

- Demetri Kofinas:** 00:00:00 Today's episode of Hidden Forces is made possible by listeners like you. For more information about this week's episode, or for easy access to related programming, visit our website at HiddenForces.io and subscribe to our free email list. If you want access to overtime segments, episode transcripts and show run-downs full of links and detailed information related to each and every episode, check out our premium subscription, available through the Hidden Forces website or through our Patreon page. And remember, if you listen to the show on your Apple Podcast app, you can give us a review. Each review helps more people find the show and join our amazing community. With that, please enjoy this week's episode.
- Demetri Kofinas:** 00:00:51 In the early days of World War II, the Third Reich's Commander of Submarines, Karl Dönitz, submitted a memorandum to the German Navy advocating for a system of submarine warfare that would devastate Allied supply lines, merchant vessels and warships. For a nation with a second-rate navy, this was asymmetrical warfare at its finest, and Allied losses began to rise rapidly, from 750,000 tons of cargo lost in 1939, to 7.8 million in 1942. Every month, U-boats were sinking ships faster than allies could build them, and the losses kept mounting.
- Demetri Kofinas:** 00:01:36 By early 1943, food supplies to Britain had dwindled to two-thirds of normal levels, less than three months of commercial oil reserves remained. The British were on the verge of defeat. At just the time when all hope seemed lost in the battle for the Atlantic, an American physicist by the name of Alfred Loomis, appointed to assemble and lead a team of the country's best engineers and physicists, presented the army with the first of two timely innovations.
- Demetri Kofinas:** 00:02:09 When mounted on America's B-24 Liberator bombers, these tiny boxes with their microwave antennas could detect the periscopes of surface submarines through daytime cloud cover or fog of night. By the spring of 1943, these long-range bombers, equipped with Loomis's microwave radar and pulsed radio navigation, were fully operational and actively patrolling the Atlantic.
- Demetri Kofinas:** 00:02:37 What ensued was a massacre. In the month of May alone, Allied bombers operating through fog and darkness, and who could now see the once-invisible German submarines lighting up their oscilloscope screens, sank 41 U-boats, nearly one-third of the German commander's total operational fleet, and more in one month than in any of the first three years of the war. Allied shipping losses in 90 days decreased by 95% from 514,000 tons in March to 22,000 in June. The lanes to resupply Europe had

been opened, making way for the ground invasion at Normandy, only a year later.

- Demetri Kofinas:** 00:03:23 The Allies turned what had appeared by all accounts to be an imminent loss into the first great Allied victory of the war, all because a small group of scientists, working out of an anonymous building at MIT, had the crazy idea to use an unproven technology to turn a German hunting ground into a turkey shoot for the Allies, and their microwave-configured, B-24 bombers that were busy lighting up the Atlantic.
- Demetri Kofinas:** 00:03:52 This week on Hidden Forces, Safi Bahcall, loonshots, and how to nurture the crazy ideas that win wars, cure disease, and transform industries.
- Demetri Kofinas:** 00:04:05 Safi Bahcall, welcome to Hidden Forces.
- Safi Bahcall:** 00:04:23 Delighted to be here.
- Demetri Kofinas:** 00:04:25 I am delighted to have you here. I told you your book is phenomenal. I love the pictures, as I said, but I also love the structure of the book. You did such a great job of ... You never lose the reader, you know? It's a complicated subject, so at the end of every chapter, you do this job of just rewinding, and there's so much built-in redundancy into the book, which I found very helpful.
- Safi Bahcall:** 00:04:46 Glad that worked.
- Demetri Kofinas:** 00:04:47 Yeah, it did work, for sure. It did work. So, what's a loonshot? We all know what a moonshot is, right? We've learned...that's entered the popular lexicon.
- Safi Bahcall:** 00:04:56 Sure.
- Demetri Kofinas:** 00:04:56 But what's a loonshot?
- Safi Bahcall:** 00:04:57 A loonshot is a small, crazy idea that everybody writes off and gets dismissed or rejected for years, or sometimes decades, and their champions are called crazy sometimes. And then, very often, those tend to be the most important breakthroughs that change the course of science, business, or history.
- Demetri Kofinas:** 00:05:18 I definitely want to get into those, because that's the best part of the book. The best part of the book is the technologies, and the personalities, and we'll get into that. Why this book? Why

now? How long has this been brewing in your head? What made you write it? And this is your first book, right?

- Safi Bahcall:** 00:05:31 This is my first book.
- Demetri Kofinas:** 00:05:32 It was a loony idea.
- Safi Bahcall:** 00:05:34 It was, because so many people said, "Oh, yeah, physics, business and history, yeah, that's not going to work. Do something different." No, I think it began when I was first appointed a CEO. When I first started a company I was in my early 30s and I read everything I could find about how do you build a great team, how do you become a good leader, and so much out there was culture, culture, culture, culture. The first 10 books were interesting, and then the next 50 were like, "Okay, I think I might have heard it."
- Safi Bahcall:** 00:06:04 And then by the thousandth, you know, you want something. I felt like I wanted something with more hard science. Is there a science of how you organize or design companies that you can really sink your teeth into as opposed to this squishy psychology stuff? That led to structure versus culture.
- Demetri Kofinas:** 00:06:21 That's a point that you made in the book about culture, that it sounds squishy to you. Squishy, or squishy. And that you wanted something that was more scientific. Could you have done this, and we'll get into this a little bit later, because one of the things that I thought about in the book is you rely so much on chemistry and physics and phase transition is such a big part of the book, right? Separating the phases and creating dynamic equilibrium.
- Demetri Kofinas:** 00:06:46 I also thought a lot about information and entropy there, and finding the signal in the noise, and that if you have too much chaos, that feeds into this, if you've got ... Although this is kind of the reverse of what entropy is, but if you were in a case where the electrons are too excited, if it's too gaseous of a phase, how do you ... I'm kind of going all over the place here, but in any case, it's interesting that you picked physics, and we'll get into that, because I think that's an interesting metaphor, transitioning between phases, and how do you take the innovation from the loonshot nursery and bring it out into the world.
- Demetri Kofinas:** 00:07:19 Which, also, I think can get us into the conversation about the mission-driven state, because that comes up first and foremost with Vannevar Bush, right?

Safi Bahcall: 00:07:26 Absolutely.

Demetri Kofinas: 00:07:28 So, let's actually start there, because there are so many stories of Vannevar Bush, Pixar, James Bond, Pan Am, Polavision, my favorite, right? Edwin Land, my favorite of all. And I'll tell you, actually, right off the bat, the ones that I find most interesting are Vannevar Bush and OSRD. I'd love to start there. Pan Am and American Airlines, Bob Crandall and Juan Trippe, right? And of course Edwin Land, my single favorite one. I think he is the quintessential Moses character according to your book, right?

Demetri Kofinas: 00:07:59 And of course, well, we'll get into it, but I just think there's something phenomenal ... Again, we'll get into all this, but the distinction between S-Type and P-Type, but there's something uniquely attractive about P-Type innovators that I wonder, is that in our DNA? And what is that that makes us just fawn over these types of people?

Demetri Kofinas: 00:08:18 But let's start with this incredible figure who we've spoken about before in our episode on Claude Shannon. He, of course, had taken Claude Shannon under his wing at MIT. Claude Shannon completed his study of electrical engineering and relay switches under Vannevar Bush, which he integrated with the work he did in Boolean algebra at Michigan, into what became information theory. So, Vannevar was this enormous figure, had an enormous impact at MIT and academia, but he moved into public life during the course of the war. And you tell this story. Tell us about this story and why Vannevar Bush, and why is this important?

