The challenge of getting water to modern cities isn't unique to the American Southwest.

In 2007, Australia's third largest city, Brisbane, experienced six months of water shortages.

A similar drama is currently unfolding in São Paulo, Brazil, where the city's largest reservoir, which was full in 2010, is nearly empty today as the 2016 Summer Olympics approach.

Those of us who are lucky enough to live in one of the world's greatest cities have never really experienced the effects of a devastating drought.

We complained about having a short shower, Navy-style.

Maybe your neighbors don't care if they see our dirty cars and dead grass.

But I don't think I've ever turned on a tap and nothing really came out.

This is because, in the past, when things were really bad, we could have expanded the reservoirs or dug additional wells.

We may not be able to rely on proven methods when all our water resources are used up.

Some people think that the city's water scarcity can be solved by pulling water from the surrounding countryside.

But this method is fraught with political, legal and social risks.

And even if we do manage to get water from the surrounding countryside, we're just pushing the problem onto others, and it's likely to bounce back on us in the long run, through rising food prices and impacts on the aquatic ecosystems that already depend on that water.

I believe there's a better way to solve the urban water crisis, and that's by harnessing four new regional water resources that can be compared to taps.

If we can invest wisely in this new water resource in the years to come, it will solve urban water shortages and reduce our chances of suffering from devastating droughts.

If you told me 20 years ago that modern cities could survive without imported water, you might have dismissed me as an unrealistic, ignorant dreamer.

But what I've experienced over the last few decades working in some of the most water-scarce cities is that we have the technology and management capacity to forego water imports. And that's what I want to talk to you about tonight.

To solve urban water scarcity, the first water resource that should be developed is related to the rainwater that falls on the city.

One of the great tragedies of urban development is that as cities grow, their surfaces become covered with concrete and asphalt.

As a result, we needed to build drainage pipes to drain the rain that fell on the city before it flooded, which is a huge waste of precious water resources.

let me give you an example

This graph shows the amount of water that could be used in the city of San Jose if it collected rainwater from the city.

The intersection of the blue line and the black dotted line shows that if San Jose could use half of the city's rainfall, it could meet all of its water needs in a year.

Some of you may be thinking,

"To solve the water shortage, we should install a large tank on the roof gutter to collect the rain."

it will work in some places

But if you live in a city where most of the precipitation is in the winter and most of the water demand is in the summer, that's not going to be a cost-effective way to solve your water problem.

And if you're going through a multi-year drought, as California is today, the tanks you need to solve the problem will be too big to even build.

I think there is another, more practical way to collect the runoff and rainwater that falls on your city, and that is to collect the rainwater and then let it soak into the soil.

Most of our cities are on natural water storage systems that can store large amounts of water.

For example, historically Los Angeles got one-third of its water supply from a huge aquifer beneath the San Fernando Valley.

Now, when you look at the gutter on the roof, the water on the lawn, or the water running down the drain, you might think, "Do I really want to drink this?"

Without some processing, the answer would be no.

So the challenge we face in urban water harvesting is also how to collect it, purify it, and send it underground.

And that's exactly what the city of Los Angeles is doing in Burbank, California, with a new project.

This picture shows a runoff stormwater treatment plant under construction, with a number of stormwater collection systems and a gutter system, where the rainwater is channeled through a gravel pit.

Water stored in stone pits slowly flows through man-made wetlands, then is sprinkled at places like baseball fields, seeps through the ground, and replenishes urban aquifers for drinking water.

And as it travels through wetlands and infiltrates underground, it encounters water-purifying microbes that live on the surface of plants and in the soil.

Even through this natural cleansing process, when the water is not clean enough to drink, it is treated again when cities pump it out of underground aquifers to bring drinking water to people.

The second tap to solve urban water problems is the use of wastewater from sewage treatment plants.

Most of you are familiar with the concept of wastewater recycling.

Have you ever seen a sign like this, indicating that a shrubbery, a highway divider, or a local golf course is being watered with treated wastewater?

this has been done for decades

But past experience has shown that this method is much more expensive than you might think.

Because after you've built a few water recycling systems near the sewage treatment plant, you have to build progressively longer pipelines to where the water is needed.

the cost is out of line

A more cost-effective and practical way to recycle water that we're investigating is to go through a two-step process and turn the treated water into drinkable water.

The first step is to pressurize the water through a reverse osmosis membrane, a thin permeable plastic membrane that allows water molecules to pass through, but not the salts, viruses and organic chemicals found in the wastewater.

In the second process, we add a small amount of hydrogen peroxide to the water and expose it to UV light.

