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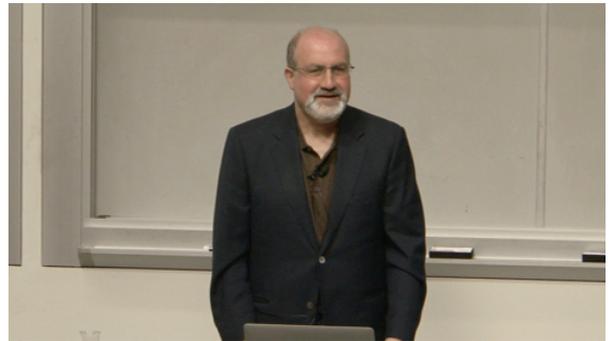
How Things Gain from Disorder [Entire Talk]

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Based on his continuing exploration of the decision making process under opaque circumstances, Nassim Taleb, author of *The Black Swan* and *Antifragile: Things That Gain from Disorder*, shares how the benefits of random conditions can be successfully harvested to help navigate a world we do not fully understand.



Transcript

2 00:00:05,394 --> 00:00:06,987 Well, thanks. Thanks a lot. So let me give you my sort of biographical story and my obsession with what I call fat tails, to explain fat tails, what you have here is the performance of an option portfolio, the variation and price of an option portfolio, daily variation over 57 years. Okay, so out of the money options, options that are remote, this is about 12,000 days, something like that, 14,000 days and as you can see there is a big spike. For that portfolio that day represents depends on what you've been doing between 80% and 99% of your total lifetime variation. If you're an option trader, one day in your life, to represent 98% of the variation, if you're involved in remote pay-offs. This is another - what I call fat tails. And this is of course if you don't get that day right, you're not going to get anything right. And it's not predictable, okay they tell you its predictable, if you go to the finance building they think it's predictable, to an economics building they convince it's predictable, it is not predictable. So that's the problem that there are events that have a huge impact and we can tell at a time when they are going to come and we have no idea about the structure and people fool themselves thinking they have an idea about the structure.

So you have to understand what domains are affected by these large deviations and also I don't know if you're - someone here is from Brooklyn but then Brooklyn as they say that you should make lemonade every time someone gives you a lemon. So you got to make lemonade out of it. So, this is the idea that we have - there is a huge amount of these events, the rare event representing a lot share of the pie. Now you live here at the epicenter of rare events, okay. Google represent this spike in its own business, all right. Microsoft on Microsoft was Microsoft is still Microsoft, but you know even more Microsoft than it is today. There were 50,000 computer companies and it had more than half the sales in that segment, okay. If you take the stock market over the past 100 years, lot of company joined, lot of company left. Thereby 12,000 surviving companies that are listed. Of these 12,000 companies how many companies represent half the capitalization, what do you think? Sorry? When I was trading some years it was 50 to a 100, some year it was 300 to 400, there is no structure, okay? Another example for example is a book business.

I don't know if you know about the book business, there are million manuscripts in the English language on the market today by people who call themselves writers but typically in U.S. they work for Starbucks and in Europe they do other things, they work for the government. So they call themselves writer of their novels. Of the million novels, literary novels, about 20,000 would be published. Of these half the sales would come from how many books, sorry? 20% maybe. 20%, no between 5% and 15% some years less than 5%. It's not 20%, really we are in what I call Extremistan. So let me give you an idea of what is Extremistan, if I can figure out how to work this computer. If you imagine that you would have the convention here and you bring in random selection of people from the planet, 1,000 people, bring them to Stanford, nice weather you know, this is great way to convince people to come. And put them on a scale, all right.

You weigh them, you add to that sample the heaviest person that you can find on the planet who can still be called a person. How much of the total would that person represent? Sorry? Okay, three time the average as we say in finance 30 basis points, all right, 0.3% and if you move from a 1,000 to 10,000, how much will that person represent? Nothing, three basis points. Okay, so the maximum you can get will affect your average rate. This is commonly known as the law of what, large numbers. About everything you do is statistically based on that law, that as your sample becomes larger no deviation is going to mess up things for you, agree? You know I eat, I consume 800,000 calories a year, not a single day is going to make me you know double my weight, all right, thank god, but unfortunately not a single day will make me lose half my weight unless you know I have surgery, all right. So the problem is that - but in finance can you lose half your fortune in one day? Of course, when I became a trader there is a - I walked in, there was something called new member, a badge, means rookie, so we get abuse by all the traders who were bored and wanted to give someone advice for life, so they grab you. So one guy grabbed, hey come over here, kiddo. I said okay, I showed up, he said - that was before this event incidentally. He said listen, you see the guy over there. I said yes, he said his name is Ed.