Safi Bahcall: 00:08:58 In some ways, that's the real nucleating event for this book. When I was running a biotech company at the time, this was seven or eight years ago, and it was a public company, and I got a call from a guy who had been a physics professor of mine who I was a TA for in college. He said, "I'm working for President Obama's council of science advisors now and we have a project to think about how we should shape national research, and I wonder if you'd be interested in working with us on this?"

Safi Bahcall: 00:09:28 I said, "Look, I don't know anything about science, or science policy. I got a day job running a business." He's like, "That's perfect. We want someone biomedical, public company. Sounds great. Business guy. We have a lot of academics. Great." So, I flew down and the first day they said, "Your job for President Obama is to write the next generation of the Vannevar Bush report." And I figured I must be in the wrong room, because I have no idea who Vannevar Bush. Credit to you guys. You guys-

Demetri Kofinas: 00:09:57 That's remarkable. Yeah. You said that either in the book or an interview did-

Safi Bahcall: 00:10:02 And I had no idea who he was. It's interesting. I gave a talk yesterday, very educated, Ivy League elite crowd. Even probably average age was 50, so it was an older crowd. Asked how many people know who Vannevar Bush? And maybe 10% which is kind of amazing given the influence he's had.

Demetri Kofinas: 00:10:19 Absolutely.

Safi Bahcall: 00:10:19 So I had three months, and we had three months to write this report, so I did, obviously, a lot of reading, and then I discovered he was this engineer who was a brilliant engineer, invented the first analog computer. He also happened to be a brilliant entrepreneur. He started the company now known as Raytheon. And he worked with the military, and came up with critical inventions for the military.

Safi Bahcall: 00:10:42 He was fluent in these three worlds, something you don't really see very often today. People are usually specialized as A, B or C. But he was equally fluent in any of these worlds, and he was kind of an organizational genius. He was a Dean of Engineering at MIT by the mid-1930s, and he'd built MIT essentially into the leading technology university in the world.

Safi Bahcall: 00:11:07 Around that time, he started to hear from emigres in the 1930s, especially in the late 1930s, who were fleeing Hitler's Germany, all about the science and technology going on in Germany. He was growing increasingly concerned because he knew the US military and knew that they lagged far behind.

Safi Bahcall: 00:11:25 In 1938, he decided to quit his job. The president of MIT said, "Listen," you know, "We need you so desperately here that if you reverse your decision and agree to stay I'll resign and make you president." He said, "No, we have a national crisis. We're going to be at war, and the nation's defense will be led from Washington." So he quit his job, moved to Washington, and talked his way into a 10-minute meeting with FDR.

Safi Bahcall: 00:11:52 He told FDR, "We're going to lose this war. It's going to be a technology-driven war, and we're going to lose, because the US military is not going to be able to catch up in time." And if you rewind the tape, erase in your mind everything we know now, in retrospect, but try to imagine you're in 1939, Germans had these things called U-boats, these submarines that were created

to strangle the Atlantic, which they did for the first four years. They cut off-

- Demetri Kofinas:** 00:12:20 Most people don't know the history of the U-boat, the war of the Atlantic with the submarines.
- Safi Bahcall:** 00:12:24 Absolutely. And that was the crucial turning point of the war because, what most people don't realize, is that England got down to three months of oil. Part of that is this misleading, false stories in either movies ... There's this Benedict Cumberbatch movie which was an awesome movie, about code-breaking and World War II.
- Demetri Kofinas:** 00:12:44 I haven't seen that.
- Safi Bahcall:** 00:12:45 It was called The Imagination Game, something like that-
- Demetri Kofinas:** 00:12:47 Oh, right, the one with Alan Turing.
- Safi Bahcall:** 00:12:49 Yes. He plays Alan Turing. That's right. Keira Knightley, who's also awesome-
- Demetri Kofinas:** 00:12:53 No, a great movie, great movie.
- Safi Bahcall:** 00:12:54 Great movie. But unfortunately, it's based on a wrong story. Code-breaking played almost no role in the Battle of the Atlantic. What is left out of that story, and many stories, is that the German intelligence, B-Dienst, yes, it is true that Alan Turing, played by Benedict Cumberbatch, did in fact crack the German Enigma codes, which was sort of a help for a couple months in this year and a couple months in that year, but left out of the movie and most popular stories is that B-Dienst, the German intelligence, had 1,000 people cracking British codes, and they'd been reading almost every British transcript. They had cracked the codes from the beginning of the war all the way to 1943. So it made no difference, because they would know the movements of the fleet.
- Safi Bahcall:** 00:13:36 So, Bush was correct. We were far behind. Not only that, it was two German scientists who discovered this little thing called nuclear fission. Splitting the atom, which put Hitler within reach of the most dangerous weapon ever invented by man, and that was early 1939. So, Bush understood, quit, talks to FDR, and says, "I'm not going to be able to change the culture of the military, and not only that, I shouldn't try. You need the military to have the tight discipline and the organization to build millions of guns and ships and planes. We need the military's systems to

move millions of soldiers in battle. But we also need a group working on radical innovations, and the two things can't exist at the same time."

- Demetri Kofinas:** 00:14:24 Phase separation.
- Safi Bahcall:** 00:14:25 Exactly. Intuitively, Bush understood that those two things are like phases of organization, just like liquid and solid are phases of matter. And you can't be in two phases at the same time, and you shouldn't even try. You can't be water and liquid at the same time. It makes no sense. So you can't be radically innovative, and have incredible operational execution at the same time with the same people.
- Safi Bahcall:** 00:14:50 Just as an example, those groups speak different languages. Words that you think are the same. Take the word risk. That's an English word. We think we know what it means. Now, to a soldier who's responsible for building ... And this applies in the business world, marketing, manufacturing, but just to go back, to a soldier is responsible for manufacturing planes, or assembling tanks, or building guns, risk is a bad word. On a battlefield, risk is a bad word.
- Demetri Kofinas:** 00:15:17 You want certainty.
- Safi Bahcall:** 00:15:19 You want high quality, high accuracy. You don't want to launch 10 planes in the sky and see which eight will fall down. "Oh, the two that are left are good." No. That's not how ... You want 99.9999. You know? To artists, risk is a good word.
- Demetri Kofinas:** 00:15:37 Opportunity.
- Safi Bahcall:** 00:15:38 Exactly. Imagine saying to an artist, "You really got the risk down there in your work." That's a bad thing.
- Demetri Kofinas:** 00:15:45 That's funny.
- Safi Bahcall:** 00:15:45 Now imagine saying to a manufacturing, soldier guy, "You really got the risk down in your work." That's a great thing. You want two different groups. And that's what Bush created with FDR. Two different groups, the artists and the soldiers.
- Demetri Kofinas:** 00:15:58 That also reminds me of something. I'm going to throw out a few things here. Some we'll go back to, some will get lost in the heap. But this thing about risk, we did an episode with Bill Janeway on his book, The Innovation Economy, which dealt a lot with this notion of the mission-driven state and the role that the

state has played in the early phases of the innovation cycle, where risk is fraught and where private companies and rational actors won't enter, because the risk is too high.