Ultraviolet light breaks down hydrogen peroxide into two hydroxyl radicals, a very powerful form of oxygen that breaks down most organic chemicals.

Through these two processes, water can be safely drunk.

Of course, over the past 15 years, we've been studying water recycling using whatever analytical techniques modern science allows.

We've found that some compounds can't be processed in this first step, but the second step, a highly oxidative process, leaves very few compounds.

This is in contrast to the way drinking water is supplied, which has long been taken for granted.

There are other ways to reuse water

This is a recently created artificial water treatment wetland on the banks of the Santa Ana River in Southern California.

This treatment wetland draws water from a portion of the Santa Ana River, and in the summer months draws almost all of its wastewater from cities like Riverside and San Bernardino.

The water flows into a treatment wetland, where the sun and algae break down organic compounds, removing nutrients and water-borne pathogens.

When the water is pumped back up the Santa Ana River and washed up in the city of Anaheim, it seeps into the soil and becomes the drinking water of the city of Anaheim. Riverside County's wastewater becomes the drinking water of Orange County at the end of its journey.

You might think that this idea of ​​drinking wastewater is a futuristic fantasy or a topical one.

But in California, 150 billion liters of wastewater have already been reclaimed by the new two-stage treatment process that I've described to you.

This water alone is enough to feed a million people.

The third faucet is a faucet that never opens, a virtual faucet, to save water.

What we have to think about is outdoor water conservation. In California and many modern American cities, half of the water is used outdoors.

In the current drought, we've learned that grass and plants can survive half as much as they used to.

You don't have to paint concrete green or put artificial turf or buy cacti.

With soil moisture detectors and irrigation controllers, you can effortlessly protect California's landscape and keep it green and beautiful.

The fourth and final tap to solve urban water problems is seawater desalination.

You may have heard people say this about seawater desalination.

"If you don't have water, you have plenty of oil, and you don't care about climate change, it might be a good idea."

It's true that desalinating seawater requires energy.

But to think that seawater desalination is impossible is completely outdated.

Over the last 20 years, seawater desalination technology has made tremendous progress.

This is a picture of the largest desalination plant in Europe, just north of San Diego.

This desalination plant was built in Santa Barbara 25 years ago, and the new process uses half as much energy to produce a gallon of water.

But just because seawater desalination doesn't require as much energy as it used to, doesn't mean we should build desalination plants everywhere.

Of all the options available for supplying water to a community, it's probably the most energy-intensive and environmentally impactful.

The current situation is like this

With these four methods, you don't need to import water.

By greening land and residential areas, we can reduce outdoor water use by 50 percent, or in other words, increase water supply by 25 percent.

By reusing the water that flows into our sewers, we can increase our water supply by 40 percent.

Furthermore, the shortfall can be made up through a combination of rainwater collection and seawater desalination.

So let's create a water supply that can withstand whatever challenges future climate change brings.

Use local water to create water resources and leave more water for the environment for fish and food

Let's create water systems that match our environmental values

Do it for your children and grandchildren, and tell them that this water system is what you must protect in the future, because this is your last chance to build a new water system.

Thank you for your attention

(applause)

Why does it feel like fire is shooting out of your mouth when you eat hot chili peppers?

how to relieve burning pain

Why does eating wasabi make your eyes watery?

How hot is the hottest spice

let's step back

First of all, what is spiciness?

We often say that food is spicy, but spiciness isn't a taste, it's different from sweet, salty, or sour.

What's actually happening is that certain components of spicy foods are stimulating sensory nerves, called polymodal receptors.

It's all over your body, even your mouth and nose, and it's the same nociceptor that responds to extreme heat.

So when you eat a chili pepper and your mouth feels like it's burning, it's because your brain thinks it's actually burning.

The opposite happens when you eat foods that contain menthol.

Cold mint ingredients activate cold receptors.

When these heat-stimulated receptors are activated, we feel that we've been in contact with a dangerous heat source, and there's an associated response.

That's why you sweat and your heart beats faster.

Pepper provokes a fight-or-flight response, similar to the response to many threats to the body.

But you'll also notice that not all spicy foods are equally spicy.

The difference is due to the type of ingredients contained

Capsaicin and piperine, found in black pepper and chili peppers, are made up of alkylamides, large, heavy molecules that stay in your mouth.

Mustard, horseradish, and wasabi are made up of isothiocyanates, which are smaller molecules that quickly float up into your nasal passages.

This is why chili peppers make your mouth burn and wasabi makes your nose tingle.

A common measure of the spiciness of food is the Scoville scale, which measures the spiciness of the capsaicin compound by diluting it to the point where humans can't detect it.