I said, yes, at a time he had lot of money. He made seven million in seven years. I said yes. And he lost them all in seven seconds. Okay, kiddo now you can go, all right. That was his advice, that you can you know that you're in Extremistan, the reasoning is different. So everything is moved by extremes in economic life and visibly you are here for that, so understand that point and we're going to take it to its conclusion. In Extremistan, okay things are unpredictable and Mediocristan you can predict things, all right. So that's point number one. Unpredictability is a problem in of course in the real world, unlike the textbooks.

I've seen - I guess you've seen this before. Do you recognize this item? This is commonly known as what? A wheel. When was it discovered? Sorry, long time ago? How long ago? At least 6,000 years ago, all right. Babylonian technology, all right? So this technology. So let's see moving from this technology to this technology. You guys are too young to remember the days when you'd have to schlep to carry our luggage because it didn't have wheel. How long did it take? 6,000 years to this discovery all right, okay. So you realize that there is unpredictability, not only that but now we're going to look at something else, that there are domains that are highly dominated by the unpredictable, medical discovery for example, entirely dominated by the rare event, they don't know it and I'm going to talk now about luck with a caveat it's not really luck, it's a function of luck, how to exploit luck by which you get more upside than downside of luck. So and the idea is you know what this is, windmill, there are two approaches in life. The first one is that you hear that there are going to be winds and you know the conservative attitude is to build what a wall to protect oneself from the wind.

A better attitude is to build windmills if you hear that weather, okay, so the idea is to milk uncertainty and try to exploit disorder but before getting there, we're going to have little excursion into what I call fragility. There is something interesting that I discovered that took me about 21 years to figure out, 21 years I was an option trader for 21 years and then realized something I knew unconsciously but only became conscious of it one day as I was looking at this patently ugly tea cup, all right. We have a definition for fragility very simply connected to what we saw about options and let me propose the following. Is fragile what doesn't like volatility. If this tea cup is on the table and there is an earthquake, will it benefit from it? No. Very simple. It is fragile because it wants calm and predictability. It's harmed by disorder. You guys have earthquakes in California, it doesn't want an earthquake, it doesn't want to be in California, it'd rather be in New York, you see, very simply. And now from this concept of fragility we're going to get into innovation and optionality, so this is the way I see it is short optionality and let's look at what short optionality is, this is a pay-off of a financial structure that is very vulnerable to phone calls at night, I mean in the middle of the night the chairman of the company gets a phone call saying, oh, there is an event.

So this pay-off, this package you make or lose some money, but typically the losses all right are very large and the profits are very small, exactly like the coffee cup, except the coffee cup has no variation except for the loss. The coffee cup will never improve. Let's see if you can connect this. This package is robust and this package has an opposite pay-off where all the gains are large. The kind of thing that only people in California seem to understand, people in New York they don't get it because people in New York have this pay-off and let me explain. The banks are in the business of hiding risks. So they make, make, make, make, make small. They have no volatility most of the time and once every 10 or so years guess what, they lose everything they make and then they come to taxpayer for support, they have the set-up for people to give them the monetary policy to help them and all that stuff and meanwhile they keep their bonuses, because it's an very efficient strategy where you make, make, make, everybody think you're smart and then when you lose, guess what, it was a bad environment, okay. It was only a quarter when you lost but visibly you've lost more than you ever made. Banks loss in 2008 more than history of banking, all right.

And of course they paid themselves a lot of money, they are going to return it to us. So this is a pay-off that's very similar to a short-term option, you sell an option, you have very little return, you earned some money, but then something happens, you have unlimited losses or very large losses, that pay-off resemble the fragile. The opposite of that pay-off would be something that's long volatility, so when I went to try to explain this, people weren't understanding that the opposite of fragile isn't robust. It's not solid, it is not the opposite of fragile, the opposite of this is not the straight line. It's not a pay-off where you end up

unharmful, do you agree? If I am sending a package to say Mongolia interior, alright, and the package is fragile, what do I write on it? Fragile, alright, okay. If the packages robust, what do you write on it? Nothing. So if the package wants volatility, wants to be harmed, wants something, wants disorder, wants earthquake, alright, it's not the same as robust. It would be something in we should write please mishandle I am anti-fragile, it's the opposite of fragile. So the opposite of fragile is not something that is robust or something solid. It's something that wants disorder and guess what, there is something called a cluster and if you like one, you like them all: uncertainty, variability, imperfect and incomplete knowledge, chance scales.