- Demetri Kofinas:** 00:16:27 And of course, the war, also this is another fascinating aspect of what your book covers in this particular section, which is that there was a tremendous amount of urgency and focus that the war created. You mentioned the role of technology. Churchill called that the secret war.
- Safi Bahcall:** 00:16:40 That's right.
- Demetri Kofinas:** 00:16:41 And we were talking about the U-boats. I forget how many the United States lost in the early phase of the war, before we deployed radar, which is just fascinating, another point, right? That radar had been discovered ... This I did not know ... In the early 1900s.
- Safi Bahcall:** 00:16:55 Again, the popular story and popular history about radar is that, oh, it was Watson-Watt in the UK in 1935, you know, was asked to examine by the air ministry there this popular claims of building a death ray, and he said, "Well, I don't think a death ray's going to work, but maybe we can bounce light." And that led to radar in England. It completely misses the fact that there was a small group inside the Naval Research Lab a decade earlier that had discovered the principles of radar and had been suggesting it within the US military, and just had those ideas crushed. Why? They were a loonshot.
- Demetri Kofinas:** 00:17:30 The implication, of course, being that we would have had radar in Pearl Harbor when the Japanese attacked. I mean, if we had potentially invested in it and followed up on it, right? If, for example, the organizational modus operandi had been instituted where you had this type of phase separation, you had part of the military, or part of a public-funded organization that was responsible for generated loonshots, you'd have seeded something like this. Was the United States the first country to deploy microwave radar?
- Safi Bahcall:** 00:17:57 It was. The way it developed was that radar did get neglected, in the US, for almost 15 years from the first principles in using it in the ocean, then using it to detect planes, but eventually a person who was completely lost to almost every major history of this is a guy named Commander Deak Parsons, who was in the navy, and was just assigned after some tour of duty, "Hey, you seem to like this physics stuff, instead of reading Playboy or whatever you read Reviews of Modern Physics in your spare

time, so why don't you go talk to these crazy people working in this naval research lab?"

- Safi Bahcall:** 00:18:33 So, he went over there and he saw that they had this device for detecting enemy planes, and he was like, "Wait, what? You can see planes from far away in the dark and through fog? Are you kidding me? This is going to change warfare." And they were like, "Really? Yeah, we thought it could be pretty good, but everybody said no." So, then he went around and pounded the table and he got it. He eventually was responsible for turning the US around and getting the US army and navy and military behind radar, and getting it just ready by 1940, 1941. It was just deployed within about a month or two before the Pearl Harbor attack. He was the one who said if we had been one year earlier, even six months earlier, we could have had radar in time for Pearl Harbor.
- Demetri Kofinas:** 00:19:20 And microwave radar enabled, not just the protection of aircraft carriers, but also the ability to bomb U-boats from planes which had these radars mounted on them, right?
- Safi Bahcall:** 00:19:30 Right.
- Demetri Kofinas:** 00:19:31 Remarkable.
- Safi Bahcall:** 00:19:32 And, you know, so radar is just bouncing light waves, and seeing what comes back. People can be familiar with sonar, that's bouncing sound waves. So, you know, whales, dolphins, bat, all bounce. Radar is bouncing light waves. Light comes in different frequencies, so radio is big, radio's a big wavelength. What Britain built was long wavelength radio.
- Demetri Kofinas:** 00:19:53 To protect London and the UK during the aerial bombings by the German-
- Safi Bahcall:** 00:19:57 Exactly, and that's what turned around the Battle of Britain, and allowed Britain to actually be the first loss. It was the first loss for Nazi Germany in Western Europe in 1940. But radio wavelengths are very big, because the size of the wavelength determines the size of the antenna. Radio is very big, microwave is very small, which is why you can fit a microwave oven in your kitchen but you can't put a radio antenna in your kitchen.
- Safi Bahcall:** 00:20:26 Once the US, and Vannevar Bush's team had developed microwave radar, you could put them on planes, you could put them on ships, and as soon as you did that, the pilots were able

to see the U-boats. It was like they all lit up like these little dots. They'd been invisible, and they were sinking ships left, right, left, right, left right. It went from half a million tons, to one million tons, to two million, to four million, to eight million tons by 1942, where it was three, four years into the war, and that was it. Hitler and Churchill and Roosevelt all knew that if they succeeded, England was running out of oil, and that would be the end. It would cut off all the supply lines, and that would be the end of Western Europe.

- Safi Bahcall:** 00:21:09 But, right around March 1943, these long-range bombers started patrolling the Atlantic with this microwave radar. All of a sudden, within the course of four weeks, four weeks, from March 1943 to mid-April 1943, they sunk one-third.
- Demetri Kofinas:** 00:21:29 Remarkable.
- Safi Bahcall:** 00:21:29 The entire German U-boat fleet. Eight weeks later, the German admiral, the head of the German navy, sent a message to all of the U-boats in the Atlantic, saying, "We have lost the Battle of the Atlantic. Withdraw."
- Demetri Kofinas:** 00:21:46 Amazing.
- Safi Bahcall:** 00:21:47 And the lanes were cleared. The lanes were cleared to resupply Europe, to resupply England. The lanes were cleared, ultimately, for an invasion of Europe.
- Demetri Kofinas:** 00:21:55 Phenomenal.
- Safi Bahcall:** 00:21:56 And that really was, in many ways, the turning point of the European war.
- Demetri Kofinas:** 00:22:00 Incredible how competition in the innovation cycle can impact the outcome of something so epic as the war. Of course, the atom bomb is the primary example of that, but isn't the only one, as we've been discussing.
- Demetri Kofinas:** 00:22:15 Another thing I want to highlight, and we'll move past it because there's so much to talk about, but this point about the transatlantic relationship and partnership. There was also a tremendous amount of collaboration that was born out of this, right? And Vannevar played no small part in any of that, right? Both within the United States and outside.
- Safi Bahcall:** 00:22:33 Yeah. I think what was interesting about studying what he did, and how he did it, and why he did it, is he had a very different

mindset than you see today. In fact, today you see a lot of people following what is actually, in many ways, a dangerous mindset, of this image, this myth of this Moses on the mountain, leading his troops, pointing a staff at the chosen loonshot, the chosen project that's going to be the next great thing, and that's not what the really great leaders do. It's not even the ones that people think did that, like Steve Jobs.

- Safi Bahcall:** 00:23:09 That's not really how they succeeded, or why they succeeded, when you peel back the layers. They led much more like careful gardeners. They managed the touch and balance between these factory for baby ideas, make sure they transfer them from the artist to the soldiers, not too early, not too late, make sure the feedback came back the other way, and they manage the cycle and the transfer, not the technology.
- Demetri Kofinas:** 00:23:35 This is also like another interesting point that I learned when I was studying for an episode that never aired on astrobiology, is that there are certain types of environment that we consider to be habitable. You know, Goldilocks zones or systems. And it is generally believed that life emerged out of a primordial soup, right? Which couldn't be too liquidy, but it couldn't be too solid. It had to be just right. That's the dynamic equilibrium, right? You're switching between, let's say in this case, a liquid and a solid to form life.
- Safi Bahcall:** 00:24:04 That's exactly right. If you think of a bathtub full of water, if you're at 33 degrees, 34 degrees, it's going to be completely fluid, and if you go below 31 degrees, it's going to freeze. What you need, if you want both phases, both solid and liquid, is to live right on the edge. And if you want a truly innovative company, you need artist and soldiers right on the edge. Not too much, not too much soldier, not too much artist. Neither one dominating the other side. They have to be in balanced equilibrium, with ideas traveling back and forth the two, and neither one dominating the other. That's very tricky. That requires very sophisticated and very different mindset from a manager, or a leader.
- Demetri Kofinas:** 00:24:47 In the interest of time, I want to probably move on to Pan Am, because it's such a sexy story. Probably one of the sexiest companies on Earth. Pan Am and American Airlines, Juan Trippe versus Bob Crandall. The S-Type versus the P-Type. Innovation and just a great story.
- Demetri Kofinas:** 00:25:04 Another thing I just want to highlight again around this point about the mission-driven state, companies like Genentech, which you discuss in the book, you didn't discuss Netscape. I

don't know if you did, but both of these companies, and others, benefit tremendously from publicly-funded research. And I just want to mention that because it's something that it's come up a lot in some of the episodes that I've done recently, and I really just want to highlight it, because this book brings that home. So much of the work that was done ... Also at Bell Labs. Theodore Vail, right? Vail and Bush are at the top right quadrant of your ... So, what is this here? This four-box thing?