Paprika has a Scoville value of 0 and Tabasco has a value of 1200 to 2400.

Attempts to create the hottest chili pepper have become a never-ending race, and two chili peppers generally come out on top: the Trinidad Morga Scorpion and the Carolina Reaper.

These peppers score between one and a half million and two million Scoville values, which is half the value of pepper spray.

Why would anyone want to eat something that causes such a high level of pain?

No one knows, but when and why humans started eating chili peppers is unknown.

Archaeologists have found a mustard-like spice along with 23,000-year-old artifacts.

But we don't know if the spices were used for food, medicine, or just for decoration.

I don't know if it's food, medicine, or just decoration. Closer, mustard has been found in old pots dating back 6,000 years, along with charred fish and meat.

One theory is that humans started adding spices to their food to kill bacteria.

One study shows that spices often developed in warmer climates, which is also where microbes flourish.

But we still don't know why we continue to eat so much spicy food today.

For some people, eating spicy food is like riding a roller coaster and enjoying the thrill of riding a roller coaster, even if the immediate sensation is unpleasant.

Some studies have shown that people who like spicy food tend to prefer things like gambling that have a high adrenaline rush.

Preference for spiciness is even genetic.

If you're thinking about training your tolerance for hotness, know that some studies show that pain doesn't change one bit.

just be patient

In fact, researchers found that people who like spicy food perceive a burning sensation as less pain than people who don't like spicy food, and people who don't like spicy food perceive a burning sensation as less pain.

Such people simply seem to prefer pain.

It doesn't matter how much you hurt your heat receptors, but remember, when it comes to spicy food, it burns you anyway.

There's an ongoing environmental mystery that begins as seemingly trivial and escalates into a global disaster.

One day, you realize that honey on your breakfast toast is getting expensive.

Instead of switching to jam, you try to find out why the price went up.

The results were astonishing

The number of domesticated bees in the United States was declining at an alarming rate.

The magnitude of the decline seemed inexplicable by normal deaths from disease, parasites, and starvation.

At the scene of a typical incident, most of the adults, except for the queen bee and a few survivors, have left the hive.

A pristine food pan, unhatched larvae, imply that the adults escaped without waiting for the larvae to hatch.

But what's most eerie is that we don't see the dying Hachi, or the dying Hachi, who tells us the truth.

Did you forget your way back to your nest or did you just disappear?

This mysterious disappearance is nothing new.

Humans have been collecting honey for hundreds of years

But it wasn't until the 1600s that European settlers brought in a subspecies, the Western honey bee, that domesticated bees began.

Since the 19th century, beekeepers have reported mass extinctions, sometimes giving cryptic names such as vanishing disease, spring decline disease, or fall doom.

But in 2006, when such extinctions were found to affect more than half of all hives across the United States, the phenomenon was given a new name: colony collapse disorder (CCD).

The scariest part of this mystery isn't that we have to use regular sugar in our teas again.

We also keep bees for our honey, but bees pollinate grains on an industrial scale, and one-third of all grains in the United States are produced this way.

So how can we find the culprits of this scourge?

We have three suspects here.

Suspect A: Pest or disease

The most notorious is the varroa mite, a tiny red pest that not only invades the hive and feeds on the bees, but also carries stunting pathogens and shortens their lifespan.

Suspect B: Gene

The queen bee is the center of a healthy hive

But these days, millions of queen bees, offspring of just a few queens, are distributed in commercial hives, resulting in less genetic diversity, raising concerns about the bees' defenses against pathogens and pests.

Suspect C: Chemicals

The pesticides used to kill parasites in both commercial hives and agricultural crops may find their way into the food and water that bees consume.

Researchers have also found that some insecticides impair honeybee homing.

Now, we've got a lot of hints, but nothing definitive.

In fact, scientists continue to investigate the case, but still cannot agree on the cause of colony collapse syndrome.

Several factors are currently considered

Bees aren't endangered, but fewer bees mean less pollination and higher food production costs, which is why it's so important for scientists to solve the disappearance of bees.

The lack of honey may be a pity, but the lack of grain is stinging.

If someone called you a scum, you'd probably be outraged, but scientifically they're not that far off.

Have you ever wondered where your food comes from?

You might say it comes from plants, animals and mushrooms, but you probably don't want to think about the rotting organic matter and waste that feeds those plants, animals and mushrooms.

But really, most of your body is just two or three steps away from something like pond scum.

All the animals in the ecosystem, from coral reef creatures to lake fish to savannah lions, directly or indirectly get nourishment from dead things.