These, if you benefit from all of these, you are classified as anti-fragile and it's very similar to someone who owns an option. So we'll now talk about how you guys can milk randomness because that's what you do in California, alright? And that we're going to be a little more technical and a little more rigorous in a way we analyze an option payoff. So there are things. Now, let's view the world in three categories. There is a fragile like this computer. You pour water on it, it's gone, alright? Do you understand? And now, we have to give a lecture of maneuvering with the mouse and maneuvering so it doesn't blow up and hope it doesn't blow up before the end of this lecture, alright? That's a fragile, okay, that's the definition. There is a robust, you hammer it, nothing happens, but doesn't benefit from it and there is the anti-fragile that likes disorder and benefits from disorder and benefits from the error. So happen that now we can identify the fragile whether there is a method to figure out what is fragile and there is a method to figure out what is anti-fragile. Very simple. Something related to convexity.

Let me explain what I mean by non - by convexity or concavity, okay? If I jump, I am fragile, my body is fragile, okay? If I jump 10 meters, what would happen to me? You guys are engineers and smart people; you would know. What happen - what would happen to me? Sorry? I'll die, I am going to say it. This is - you die, your hospital here won't be any good, right? You'll die when you fall 10 meters. By if I fall 10 times one meter, what would happen to me? Nothing. It means that every additional meter harms me more than the previous one, you know. Everything fragile, we saw it in time-series space but if you look at it as a response, everything fragile has to have accelerating harm at some point. And we can actually show that everything that has an accelerating harm doesn't like volatility and the opposite of it that something that has accelerating benefits. The non-linear harm more, you see this accelerating harm. It's harm a lot more than the linear and visibly the linear for small variation for more response than the non-linear. This is very - this is easier to understand if you look at it this way.

You saw that the harm I get from hitting the floor, okay, it has to be non-linear for me to be harmed at 10 meters than not to be harmed at 10 times one meter, you agree? Okay. It has to be that way because walking, you know, from on-campus would kill you otherwise because being harmed by that large - it's the same where linear you'd be killed. So harm for anything that has not be broken has to be non-linear. The coffee cup sees thousands of hits very small intensity but very small pounds per inch hits. It doesn't really care but one big hit and it breaks. So things that are fragile have to be non-linear and this is what central about this idea. It had to be accelerating and harmed. Another example is look at the world around us, okay? If we were linear to harm, we would be blown up long time ago, the world has three to four million earthquakes every year low - of low intensity on a Geiger scale, you see? It would be like a Fukushima, every few minutes if it were - if the harm were linear but it's not, you see? So this is quite central because now we can figure out what is fragile from non-linear and look at its opposite. Simply, we have the following, if you have more gain, say, if the market goes up 10%, you make more money. Then the market went down 10%, then you lose if the market went down 10%, you're convex, you see? And otherwise, you're concave.

The best way to figure it out is with this. This is convex, this is concave. If you want to remember this is convex and this is concave, okay? So if you look at the payoff of the convex you make more than you lose. You are here, you make more than you lose here for an equivalent one or you make more the second time than you make the first time. If the market goes up 20%, and make more than twice since the market went up 10%. If you are in that situation, then you like volatility. If you are in that situation, then you are like benefiting from randomness, what I call the disorder brothers, uncertainty all these things. Let me take one or two questions here before continuing. And as you're asking the question I can look at - I can see if I can fix the computer. Yes.

Are you considering only the sloping upside of the convex curve, because it seems to be that on the other side of your smiley face you would lose? No, no. Yeah, it's on the increasing - has to be increasing but you're not going to be here also, I mean it's not going to be harmed. Here, this is f , f of X and this is X ; and if you are here, see, or decreasing but not very at decreasing rate, you see? For the increasing, alright, you make more than you lose and for the decreasing, it slows down. Any other question? The idea is for you to see the connection between convex. The idea is its connection and likes volatility. Think about why the convex likes volatility, you can do it here. Instead of getting X all the time, you are getting X plus 50% sometimes, or X minus 50% sometimes that linear combination is much better than just getting X . So you like volatility, you like variability. I did a simple - very simple experiment. On my computer, I generated two kinds of series.