Safi Bahcall: 00:25:38 Right. It goes to this idea of life on the edge. If you want to build a team or a company or a group that can sustainably innovate over a very long time and long period, you need to maintain this delicate balance that you were talking about. You can think of that, in order to do that, you need to get two things right. Phase separation and dynamic equilibrium.

Safi Bahcall: 00:26:04 They sound like fancy terms, but it's really a pretty simple idea. Phase separation just means you separate your artists and your soldiers. You create different homes for them. Different tools. The things that motivate artists are totally different than the things that motivate soldiers. Artists, you want to ask them about their design, grill them about their design, their aesthetics, their choice. Soldiers, you want to talk to them about how are you on time, on budget, on specific, what's your error rate?

Safi Bahcall: 00:26:31 As an example, let's think about Apple today. You have Jony Ive, one of the great product designers, artists. You have Tim Cook ... Sorry, this is Apple a few years ago.

Demetri Kofinas: 00:26:42 Mm-hmm (affirmative). Version Two.

Safi Bahcall: 00:26:42 Right. Just before Steve Jobs passed away and Tim Cook took over, he had his artists and his soldiers. Jony Ive. Tim Cook was known as Attila the Hun of Inventory when he was at Compaq. He was a general. Now, so when Steve Jobs is talking to Jony Ive, he's not talking about, "What's your six-sigma error rate on production of these?" No. He's talking about the beauty and the aesthetics of the product, and the user experience.

Safi Bahcall: 00:27:08 Now, when he goes to Tim Cook, he's not talking about, "Well, let's talk about the beauty and aesthetics of this product." He's talking about, "What's our manufacturing supply look like? How can we get the margins down?" Et cetera. So, if you're not aware or mindful of who you're talking to, and which hat you need to be wearing, you're going to screw it up. Imagine talking to Jony Ive about, "So, let me tell you, can you give me the reports on the manufacturing supply line?" He's like, "What are

you talking about?" Imagine asking your Tim Cook about, "Well, do you think it should have rounded corners or sharp corners?" And he's like, "What are you talking-"

- Demetri Kofinas:** 00:27:44 Tim probably has an opinion on that. Everyone has an artistic opinion.
- Safi Bahcall:** 00:27:47 Right.
- Demetri Kofinas:** 00:27:48 It's just someone's opinion is more important than other. I hope we get into that part, because Apple's a unique example that you have in the book, because you've got, basically, Steve Jobs' Version One which was Apple II versus the LISA Group, right? Where he berated all the Apple II engineers and eventually Wozniak resigned, and that was a whole catastrophe. And then the Version Two where he had learned so much and so much had changed. I think that's a fascinating one.
- Demetri Kofinas:** 00:28:11 But, let's get into the distinction between S-Type and P-Type innovations, and that'll be a way of getting at the Pan Am and American Airlines. What is the distinction between these two?
- Safi Bahcall:** 00:28:21 So, by P-Type I just mean something very similar. It's a product or a technology that everybody says won't work. Could be the telephone, it could be the transistor, it could be the personal computers, could be digital cameras, or in the case of airline industry, jet engines.
- Safi Bahcall:** 00:28:40 S-Type is a small change in strategy that everybody says can't work, or won't matter even if you do it. For example, Sam Walton put his stores in rural America, and everybody said, "Well, if you're going to open a retail store, obviously you should do it in the city where you have the most number of people. What are you thinking? That's crazy." So, he put it in rural America. Actually, he didn't have some conscious design, "I'm going to go disrupt the industry." His wife didn't want to live in a big city, and he liked quail hunting.
- Safi Bahcall:** 00:29:08 So he said, you know, "There's one region in the middle of America where there's four states that border on each other, a little point, and each state has a different season for quail hunting, so let me locate in Bentonville, north-west Arkansas because then I can do quail hunting." And it turns out it exploded. Now, he didn't invent selling stuff cheaply. He didn't invent retail. He just moved his store somewhere. There was no new technology. So, that's an S-Type change. No new technology. It's a small change in strategy.

Demetri Kofinas: 00:29:37 Can I interrupt you there just to highlight that point? The Wanamakers, the Strausses, they were all in New York. They were in these big cities. But I think this is interesting, also, metaphorically speaking, because is it true, do I understand this correctly, S-Type innovations are also about metaphorically going where no one else is, right? If everyone's already there, that market's developed.

Safi Bahcall: 00:29:56 That's right.

Demetri Kofinas: 00:29:57 The opportunity is where no one else is, right? And so, in a sense, Sam Walton is a paradigmatic example of what that would be.

Safi Bahcall: 00:30:04 Right. And, you know, that's obviously an older example, and in retail, but in technology, you can think about it. Say, Google. There have been a ton of search engines before. Did they invent search? Obviously not. What they came up with is they said, "Hey, we have a wacky idea. Let's prioritize search results by how many people link to the page." That was the original. And then that just blew up. That turned out to be an incredibly good strategy for prioritizing search results.

Safi Bahcall: 00:30:33 So, these small changes in strategy, let's say we can go back to even Steve Jobs was a good example of someone who started as a P-Type innovator, a product innovator, who saw himself as a great product innovator, and later in life learned ... And he rejected all these strategy type changes that ended up being very detrimental, until his second time at Apple.

Safi Bahcall: 00:30:57 And here was a strategy idea. In the middle of music piracy, this was 15 years ago, back when everyone was copying, Napster, he said, "I have an idea. We're going to release this phone. Let's sell songs online. And by the way we're not going to sell albums. We're going to sell them for 99 cents per song." And people were like, "That might be the stupidest idea I've ever heard, for the following reasons. A, everybody can steal it, so that's obviously dumb. No one's going to pay for it. B, when they pay for stuff, people are only doing radio." They were downloading radio monthly. "So, no one's going to pay per song. Are you crazy?" Well, two days after he launched it, seven million downloads.

Demetri Kofinas: 00:31:39 Was there no digital rights management software, really, an ecosystem of DRM at the time?

Safi Bahcall: 00:31:43 He had worked something out. So, he was one of the first people who got-

Demetri Kofinas: 00:31:46 Really?

Safi Bahcall: 00:31:46 He was a great deal-maker. So he was able to get that. But those are the small changes in strategy. Everybody knew how to sell stuff online. That was a tweak on strategy, not a tweak on product.

Demetri Kofinas: 00:31:58 No, he was remarkable. So, let's go back to Pan Am and American, because we could start with the S-Type innovation that Bob Crandall made, which I think is very interesting. Or we could go back to P-Type, with JT. So, how do you want to start to tell the story? Because this is just wonderful, and I just want you to retell it.