Much of the organic matter in our bodies, if we trace it far enough back, is made from carbon dioxide and water through photosynthesis.

Plants use the energy of sunlight to convert the carbon dioxide and water around them into glucose and oxygen.

That glucose is then converted into more complex organic molecules that form leaves, stems, roots, fruits, and so on.

The energy stored in organic molecules supports the food chain we know so well.

You've probably seen illustrations like this

These are green food chains based on living plants.

But in a real ecosystem on Earth, only about 10 percent of plants are eaten during their lifetime.

What about the remaining 90%?

Let's see the ground on an autumn day

Living plants shed their dead parts – fallen leaves, broken branches and even underground roots.

Many plants are lucky enough to end their lives uneaten, leaving behind debris.

What happens to all the tissues of plants that are inedible, undigested, dead, 90% of the plants on earth?

They become the waste product and the starting point of what's called the brown food chain, which looks like this.

What happens to plants happens to organisms higher up the food chain, some of which are eaten alive, but most of which are only eaten when dead and rotting.

All along this food chain, even before an organism dies and rots, it sheds unwanted organic matter from its body and excretes post-digestion leftovers.

A death like this sounds frightening, doesn't it?

but that's not the case

All of the waste is ultimately consumed by microbes and scavengers, so it actually forms the basis of a brown food chain that helps many other organisms, including us.

Scientists are learning that this waste material is a much larger source of energy than we imagined, supporting most of our natural ecosystems.

But the interrelationships within an ecosystem are much more complex than this.

What the food chain really represents is a single stream of energy.

And within any ecosystem, many of these streams are interconnected, forming a rich network of interactions, or food web, with carcasses supporting each step of the network.

The resulting food web is so tightly connected that almost all species are within two steps of waste, even humans.

You probably don't eat rotten things, poop, or pond dregs directly, but what you eat should.

Many of the animals that we eat, like pigs and poultry, mushrooms and crustaceans, catfish and demersal fish, either eat the waste directly or are made from it.

If you think the natural world is full of excrement, you're right.

Garbage to one organism is gold to another, so anything that rots and dies ultimately provides the energy that feeds us and many other organisms on the planet through our food webs.

“Food for thought” is here

Please draw a card of your choice

Please pull all the rest

This deck of 52 playing cards has been around for centuries.

Thousands of playing cards are shuffled in casinos around the world every day, and the order of the cards is changed each time.

Every time you draw a well-shuffled deck of cards, in most cases you're getting the first card arrangement that has ever existed.

What does that mean??

The answer is 52 cards, or whatever, but how many different arrangements are possible?

52 may not seem like a big number, but let's start with a smaller number.

For example, if four people try to sit in four numbered chairs,

How many ways can you sit?

First of all, any of the four can sit in the first chair.

When this chair is filled, there will be three people left.

When the second person sits down, there are two people left for the third chair.

When the third person sits down, the last person left has to sit in the fourth chair.

If you write down how many possible arrangements, or permutations, one by one, there are 24 possible ways for four people to sit on four chairs.

Is there a faster way

So let's start over. The first chair has four options, so the second chair has three options, and the third chair has two options.

Instead of counting the final options one by one, let's multiply the number of options that each chair can have: 4x3x2x1, which is also 24.

An interesting pattern emerged

First, count the number of things in the array, in this case four.

that's an amazing find

So mathematicians chose the exclamation point (!) as the symbol to represent this calculation, known as factorial.

As a general rule, the factorial of any positive integer is calculated as the product of the same integer and all integers up to 1.

In this simple example, four people sitting down on a chair can be expressed as the factorial of four, which is 24.

Now let's go back to Trump

When four people are seated, we calculated the factorial of 4, so to place 52 cards, we need to calculate the factorial of 52.

fortunately with a calculator

You don't have to do the math yourself, so the resulting number of possible arrays is 8.07 x 10^67, 8 followed by 67 zeros.

How big is that number?

If you started writing out the permutations of 52 cards every second, 13.8 billion years ago, when the Big Bang supposedly happened, you're still not finished, and it's going to take you a very, very long time.

In fact, there are more permutations of cards than there are atoms on Earth.There are more permutations of cards than there are atoms on Earth.

The next time you shuffle your cards, remember that you're holding something that never existed and never will.

sugar is playing hide and seek with you

Soda, ice cream, candy, and the big white bag that says sugar, you might think that sugar is only there, and that it's easy to find.

Because people get about half of their added sugar from these drinks and snacks, the sugar is in easy-to-find places.

Check out our ingredients for ketchup, bologna sausage, pasta sauce, soy milk, sports drinks, fish sticks and peanut butter.