One where a person knows where he is going, very intelligent person, he knows where he is going but doesn't have any convexity in his payoff. The other one of a person who doesn't where he is going, has no idea but has convexity in his payoff, you see? Look at the difference between the two. Trial and error is an option, why? Look at trial and error as something like this. You lose, lose, lose, lose, lose, lose and once in a while you make a lot, you see, exactly like the opposite of the coffee

cup like what we saw before something that gains from disorder and gains from black swans. That's trial and error, okay? You are in a business of trial and error. Someone who trial - does trial and error versus someone who has directed ideas is going to perform extremely well when you have randomness and what we're going to see is why when you have trial and error you outperform someone who knows because convexity matters a lot more than knowledge. You know not what's going on, you keep trial and error and you're rational enough not to make mistakes by doing the same trial twice or having a result and giving it up. So we can generate rules from this. And I was thinking on seven rules because people like the number seven, look here, seven money rules for life. There is here.

Seven rules for success, alright? Seven rules for weight loss, alright, you can do that as well. And seven rules for change management, okay? So, okay, I am going to come up with my seven rules but then I realized you guys will not remember the seven rules as you leave this place. So what you have to understand is how an option works. And once you understand how an option works then you understand one rule, how to milk, how to be in a position where you are antifragile and benefit from randomness. It's a big, big misnomer that trial and error you know or luck, benefiting from luck, all right, is a good - the word trial and error is a misnomer. We should not say trial and error, we should say convex function of randomness or trial with small error, okay, trial and the error has to be small. So the antifragile your environment where the errors are small and of small cost and the gains are large and unlimited. And then you are positioned properly towards the black swan, unpredictability, all these things. This is what's central and you can model it exactly like an option and an option increases monstrously in value when there is volatility. Now there is some good news and bad news is that people don't quite understand that optionality concept.

In this book four, I am attacking the notion that we got to where we are because of the superb intellect and brilliance of the ancients. That's not the case. We got to what we are thanks to people who were taking risks involved in trial and error. And the problem is I call it lecturing birds how to fly. People - birds, you know if you lecture birds, tell them this is how you should be flying and birds will fly according to your principles then you can claim credit, you agree? And then everybody would believe that - because you never see, it's called epiphenomenal because you never see the birds flying without someone lecturing it, okay. Now it's the same thing with the problem we have with education, alright. People have this idea that science creates technology. So if you take a book, any book, you have this idea science technology, alright, practice. It looks like it's exactly backwards in history but the problem is that birds don't like books the last time I checked. Who writes books, those who lecture birds.

So we have the next generation of people who will forget how it was before. Now let's take the history of technology. To me it comes from optionality, discoveries, and then someone formalizes it and dresses it up as you know this is directed research, this is from the top down but in fact it all comes from trial and error. You don't know what you're doing, you don't know where you're going but the harm is small. So it's much closer to cooking, you see. How do you cook, it's trial and error, you agree? You don't take a chemistry class even except if it's with Tina because she wrote the book on the chemistry of cooking but you don't really take a chemistry class then work out the equations, the chemical - and then you get your perfect dish, you know. How does it work? You try, you taste. The harm is small if you're wrong and by little by little and after three or four generation of trial - collective trial and error you get a good dish like or you get whatever or sour dough bread or kind of thing you have here, you see. This is cooking. Well it looks like technology resembles cooking but we read the wrong books and then matter of investigating how things were derived, you see, whether it's optionality or whether it was knowledge.

In book four, I start book four with this story by Aristotle, he was talking about Thales of Miletus, okay. And Thales made a killing. He was a philosopher and he was tired of the people who were telling him listen philosopher, you know you are philosopher, you are a schmuck, you get the idea, you can't make money. Plus the guy was Phoenician, so you can't make any money, so he was tired with these people. He wanted to prove that he was philosophizing because he loved that business, not because he wasn't competent, alright. Now how - this is moving on by itself, it's moving left if you've noticed, it's going backwards to the seven rules, okay. So what did he do? He went in and put some money, some bets on olive presses. Okay, so he put some money on olive presses. He went in and made a bet that it was going to be a demand for olive presses. He put a little money on it.