Safi Bahcall: 00:32:14 It's a great example. Two people, two different airlines, two different ways of thinking about the world, with a really important lesson for leaders and managers today, because almost everyone is blind to one type or another. They have a blind spot. And if you're not aware of your blind spot, it'll come like a bullet to your head and take you out, which is essentially what happened to Juan Trippe.

Safi Bahcall: 00:32:38 For those people who don't know the story, which is, I think, 99.99% of people-

Demetri Kofinas: 00:32:41 I didn't know the story, and it's just wonderful.

Safi Bahcall: 00:32:43 And I didn't know the story. So, Juan Trippe began life as a young guy, he was a pilot and he loved engines and he loved planes and he would take them apart. He was a true product person. And he built Pan Am by always finding the next product innovation, finding the next bigger, better engine, the next radio navigation was one time, and he grew Pan Am from a tiny, little island hopper, two-seater plane, to the dominant airline in the world. Not only that, the dominant brand in the world. It was number two most recognized brand in the world after Coca-Cola, if you can imagine.

Safi Bahcall: 00:33:20 Pan Am pilots, they were like astronauts. They were rock stars. People would get their autograph. The stewardesses ... I mean, ABC just made a movie about Pan Am stewardesses. The Beatles would fly Pan Am. James Bond in the movies would fly Pan Am. The Stanley Kubrick 2001 movie had a-

Demetri Kofinas: 00:33:36 It was an experience, flying Pan Am.

Safi Bahcall: 00:33:38 Yeah. And it was a whole ... There's nothing like that today.

Demetri Kofinas: 00:33:41 Celebrity culture.

Safi Bahcall: 00:33:43 It's hard to imagine that there's any brand like that today. It just dominated. That was because he created the jet age, because jet engines, it was an idea developed by Robert Goddard, and it was ridiculed in the US, but the German scientists picked it up and developed it, and then he found it and brought it back to the US. But then it had a bunch of problems. There was some early British planes that flew jet engines, and they had some crashes. So, everybody said, "This is never going to work." We had these crashes in England, and these things are too expensive. And you had all these agencies and analysts, the RAND Corporation, this big engineering ... wrote this long report, like PhD thesis, "It will never work. You can never make it economic. The physics of it and the economics of it. It is absolutely impossible any plane will ever fly."

Safi Bahcall: 00:34:32 So, every airline CEO at the time said, "We will not be using jet engines," except for one. Juan Trippe. He said, "Really? I don't think so. I think there was some other problems going here." So he figured out a way to get the airline manufacturers behind him, and to make what became the Boeing 707, one of the first jet commercial airliners.

Safi Bahcall: 00:34:59 That launched the jet age. It really brought the globe together. You could now, anyone could fly, middle class could fly, from the Old World to the New World, from the US to China, and it just brought the globe together. It was a great time, because the globe shrank.

Demetri Kofinas: 00:35:17 And over the weather. It transformed the quality of air travel, not just the time.

Safi Bahcall: 00:35:22 Absolutely.

Demetri Kofinas: 00:35:23 It was scary as shit flying under the clouds, you know?

Safi Bahcall: 00:35:25 Exactly. Exactly. It's hard to imagine today because we're so interconnected and you could Tweet somebody and they respond five seconds later from halfway across the globe, but back then, obviously, you couldn't do that, and this reunited family. So he transformed the planet with these products, and then he started focusing, like, in fact, so many in Silicon Valley,

or so many companies today do, product, product, product. That worked for me. Always finding bigger, faster, better. Bigger, faster, better. Let's build a bigger, faster, better computer, or a bigger, faster engine, or this, this. Product, product.

- Safi Bahcall:** 00:35:58 So, he said, you know, "You've got a Boeing, let's build the 727. Let's build the 737. Let's build the next one. Bigger, faster, better. More seats. Faster. More seats. Bigger. Faster." Meanwhile, you had guys on much less glamorous stuff working on things that didn't sound quite as sexy. They were small changes in strategy, like Bob Crandall at American Airlines, doing things like, I don't know, hub and spoke. Is that sexy? Not really.
- Demetri Kofinas:** 00:36:23 No.
- Safi Bahcall:** 00:36:23 But you know what it did? It brought cost down. It made the airlines much more feasible. He did fast turnaround times. Was that sexy? Not particularly, but you know what? It was a good business strategy. Invented frequent flyer miles. Is that something to be on the cover of Time Magazine, this guy invents frequent flyer miles? No, but you know what? It worked. Now we understand, with behavioral economics, why people get so attached, and once they get a little card that says they have two little ice cream lollipops or whatever on them, they go back for more.
- Demetri Kofinas:** 00:36:55 Let's talk about that, because that was a huge innovation in terms of background systems, itinerary, right? I don't know what the official name of the software was called, but basically the database managing all that. And that created, of course, the frequent flyer miles. Also, give us an explanation about the role of deregulation in the industry, and how that really put those types of pressures for S-Type innovations into the industry, and of course, Pan Am was not well-suited for it, because they were innovating on product in a highly regulated market, and then the market deregulated. So, you needed to have something like a Bob Crandall come-around, and make S-Type innovations.
- Safi Bahcall:** 00:37:34 Right. You mentioned the reservations. That's the Sabre Reservation System that was invented by ... So, this another Sam Walton crazy idea, this technology. He just said every airline had their own reservation system, and he said, "I have this wacky idea. Why don't I give my reservation system to every travel agent in the United States?"
- Demetri Kofinas:** 00:37:54 It's like Android's operating system.

- Safi Bahcall:** 00:37:56 And people said, "You can't do that." And he was like, "Watch me." And he did. And then they were like, "Oh, we get this little box for free? Cool. Okay. Let's use it." And the other airlines went, "No, no, no, that's not fair. You're using American systems, so of course they're going to have the American logo there." And American was like, "Well, we just did." And you know what that happened? Their bookings went way up and the other bookings went way down.
- Safi Bahcall:** 00:38:17 So, all of these were S-Type ideas. You asked about why did it matter. Well, while Trippe was focusing on product, product, product, Crandall was focusing on the small, subtle shifts in strategy that just kept making the airline just a better business. More solid base, lower cost. What happened was airline deregulation hit, and when airline deregulation hit, all these little, small planes started competing, and all these costs started going down, and Pan Am was stuck with the 747. They just invested millions, hundreds of millions, in this thing called the 747 Jet Airline, and what happens is they started flying these big jumbo jets full of empty seats. And their costs just killed them. It just crippled them.
- Safi Bahcall:** 00:39:06 Meanwhile, Crandall using the small shift in strategy, hub and spoke that made it a tighter, faster, leaner business model. So, American Airlines was the only major carrier to survive airline deregulation without going bankrupt for the next 10, 15 years or so. So, that's why being aware of your blind spot ... Trippe was a brilliant innovator, but he wasn't aware of his blind spot. He wasn't paying attention to the small changes in strategy.
- Safi Bahcall:** 00:39:36 Being aware of those things, if you can understand and master both types, you can become unstoppable.
- Demetri Kofinas:** 00:39:44 Yeah. You know, one other thing, I might be mistaken here, but we did an episode on philosophical mathematics, and I think I learned, in preparing for that episode, that imaginary numbers, which were in the field of pure mathematics, ended up being actually very useful for jet propulsion technology.
- Demetri Kofinas:** 00:40:02 I don't know if that's entirely right, but if it is, that's another really good example, because it's some place where you're doing something totally irrelevant to any sort of practical use case, and then you pull from it, and you end up using it. It's not exactly in the vein of what you discussed, but just kind of came to me.
- Demetri Kofinas:** 00:40:17 All right, so let's go to my favorite. My favorite Moses character here, right? Which is Edwin Land. First of all, how do you feel

about Edwin Land? How does he fit? Because for me he's my favorite, and Juan Trippe, just virtue of the fact that he ran Pan Am, and who doesn't like planes and jets and fancy stuff like that? But Edwin Land was my favorite.