Sugar is lurking in most of its products.

In fact, sugar is used as an additive in three-quarters of the more than 600,000 items sold in grocery stores.

So where is the sugar hiding?

Can't you just find it on the food label?

it's not that easy

Your friend Robert is called Bob, Robbie, Rob, Bobby Roberto. There are many names for sugar as an additive.

The number is not 5 or 6 types, there may be 56 types.

Brown rice syrup, barley malt Demerara, Florida crystals, muscovado, and of course high-fructose corn syrup, which is sometimes called HFCS or corn sugar.

This confusing nickname has yet another nickname

Concentrated grapes or concentrated apples have the same effect on your body as the 55 siblings of sugar.

Organic sugar cane juice sounds healthy, but when you evaporate it, you get sugar!

chemically they are all the same

To make things even more confusing, when different types of added sugar are used in one product, they can get buried in a long list of ingredients, and even if the sugar content seems fine at first glance, when you add it all together, sugar can become the main ingredient.

Currently, the Food and Drug Administration (FDA) doesn't have an appropriate maximum daily intake, so we don't know if 65 grams in a can of soda is a lot.

But the World Health Organization (WHO) recommends limiting it to 5 percent of total calories, or 25 grams per day.

65 grams is easily more than double this

By the way, what is sugar?

What is the difference between glucose and fructose?

They're both carbohydrates, and they're the same chemical formula, made up of carbon, hydrogen, and oxygen.

But they're structurally very different, and they work very differently in the body.

Glucose is the best source of energy for most life on Earth.

can be metabolized in all organs of the body

Fructose, on the other hand, is metabolized primarily in the liver.

In fact, fresh fruit does contain fructose, but it's natural and not too much, because the fiber in fruit slows down its absorption.

This gives the liver enough time to do its job.

Sugar gives cookies chewiness and candy crunch.

Gives the bread crust a nice tan color

It's also an excellent preservative. Because it doesn't spoil or evaporate, food with added sugar is easier to store and cheaper to transport over long distances.

That's why sugar is hidden everywhere

It's actually easier to list foods that are sugar-free, such as vegetables, eggs, meat, fish, fruit, raw nuts, and a kitchen sink.

Simply choosing water over sodas, juices, and sports drinks is a great way to avoid sneaky added sugars.

At least pay attention to food labels so you can keep your sugar intake at a healthy level.

You don't always find sugar in this hide-and-seek game, so you win!

A few years ago I received a typical spam email

Dives beautifully through my spam filter

For some reason it was in my inbox from a man named Solomon Odonko.

(laughs) Isn't that weird?

(Laughter) It says, "James Veitch, I have an interesting business proposal for you, Solomon."

My hand reached over the delete button

As I was looking at my phone, I thought, I can just delete this...

Or do you want to do what everyone has always wanted to do?

(Laughter) Me: "Mr. Solomon, this is intriguing."

(Laughter) (Applause) Now the game is on.

Solomon: "Lord James Veitch, I will send you gold."

(laughs) Seo: "10% of the gold you sell will go to you."

(Laughter) Now I know he's a pro.

(laughs) Me: "How much?"

Seo: "Let's start with a small amount—" What?

(Laughter) That's $2.5 million."

Me: "Solomon, if you're going to do it, let's do it big."

(Applause) I said, "I can do it. How many do you have in total?"

(Laughter) Seo: "The amount I have is good. What matters is how much you can handle.

Let's try starting with 50kg."

Me: "50 kg?

If you don't have at least 1 ton, it's not worth doing."

(laughs) (Applause) Seo: "What do you do?"

(Laughter) Me: "I'm the CEO of a hedge fund bank.

(Laughs) It's not the first time I've transported gold bullion, don't underestimate me.

and i get upset

Me: "Where are you based?

I don't know about you, but if you use the mail, it should be registered, because it's a lot of gold."

Seo: "I'm not sure if the company agrees, because we're going to be transporting a lot."

Me: "Solomon, I know all too well.

Prepare visual materials for board meetings

Hold on until then."

(Laughter) I sent this.

[Golden Amount / Wealth] (Laughter) (Applause) I don't know if there's a statistician here, but it sure sucks.

(laughs) Me: "Solomon, you should be able to use the attached chart.

I had one of my assistants do the math.

(Laughter) We're ready to ship all the gold we can."

Somewhere, they always try to win over my heart He said this is the only time Seo said: "It would be great if this deal went well.

I also have a good margin.” Me: “What are you going to do with your nice cut?”

Seo: "Real estate. Who are you?"

i thought a lot

Me: “One word – hummus.”