And of course there was a lot of demand, the season was great and he made a fortune, okay. Now what does Aristotle write? That Thales made a fortune because he read the stars and predicted. Okay, a great season for olives, alright, high demand for olive presses but in fact what did Thales have? He had an option, he had the down payment, a call like the right to use the olive press by putting very little money on it, you see. Had he been wrong it would have cost him nothing, so he could have tried 10,000 times or not 10,000 times, maybe 10, 20, 30 whatever, high number of times at no big harm, you see. He would have been breaking even, breaking even, breaking even and making a killing once in a while and that's where really what he had is a big payoff. That was what Thales had was a big payoff. The problem with the story of Thales is that they were convinced, people were convinced that all this great thing came from knowledge when in fact it was from trial and error. And then if we continue what I did here and I can find it here probably in the book which also is wet but you see much less fragile because you can still - a wet book doesn't play tricks on you. You can figure out that in history all right, that a lot of things that were discovered by trial and error that later masqueraded as coming from top down research. And then nobody gets credit for

trial and error.

We've known for example a lot of things, think of Euclidian geometry, you think that we need geometry to build buildings, no? That's what people think, no? Alright, we had Euclidian geometry since the second century, okay? Alright. Did people use it to build you know these big - did the Romans use it? No. Nobody used it. They had their own heuristics, their own tricks coming from trial and error. And they only used it later, okay, after the 15th century - by the 15th century there were only four people capable of doing making the long-hand division in Europe. So I take that example. Another example, a patent example other than - sorry? Which one, pyramids, well the pyramids were built before. You take a lot of things in medicine - sorry? Penicillin was discovered, we know everything in medicine is discovered like Viagra by error, a side-effect of something else and then people, you know, like Viagra the nurses were complaining from behavior on the eighth floor when they were doing the trial so you get the idea for a - and it was a blood pressure medicine. So there are a lot of example of storied backward, even cybernetics, the thing is, Norbert Wiener, in fact just someone sent me a book as I was writing this, about the that it was practiced by technicians way before and of course no credit for them. So let me take some questions here as the computer is - as I find my bearings.

Let me take a few question on this. Yes? Isn't there in general a mix of knowledge and luck? That is true. So there is something called - yes. The bacterium in the stomach that causes ulcers, it was always believed that there was no bacteria in the stomach. It was discovered quote, unquote by chance by two guys who went on vacation, left things in the lab, came back, but it was not by chance that they had left the stuff in the lab. Okay. So there was a mix of the two. There is a mix coming from optionality is when you mix the two but effectively there is some kind of improvement in scientific knowledge built from optionality, you see, improvement that helps you conduct other experiments, but typically the role of knowledge is highly overstated. So we have this impression that things were driven a lot more by design than they were by luck, you see, but the point is it's not luck, it is a convex function of luck. It is by tinkering, it's a convex function of luck.

This is what is quite important in this is that you have more upside than downside into whatever you're doing. The biggest improvements we had in drug discovery were when people had no idea what they were doing but knew that. They kept trying dyes, okay, 'til they found something and today we're directing and we haven't been able to find much. Now we know the genome, we know so many things, we understand bacteria, virus but we haven't been able to find as much as we did in the period when it was purely trial and error. So we continue with this idea of trial and error has optionality, leads us - you remember the seven rules, okay, to maybe you can make 77 rules, you can make a lot of rules but the principle should always be to be on the right side of convexity because convexity will pay you a lot more in the long run than direction. So what do you do it? The first thing is make sure that you have optionality; you're not locked into business plan, like you're not locked on a highway with no exit. Yes? So I agree that I think people know that if you're convex you're - you benefit from extra volatility but you've now popularized this idea, right, this is not, I mean and many people knew about it before so who are you going to buy these options from to be...? This is very interesting. Now when we talk about antifragile as gains from randomness and volatility, in financial option you buy the option from someone, do you agree? But in real life, you don't buy it from anyone. Trial and error you're not buying it from anyone. This is not the financial option.