- Safi Bahcall:** 00:40:37 Tell me why.
- Demetri Kofinas:** 00:40:38 I loved him because, first of all, I'm perplexed by the digital, satellite issue with Nixon, and we'll get into that. And that's perplexing to me. I just love it, how he was so at the vanguard of innovation, and just how ballsy his innovations were. Polavision, you know, for its time ... In fact, this might be a good time to quote a giant paragraph from your book. I've never quoted something this large. I hope it goes well. But I wanted to pull it out, because I think it highlights what I loved about him, and I think it'll help the audience understand it. So, let me just quote that now.
- Demetri Kofinas:** 00:41:11 "At the 1977 Polaroid shareholders meeting in Needham, Massachusetts, surrounded by mimes and dancers, in a performance that a Wall Street Journal reporter wrote deserved an Academy Award, Land introduced the world to Polavision, announcing, "The first public demonstration of a new science, a new art, and a new industry." A long-haired dancer in a white sailor suit with red hat and scarf emerged on stage and gradually began dancing. Land grabbed a small, elegant movie camera, 24 ounces, about the size of a hardcover book, by its angled grip and began to film. After about a minute, he popped out a cassette and inserted it into a rectangular box with a 12-inch screen at one end, called the Polavision Player. The Player simultaneously rewound and developed the film. 90 seconds later, the dancer appeared on the screen."
- Demetri Kofinas:** 00:42:06 "You have to pause to appreciate this even today, in the 21st century. Processing an entire film negative, thousands of images, inside a consumer, tabletop device, without error, while it rewinds in 90 seconds. Technology Magazine raved, "The company that seems to specialize in turning impossible concepts into hardware has done it again.""
- Demetri Kofinas:** 00:42:30 So, that quote from your entire paragraph there, but particularly that last quote from Technology Magazine, right? I mean, that's why I love Edwin Land, because he had a company that specialized in turning impossible concepts into hardware. What a phenomenal thing. And yet, no one, including myself, had even heard of Polavision.

Safi Bahcall: 00:42:51 Absolutely. It's a perfect example of why you need to watch your blind side. He was absolutely an innovative genius, and what is, I think, so remarkable about him is that he was not only the engineer and the designer and the inventor of so many products and ideas, probably three or four of them, as other scientists and engineers have noted, three or four of them could have been worthy of a Nobel prize. Things of that caliber have won Nobel prizes. So he was doing that while also building what was essentially the most beloved consumer company of its day. Rabid fans. While, he was also putting on Academy Award-winning shows for investor, and he was doing all of those things.

Safi Bahcall: 00:43:42 There are very few leaders today who could operate at that level, and he had an incredible work ethic, an incredible approach to life. He was a very inspiring guy in many ways. He was very serious, and passionate about science. He really cared about experimenting. He said, "It's not a good day unless I've done an experiment."

Demetri Kofinas: 00:44:07 What a nerd.

Safi Bahcall: 00:44:08 You know, there's something just kind of awesome about that. And he would do experiments with everything, and he would teach his wife, and teach his workers, on just random things in the kitchen or in taxi cabs. He'd drive people nuts. But he just said, "It's not a good day unless I've done at least one experiment." That's an awesome attitude to go through life. But he missed his blind spot.

Demetri Kofinas: 00:44:30 So how the hell did this happen? Right? It just feels so incredible that this actually occurred. Right? So, tell the story of how Land was at the vanguard of digital photography. That he recommended it to the president of the United States, who deployed it in satellite systems in satellite imaging technology, to help win the Cold War.

Demetri Kofinas: 00:44:55 And yet, in his own company, not only did he not deploy it but he went down this obviously foolish path of putting in hundreds of millions of dollars to develop Polavision, which basically ... It didn't bankrupt the company, but it sent it, certainly, on its way to financial failure.

Safi Bahcall: 00:45:11 Yeah. It's almost a perfect example of what I call the Moses Trap, when you are that good, when you had so many successes with product, product, product, from instant photography, which was hailed. Nobody could ever even imagine doing that. That in and of itself was worthy of a Nobel prize. All the things

that he invented, almost single-handedly ... Well, he had a team working with him by the point of that invention, but incredible ideas, incredible technology, almost a miracle, in retrospect, of technology, and then color. Instant color, which required inventing new molecules.

- Safi Bahcall:** 00:45:47 So, all this stuff that he invented, you get into this cycle of product. A better product is what builds a company. More product. Better, faster, better. So, I make better products, people will buy more cameras, they'll buy more film, and that's how we make money. More film, more cameras, better product, that founds more innovation. So, you get in that cycle.
- Demetri Kofinas:** 00:46:08 Innovate to death.
- Safi Bahcall:** 00:46:10 But product-type innovations. So, the Moses Trap happens when you have two conditions. One, you have these blinders on for product, product, product, and two, your decision-making is through a Moses on the top of the mountain who picks the holy loonshot. And Edwin Land, in Polaroid, was certainly the Moses on the top of the mountain. He said, "We're going to do this product, but not that one." Polavision for example, which as you said, cost hundreds of millions of dollars, and within weeks of launching it, sold nothing. Because Betamax was ready. The other VHS tapes were-
- Demetri Kofinas:** 00:46:48 It cost a fortune.
- Safi Bahcall:** 00:46:49 It was expensive. It was incredible technology, but just the alternatives out there were much less expensive, and customers didn't really want to pay for it. So, the Moses Trap happens when you have someone who's focused on product, product, product, product, who's had a lot of success and that cycle keeps going and building and building and building, and he's a Moses on top of the mountain.
- Safi Bahcall:** 00:47:08 When you have those two things combined, you get the Moses Trap, and eventually something will happen. There'll be a small change in strategy, which is very important. And that's exactly what happened. So digital ... There is this wrong history about Polaroid, that Edwin Land was focused on instant print, with these cameras, and then digital appeared and surprised him. But that's not what really happened. That was one of the interesting things in doing the research for this book, is that all the formerly classified documents got declassified, and it turns out he was an advisor to three, four presidents.

Demetri Kofinas:	00:47:43	Going all the way back to Ike.
Safi Bahcall:	00:47:44	Exactly. And he was one of the top people involved in the National Science Advisory boards. And he was aware of digital technology before Sony even heard about the idea, before Canon, before Kodak-
Demetri Kofinas:	00:47:58	This guy's a super nerd. This guy was at the vanguard. At the vanguard.
Safi Bahcall:	00:48:02	He was in the lab where the idea was invented within months. He knew every aspect. And not only did he understand it and know about it and hear about it before every digital camera manufacturer, later, in retrospect, who invented it, he recommended it to the president of the United States for spy satellites. Again, this was all classified, recently declassified. He was the one pounding the table to use digital technology.
Demetri Kofinas:	00:48:26	What was the military, and what was the other side, advocating for?
Safi Bahcall:	00:48:29	It was Edwin Land versus the US Military. God, it was a giant lineup of cabinet members and generals all saying, "Well, this digital technology thing, it's just a fad. It'll never work. We should really just, in our satellite space, or we're spying on Soviet Russia, what we should do is just take pictures and then use a scanning machine, and then try to fax that back down," or whatever.
Safi Bahcall:	00:48:53	It was one guy, it was Edwin Land standing up to them and saying, "No, we should use digital. It'll work much better, and this is why."
Demetri Kofinas:	00:49:02	They were saying, "It's too risky. It's too risky. It's too uncertain."
Safi Bahcall:	00:49:04	It's too ... Exactly.
Demetri Kofinas:	00:49:05	Explain, though, how ridiculous this is when we think about it today, that they were going to take a film picture, and then scan it into a digital file and send it, beam it down to the United States.
Safi Bahcall:	00:49:15	Right, and that was a rocket procedure. In fact, even before then what they were doing is they were taking normal analog pictures, and then taking those canisters and ejecting them out of the satellite with a parachute, and then having planes fly and

pick up the parachute. They were doing all these old things. Because the military, they were familiar, and those sort of worked, and Edwin Land said, "This new technology," again, before anybody got interested in digital technology, he was pounding the table.

- Safi Bahcall:** 00:49:46 So, there's something off about those histories that say ... Well, it's not off. They're just wrong, that he wasn't aware of digital technology. The problem was that he was missing the subtle shift in strategy. And that subtle shift in strategy, it's not so surprising when one person makes that, it's also the reason why IBM lost a trillion dollars. We can come back to that story. But in the case of Edwin Land, he said, "Well," you know, "it's a great technology, but it'll never make money because we make money through selling film."
- Demetri Kofinas:** 00:50:19 Exactly.
- Safi Bahcall:** 00:50:20 "And there's no film, so forget it." So, he missed a subtle change in strategy that digital would open up a whole new world. And Polaroid was an incredible technology. It was the dominant, the by far the dominant consumer technology company of the day. They could have done any of this stuff. But he just said, "Nah, consumers won't pay for it."
- Demetri Kofinas:** 00:50:40 So, you know, I was thinking about something when I read this story, and your point about blinders. I was reminded of the story of Netscape, and Bill Gates at Microsoft, and IE, the launch of Internet Explorer. Netscape came along just at the time that Bill Gates was ready to lean back into his chair and say, "We won." Right? He was about to release Windows 95 and just take over the whole software universe.
- Demetri Kofinas:** 00:51:07 He agonized over this, eventually, but then once he made the decision, they turned the ship, and then they eventually built IE to become, by 2002 I think they had 96% market share. But how much does comfort play a role? Isn't it just you don't want to have to make all those changes? The level of work, and focus that it requires to do that. Right? I mean, how much of that is also an issue?
- Safi Bahcall:** 00:51:31 No, it's a great question, because you get stuck in a pattern. In fact, probably the most incredible story, that not many people know today, just before Bill Gates did the Windows and IE, IBM. IBM was the dominant technology company, not for five or 10 years, but for five decades. More dominant than Amazon or Google. Actually, I'm not sure about Amazon or Google. Those are pretty dominant. But it was the-

Demetri Kofinas: 00:52:03 It was dominant. It was enormous, yeah?

Safi Bahcall: 00:52:06 The industry was called IBM and the Seven Dwarves. Its revenues exceeded the next seven or 10 players combined. People think, "Oh, well, you know, IBM was taken out on lots of technology stuff because it missed the personal computer revolution." No. Actually it understood the personal computer revolution, and in fact, within ... They were not the first. They came after Tandy, and Apple, and Commodore, but as soon as they launched, within three years they went to \$5 billion.

Safi Bahcall: 00:52:38 They were by far ... I don't know how many people will remember this, but IBM PC and PC XT were the dominant personal computers of their day, and everyone else just dwindled in terms of market share. So what happened?

Safi Bahcall: 00:52:53 Well, they were a product company. They were the dominant product company, and they always made better, faster machines. Every year people bought from IBM because they made better. You talked about being stuck in a rut. This is that Moses Trap for a company. When personal computers became clear, it was like, "Oh, this is great. It's another product, and we're a product company." They didn't have any problems shifting there. They crushed the PC launch. They crushed it. And they, number one.

Safi Bahcall: 00:53:20 But along the way, they missed a little strategy of what matters to consumers. They said, "Well, everybody likes the brand, so they're going to care about the brand on the box. So that's great, so it really doesn't matter what's inside the box, because our three great letters are on the outside of the box, and that's what people are buying for." So, they said, "The inside of the box doesn't matter very much. Let's just outsource that little software stuff to a small ..." I think they were 32 people at the time company in Seattle called Microsoft.

Safi Bahcall: 00:53:50 "And then, the microprocessor inside, I don't know, let's find this. There's a Silicon Valley company struggling called Intel, so let's have them make the ... Just the stuff on the inside. Doesn't matter very much." Fast-forward, the combined market value of Microsoft and Intel is well over \$1.5 trillion. IBM is not even a tenth of that.

Safi Bahcall: 00:54:11 They missed a small change in strategy. Consumers didn't care about the three letters on the outside of the box. What they cared about was emailing with their friends. Sending photos to their pals. And what mattered was standards.

Demetri Kofinas: 00:54:24 And playing games.

Safi Bahcall: 00:54:24 And playing games. What mattered, to do stuff with their friends, was standard. Microsoft created a standard and microprocessors created a standard, and they missed that small change in strategy.

Demetri Kofinas: 00:54:34 The revolution was in software.

Safi Bahcall: 00:54:36 Absolutely.

Demetri Kofinas: 00:54:37 And, of course, now we're in a completely different revolution, and may be on the cusp of another one. There's also ... There are a number of other companies that you mention in the book. I don't think we'll have time to go through Nokia, but I'll mention Nokia as well, because something I didn't know was that in 2004 they had created an internet-ready phone with a big, color touchscreen display and a high-resolution camera, which is basically what an iPhone is. I don't know what it looked like, but of course we all remember, those of us who were around at the time of Nokia and the early cellphone days, they were a dominant, if not the dominant, player, right? Then Motorola, Samsung, those were the big players.

Safi Bahcall: 00:55:12 Nokia was selling one out of every two smartphones on the planet. Far more market share than Apple today.

Demetri Kofinas: 00:55:18 Enormous. Enormous. But I do want to get into Xerox Parc, and that might be a way to get right back into Steve Jobs before we end the full episode, because Xerox Parc is part ... Again, this diagram you have here, we have on the upper-left-hand quadrant, you have chaos, and on the bottom left you have stagnation. These are the two poles, extremes. And on the top right, which is the ideal quadrant, you've got Bush, Vail, is Theodore Vail of AT&T fame, and Bell Labs. And that's the balance. That's the ideal state.

Demetri Kofinas: 00:55:48 At the bottom right, you have the trap, right? And one of these traps is the Moses Trap, the one we just described, the one we just discussed, with Edwin Land, or with Juan Trippe. The other one is the Parc Trap, which refers to Xerox Parc.

Safi Bahcall: 00:56:00 Right.

Demetri Kofinas: 00:56:01 Tell us about what happened at Xerox Parc, and how this differs from innovating too much or innovating the wrong way, to basically allowing your crops to die. And that makes me think

about something else, which is an interesting point. Nurturing loonshots the way you describe it in the book, and also just experientially from me as well, it requires comfort with uncertainty. Right?

Demetri Kofinas: 00:56:28 This is why complexity theory works so well with this. This is not a discrete system. You're not using an algorithm and saying, "If I deploy this algorithm, I will get success." But you are using an algorithm. You are using a recipe. But the recipe is there to create an environment that is hospitable to life, to this primordial stew, which is what you're generating.