This is a real option. That is number one. Two, you still have an option that you are buying very cheap, whenever you buy, if you buy a house and you have a mortgage you already have an option, you see? People don't understand you have the option. And for a long time, you know, people were getting even greater option from banks. So the built-in, the explicit option is not what I am talking about here. What I am talking about is embedded option in things or option-like characteristics in things. And if you take the formation of wealth and history, it all came from this optionality. Other questions? Yes. Are you for trial and error like in an industry like for the airline industry where the errors are costing - would cost, you know...? There is explicit trial and error where you are willing to take the error, okay, there is explicit trial and error. This is the system that has explicit trial and error where you tinker voluntarily and you have to maintain your error small and make sure it's not like a lottery ticket where the upside is known, someone is overcharging you for it as a financial option and it's open-ended, you see.

But also there are businesses, okay, where you make mistakes in which case you want to make the mistakes as small for the system as possible and never let a mistake go to waste by exploiting them. So let me give you an example, you know, you just mentioned the transportation industry, okay. Every plane crash which is an error leads to the improvement of the safety of traveling. We haven't had a plane crash in America, a commercial - the commercial plane crash in more than three years and before that it was more than three years, so - or at least one. So you realize that there are businesses that even if they can have a large error to make sure it's one at a time, not like monetary policy where you have big mistakes or, you know, politics where we have one person make a big mistake that cost so much in lives and money like a war, you see, you want your mistakes to be small. When you can't avoid having mistakes you want them to be - to remain small and typically top down things make large mistakes. This is what my idea of decentralization of you have to decentralize the errors by making sure they remain small and distributed, okay. But when you are willingly making errors because they are small, and because they're not of huge cost, when you are willingly then you want, you see, then you want to make error, you want to make a lot of errors because they're not that harmful, you see, and the payoff come from it. But remember one thing, you saw my first graph where

I was showing you the returns in this business, okay. The strategy that immediately comes to mind from that is that you can't be directed if a lot of your returns are going to come from one.

What are you going to do, what do you need to do. You have to be as broad as you can in your strategy, that's number one, but you can't do it if you're an entrepreneur. An entrepreneur by design is not broad. And if you don't have trials, you could probably - you can't have 20 trials in a lifetime but collectively society has been benefiting from this army of entrepreneurs. Very few of them manage to buy the big houses around here, I hear real estate, she's telling me is hugely expensive, you see, very few win and then remaining people are like soldiers who fall in battle for the sake of the system, which is why I was calling for a national entrepreneur day and then suddenly it happened by the way, alright, but I didn't get credit for it. It happened on publication - on the pub day of the book, by the way. So the - called National Entrepreneur Day because hey, you know what, we salute fallen soldiers as some - because they are needed for the system, for the collective, they are needed for the system to afford - to prove the system we need soldiers to fall. We should do the same for entrepreneurs because realize how few win and you don't want the other ones to be demoralized, you want to thank them for getting involved in their side of trial and error without having anything but errors all their lives but they are doing it for the sake of the system. And this is what - everybody sees there is something moral about what you're doing if you're trying to improve the system, something moral even if you fail, especially if you fail, you see. And this is what people don't understand.

We bail out - we tend to bail out corporations that are rotten and fragile, okay. We don't bail out entrepreneurs. We should be bailing out entrepreneurs. We should also make it more honorable. The only place - I am honored to be here, the only place on the planet where it's honorable to fail is here. Before that it was used to be guess where? Couple of centuries ago, where? The battlefield. No, no. In entrepreneurship. In entrepreneurship. Sorry? England.

They pulled out of the Industrial Revolution thanks to these aggressive tinkerers, you see. So you have, that was when and now where the problem is look at England, what happened to England. The minute you get rich from tinkering you have the illusion of being able to replicate it through Whitehall and economic policy and Whitehall research policy and this and Minister of Policy and stuff like that. They didn't have that when they pulled up, you see. And the minute they had that, of course, they went into relative decline compared to other places. So you see you have to let the things develop organically on their own and tinker to the max because that's how systems operate. Let me take more questions. Yes, I'll conclude with a question. Yes, go ahead. You mentioned monetary policy a few minutes ago and today we had the meeting of the Fed where they were talking about ending quantitative easing? Ending quantitative easing.