Demetri Kofinas: 00:56:49 So, Xerox Parc was able to generate a tremendous number of loonshots. But for whatever reason, they did nothing with them. Right?

Safi Bahcall: 00:56:57 Right. So, when you talk about the two by two, again, it's just a very simple thing. In order to maintain balance between the artists and soldiers, you need two things. First you got to separate them, and then you got to maintain good equilibrium between the two, good transfer between the two.

Safi Bahcall: 00:57:14 So, you're in the top right corner and you're doing both well. Now you're talking about the one where you separate your artists and soldiers but you don't do a good job on the transfer. So, that is a very common problem, because everybody's got an innovation lab, and most of them fail. Most of them, they've figured out that one axis, so they separate out their artists and their soldiers, but they haven't figured out the transfer right.

Safi Bahcall: 00:57:42 What do they get wrong in the transfer? You mention there are two ways to get it wrong in the transfer. There's the Moses Trap, which we just talked about, and then there's this thing you just asked, about the Xerox. So the two ways to screw up the transfer are you over-force it or you under-force it. Over-force it is what we just talked about. You have Edwin Land and he's saying, "Only this loonshot, Polavision, and nobody else. Forget digital. Don't even try it." That's over-forcing.

Safi Bahcall: 00:58:11 Under-forcing is the CEO just sits back and says, "All right, do whatever you want." Why is that not good? Because the soldiers will never take the artist's product. People really need to understand that. Why? It's not because their culture is bad or they're bad people. It's the structure. What are their incentives? People also missed the story of Xerox Parc, but eventually people, even though the senior leaders of Xerox Parc at the time, the soldiers of Xerox, were selling typewriters. And the engineers, the people who invented all these amazing ... The

first graphical user interface, the first mouse, the ethernet, the laser printer, at Xerox, they were so frustrated. Why is our marketing group, or our manufacturing group, not bringing this out to customers?

- Safi Bahcall:** 00:59:01 Only years later they said, "Well, let's say you're paid on selling typewriters, and now we give you this crazy new product which is really going to be pretty buggy. It's going to take you weeks to figure it out, and when you show it to your customers, it's going to blow up, or something, and then they're going to be really angry at you. Or you can sell them another typewriter and take your 10% commission, and feed your kids."
- Demetri Kofinas:** 00:59:22 How bizarre.
- Safi Bahcall:** 00:59:22 So what are you going to do? It's not that they're bad people, it's not that you have a bad culture, and the CEO needs to bring everybody into a room and watch videos of kumbaya, and let's all strum a guitar and hold hands. It's structure, underneath that, that's driving these patterns of behavior.
- Safi Bahcall:** 00:59:40 So, the problem, the Parc trap, is when the CEO just sits back and separates the group, but doesn't manage the transfer. Doesn't worry about, how is he going to solve the problem that when artists have these crazy new ideas, and they're very early, and they're baby stage ideas, they're not going to work very well, they're going to wobble, and when you bring them out into the field they're almost always going to fall down, of course the marketers are going to reject them. And then they'll never get the feedback they need to grow and get better.
- Safi Bahcall:** 01:00:10 There are two ways to screw up the transfer. The Moses Trap is your over-forcing. Your hand is too strong. And the Parc Trap is your hand is too weak. So, that's what those two traps are.
- Demetri Kofinas:** 01:00:23 A similar story, of course, happened with the shift from telegraphy to the telephone, right? Same sort of story. But of course, what's also interesting about the case of Xerox Parc and how it transitions us a bit is that Steve Jobs notoriously stole the graphical user interface from Xerox Parc, right? I mean, maybe stole's a strong word, but everyone steals, I guess, right? The greatest inventors steal. But there was so much innovation coming from there, it seeped out. Right?
- Safi Bahcall:** 01:00:50 Oh, absolutely. What happens when you fall in that box? When you did separate your groups, you let the artists play and the artists come up with all these great ideas, and they're just stuck

there? You haven't fixed the transfer. You haven't created the right structure for it to flow both ways. How are they going to feel?

- Safi Bahcall:** 01:01:10 After a while they're going to be demotivated, because who are their friends? Their friends are going out and having beers with other great artists, who are like, "Oh, yeah, where's your product?" I'm like, "It's still in the lab." They're going to be really, after saying that for two or three years, they're going to be really demotivated, and they're going to be frustrated, and they're going to leave.
- Safi Bahcall:** 01:01:25 Of course, after a while, they left, and in fact, Jobs didn't really steal it from there. There was another guy named Jeff Raskin who'd been working on a ... He'd written his PhD thesis, it was an early employee, and it started this project at Apple called the Macintosh Project, which Jobs hadn't even heard about, and he had spent a while working at Xerox. He had written it for his thesis, but he'd also worked at Xerox, and he'd been creating, nucleating this project inside Apple when Jobs heard about it, and since he didn't do well on the Apple III project or the LISA project, they put him on that project, and he took it over.
- Demetri Kofinas:** 01:02:04 Yeah, and the rest is history. Right?
- Safi Bahcall:** 01:02:06 And the rest is history.
- Demetri Kofinas:** 01:02:07 So, Safi, I want you to stick around. I want us, in our overtime, discuss the three fails, what you call listen to the suck, which I promise we'll explain what that means, or you will explain. You also ... I don't think you call it second-level thinking. You call it level two thinking.
- Safi Bahcall:** 01:02:23 System mindset. Yeah.
- Demetri Kofinas:** 01:02:25 We did a few episodes on this, one with Howard Marks where he calls it second-level thinking, which is not just understanding why you made a mistake, but what was it about what you did that ... You know, just delving deep into analysis. Also, magic numbers. How do you raise the size of the organization? I also want to get into a comparison between East and West. You talked about it historically in terms of the rise of the West, and why did the East, which created, let's say, paper, and other technologies, why did India or the dynasties of China not rise? I wonder how that relates to modern times in terms of China and things like this.

- Demetri Kofinas:** 01:03:04 Also, how does this apply to small organizations? I think that's interesting. You have some work on that, and I think that's also interesting. I want to get into all those on the overtime. For those who are subscribers, you already know. If you're new to the show, or if you've been a listener but haven't subscribed yet, you can go to HiddenForces.io/subscribe to learn more, or just go straight to Patreon.com/HiddenForces and you can subscribe, either to the overtime, or if you want access to this week's rundown, which has tons of great information, great pictures of Edwin Land and the Polavision, and links to a lot of material including a video of someone demoing the Polavision which is just phenomenal. You have to watch it. So, stick around, Safi, and we'll be right back.
- Demetri Kofinas:** 01:03:50 And that was my episode with Safi Bahcall. I want to thank Safi for being on my program. For more information about this week's episode, or if you want easy access to related programming, visit our website at HiddenForces.io and subscribe to our free email list.
- Demetri Kofinas:** 01:04:08 If you want access to overtime segments, episode transcripts, and show rundowns full of links and detailed information related to each and every episode, check out our premium subscription, available through the Hidden Forces website or through our Patreon page at Patreon.com/HiddenForces.
- Demetri Kofinas:** 01:04:28 Today's episode was produced by me and edited by Stylianos Nicolaou. For more episodes, you can check out our website, at HiddenForces.io. Join the conversation at Facebook, Twitter and Instagram, [@HiddenForcesPod](https://twitter.com/HiddenForcesPod), or send me an email. As always, thanks for listening. See you next week.