Sorry, he is asking me, he is telling me something not related to this talk but he knew that I'm very interested in the topic which is federal policy today leads - that they are ending quantitative easing. No, I'm not involved in journalism or commenting on events but I am going to talk about monetary policy, okay. We should - the thing is, what the Fed has been doing, the idea of the government, they don't understand antifragility, they don't understand that when you have a crisis you should come out of it better than you were before. You guys had your crisis in California, remember? 2000, you weren't born many, okay. So you came out of it better off than before, no? It cleaned up the system. So you should never let a crisis to waste. Now what happened in Japan and here and in Europe, they had a crisis, now they shoot to establish the system to bring it back to what it was before, without letting what is fragile break and new things come in its place, you see. So the monetary policy aims at preserving the status quo and then also a side-effect is of course to enrich those who were involved in the crisis, alright, in causing the crisis. And of course it's not good to have such, you know, to have very easy money because you don't want people to take money and go gamble with it in the stock market, you want them to go use the money for what you're doing. The real things, the trial and error that you don't get respect for, for losing a little bit all the time.

Other questions? Yes. On a related note then, how would you think about Chapter 11 bankruptcy which essentially grants the original proprietors the ability to keep on doing what they do? What do I think about Chapter 11? I have written two things about the notion of limited liability, okay. The - if it's used, okay, for this trial and error, then it's very good with limited liability. If limited liability is used to transfer your losses to society so you get the bonus, the upside, and society gets the downside then it's not good, you see, and what has happened in the capitalistic system is instead of having incentives and disincentives we have some people who have the incentives and then when they lose money, take banks, they make bonuses when they have good years and then when they have a bad year they transfer it to society, to the tax payer and they keep their bonuses as we saw before. Again remember the two kind of payoff, the payoff where you lose a lot to make small and the other payoff which is what you have here where you lose small to make big, you see. Now those who lose a little bit, who you know lose a little bit to make big are not gaming the system because the tax payer doesn't bail you out. Have you heard of a bailout of any company in California? No. Because you guys - all your big volatility is to the upside, not the downside, you see, but the other ones have their big volatility to the downside and they lose more than their capital and someone has to pay for the losses, ends up being the tax payer. Other questions? Yes. What do you think about the rise of like, so you have all these things to say about the nature of probability and being able to predict things but we also use probabilistic AI a lot and we are using it more and more in every field.

Okay, he is saying that I'm skeptical about the use of probability to predict. And he is telling me that in AI they predict. In Mediocristan you can use probably very well, it works very well. Okay, what's the role of...? Outside Mediocristan when you have things dominated by rare events, okay, these things fall apart and they fall apart ahead - I just put the text because nobody will understand my Black Swan, they would read it and comment and write articles are not even wrong about it. My point is that we have large deviations occur, they are unpredictable, okay, no matter how many PhDs you put on it, they are not predictable. And all the people who relied on predicting rare events have blown up. And this is how actually you can make money on Wall Street, you identify those rely on the probabilities to compute the risk of rare events and make sure they went robust, like Fannie Mae or like others and you can make a buck and celebrate you know being right with these guys. So, I'm saying, but for AI you can apply it for small problems that don't have big tail effects, yes you can definitely apply, but use probabilities for anything for insurance on your house, for insurance - medical insurance, these probability works beautifully in these domains. And in casinos, it's perfect, okay? Yes. Can you comment on the convex function of laws in drug discovery given the fact that the average drug in the U.S.

cost about a billion dollars in 25 years of discovery. So, if you've got any insights on that entity. Yes, when you have a - okay, how did we get to where we are today, you lose small to make big. So, because you have to have a lot of trials to get to destination, okay. If you are what I call teleological in a slide that I can show and things you know where you're going, then you can bypass the trial in air, because you have great scientists and great scientific understanding. And it looks like pharma got to where it is today through accidents, the side-effect of drugs, side-effect of thing and now suddenly they woke up and said okay, now we're going to target results, you see, when, in fact, it's a collective effect of lot of firms trying and those who succeed thought that they succeeded because of their brains, not that they succeeded because of their taken advantage of luck, you see, that's a problem with pharma today. And pharma has more problems in that. And the best you come up with the drug, okay, you have to look at side-effects and probably few other drugs. Today, we have 850,000 authorized drugs, okay, something like that and 100 and some thousands existing drugs, alright. So, every time you've introduced a drug, you got to look at side-effect of patient and you got to look at co side-effects and then you had to look at tri side-effects and all these drug interactions that you had becoming more and more unpredictable.

So, pharma is in trouble in that sense. Plus there is another thing in my book here that I discuss about some systems - sometimes curing people is much easier to do by subtraction, you see, subtraction is much easier, you see the seven rules, all these rules are positive, means do this, do this, do this. It's much - charlatans typically have nothing but positive rules. People who are, you know, scientists or philosophical have negative rules, okay. Don't do this, don't do that, it's much more rigorous actually and they don't have side-effects. So, if instead of curing people by giving them drug every time, we look that subtractive methods, remove things, like for example, remove cigarettes from society, you say it is more effective than anything we're spending on drugs and cumulatively more than anything done since penicillin. Let's say, I don't believe the statistic when I saw it. And in fact, it turned out to be true. If you just remove cigarettes, if you remove corn sugar, okay, you remove by removal. If you remove diabetes, the first thing people do is give people drugs.

If you send them to Siberia, we didn't have the money, put them on 500 calories a day for three months, you come out of it fluent in Russian or conversant in Russian, and it's more effective than any drug initially, alright, but what the protocols you start instead of starving people, because it's a stressor that someone needs, we aren't antifragile to variation if we derive - if we are deprived of these variations we get weaker. So, if you - so people - the first thing they do is try to give you drug instead of removing, alright. Instead of removing food, try to give you something and effectively now epileptics, if you have - if child has an epileptic seizures, the first thing they do is give him drugs, whereas the most effective treatment is removal of all sugars, you see and we know, we've known now for this 70 years, but pharma doesn't make any money removing things from your system, nobody is going to make any money if you stop smoking directly, if you stop smoking, they're not going to sell you something, unless they sell you method to stop smoking, you see. So this is what the problem. There is a gentleman in the back. In fields where it's hard to disentangle luck and ability, such as trading, how do you devise an effective compensation? I believe in something I call skin in the game, okay, skin in the game is defined skin in the game is most moral and effective to remove risks is that nobody should ever put someone else at risk. I don't really care about compensation, okay. I don't really care about ranking, because you can't have a trading competition because someone has a strategy that pays off very rarely, okay. He would lose in the competition, he would lose every battle and win the war, you see. So, I can't really rank traders, but there is one rule I have, I call, skin in the game is that nobody should put others at risk, without having harm to himself, okay.

In other words if you lose money to your clients, you should be exposed to the same risk, that's sort of - it boasts moral and risk management rule. Risk management because in Hammurabi's code, it was simple as the architect builds the house and the house is fragile, but hidden fragilities in a basement, you get the idea when the foundation like in the bank system, banking system they look very stable when they have the cut corners that nobody will see okay to make the bonus and if the house collapses the architect is penalized that was in Hammurabi's code. Actually, he's put to death, if the house collapses and kills the owner of the house. So, this system, okay, is the best, this is the best risk management rule, because as Hammurabi discovered that something they forget today in Washington, the architect or engineer knows a lot more about the risks. He doesn't know a lot about the risks, but he definitely knows a lot more than the inspector, you see, so if you make people eat

their own cooking, you see they are lot better off, okay and someone sent me, read my book and sent me something, a story in Brazil where they discovered that they can lower the rate of helicopter crashes by forcing helicopter engineers randomly to take a ride, a half an hour ride once a month in a helicopter, alright. Now for example something the Romans knew and Victorian knew that you make engineers sleep under the bridge, alright. Okay, so in trading what do you do, so long as whoever is involved in a strategy has losses, small, okay, it doesn't matter, alright has losses, if they can harm others, in other words you have some incentive, but some disincentive then we should be okay. It's when people don't have disincentive when they lose that the system blows up. Yes. Some systems are more prone to errors and mistakes.

Politics today is talked out. You're your theory of antifragility has some implications or suggestions on how politics should move forward? Okay, the idea that I put is very simple. Along the rule, if you look at these rules very simply that you want mistakes to be small and gains to be large, okay. And the mistakes side you want to distribute mistakes then you necessarily need decentralization, you see. The most stable country in the world is Switzerland where nobody knows who the President is, alright. They can tell you that there is Gadaffi is President of this, Assad President - they don't know their own President. The system works well is so decentralized, it's completely bottom up, you see. So, mistakes are small. So, this simple concept prevailing the book, convexity means mistakes are small, okay. Concavity means mistakes are large and rare, you see, and that's simple system.

So, we don't have any more time. I have another lecture, but thank you very much.