CONVERSATIONS WITH MIKE MILKEN

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Mike Milken: David. Thank you for joining me today.

David Siegel: Pleasure to be here.

From as far back as I can remember as a little kid, I loved data. I used to get excited in that my parents had a bridge club once a month: 24 couples were coming over to the house, and I got to quiz them. At a very young age, six or seven or eight, I was just surprised that adults knew so few facts. They couldn't tell you all 50 states. They couldn't tell you all 50 capitals. They couldn't even tell you the speed of light. One of my favorite books when I was young was the Almanac, which I used to put under my bed, and if my mom checked, I'd put it under my pillow, and study facts. I didn't have any computers to pull up.

When I switched from math and science to business and finance, I discovered that very few people knew the facts or knew anything about credit. Everything they said for the most part was wrong and that very few people did research which required enormous effort. I had enormous respect for a man that headed the Cleveland Fed named [Bradford] Hickman, who with his staff, looked at every single debt issuance from 1900

This interview has been lightly edited for clarity and readability.

to 1944, prior to computers, to see what happened. That plus my love of mathematics kind of propelled me into data. You've built your career by analyzing and acting on data – investment managers who take a scientific approach to investing by using machine learning, data, artificial intelligence. So, you do have an advantage. Talk to us a little bit about your love of data and mathematics.

My route to data actually came from an initial love of computers. As a young kid, really young kid, 10 years old, back when computers cost millions of dollars, I was lucky enough to learn how to program them with punch cards. One of the first jobs that I had, just a way to earn a little bit of money in high school, was to analyze some medical data on a computer. I began to recognize that one of the greatest applications of computing, back then and even to this day, is its ability to look at large quantities of data and to find patterns in the data, and to reason with the data in ways that it would be very hard for a human being to do itself.

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One of the best advances in the analysis of data has come from really the field of artificial intelligence, which to a large extent is involving methods that are based upon learning from data. I think that when you think of a problem like investment management or making investing decisions, there's an enormous amount of data. In fact, really everything going on in the world, there isn't any event – you go to a store, you buy an iPhone – whatever you're doing, that's a bit of data that's collected. This data has some influence on the economy, on investments. But the problem in the past is that there's far too much of it. It's not being collected systematically. So it was hard to do this sort of thing. Even in the COVID crisis today, this is a data problem in my mind.

So as far back as I can remember, David, I think I was in my teens, when you looked at things and analyze them, if you could assimilate diverse facts they led you to believe something was going to happen. As I got older, I became much more focused on where the data told you something negative was going to happen. Could you change the course of history? Could you refinance a company, change its capital structure?

As we look today at the coronavirus, we can start to think what could happen and this data science challenge. Could we use data to change the course of history? What have you thought about as you've watched this coronavirus unfold?

One of the things I find very shocking is that people have not been systematically collecting the kind of data that could be useful for understanding the course of the disease, and for understanding the most effective mitigation approaches to take while we await a cure. Hopefully a vaccine will come sooner rather than later. But in the meanwhile, we have to figure out how to get on with our lives and at the same time not have the disease run rampant through the world. This is something that data can certainly help us with.

I'll give a few examples. If you're thinking about reopening a school, which we have to do, what's the right way to do it? People are going to have to make decisions about how many students you can put in a classroom, what sort of sanitary standards are actually required. Without data, this is going to be complete guesswork. People will maybe say, okay, put the kids four feet apart, or maybe it should be six feet apart. Maybe we should clean the classrooms once a day, once a week. It's all guesswork. On the other hand, with data experiments are going on around the world, we can measure what's working, what's not working. We can be surveying students to see who's catching it, who's not catching it. We can convert this from a hand-waving process to something that's very scientifically driven.

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The contagion, the transmission of coronavirus or any airborne disease, is something that can actually be studied. The physics of particles and droplets gets very little attention. Apparently, there's really only one academic researcher in the United States that even studies this problem at MIT. I think, ultimately, we need to know more about how the disease is propagating, who it's affecting the most. We know, or we're guessing, that younger people are pretty safe. Older people are not so safe. Men are more impacted than women. But with more data we could make much more evidence-guided decisions about the right way to move society forward while the disease is still with us.

So David, obviously one of the goals that we've been very focused on at the Milken Institute, our medical foundations, my family's foundations, has been to define medical solutions, and we are now tracking more than 350 potential solutions from vaccines to antivirals, to immunology efforts, to antibody efforts. How would you characterize the current state of COVID-19 data and do we even have enough information to make the right decisions?

I think we may have a bit of what I would call a market failure here. When it comes to medical treatments like the development of a vaccine, this is a commercial problem and a company could make quite a bit of money if they're successful in the endeavor. Venture capital, even government money flows into hundreds of companies that are looking either for effective therapeutic treatments or cures through vaccines. This is well funded and I really have no fear that we have adequate work that will lead us eventually to a solution.

The part that's not really funded is when it comes to things that don't really have a commercial application. For example, to determine if an N-95 mask is superior for everyday use over a standard surgical mask or even a homemade mask? What's really needed to protect you when you're going into town? That's not a problem that anyone's going to make any money on. Any kind of research to better understand that problem and to collect actual data of the effectiveness of one mask over another is something that either philanthropy will have to fund or the government will have to fund. Universities don't have the money; they can't just start projects up to do this without funding sources.

I think that we have to look at the mitigation problem as well as looking at cures and treatments. The mitigation problem really doesn't get very much funding. I know that in the private sector, there's plenty of thinking going on about how to create safe working environments in the presence of COVID. But this is usually limited to one company taking one approach and another company taking a different approach. Information isn't being shared. The data that they collect and the experiences, in many cases, might be considered to be something the company wants to keep to themselves. It's a competitive advantage. This whole ecosystem of mitigation data I think needs to be addressed by partnerships with government and philanthropy.

When I think about data, one of the areas that I've been active in has been prostate cancer. A few years ago, the government suggested that men should not get these blood tests, the simple blood tests, because they might be inaccurate. And if they told you, you had prostate cancer, you might not have enough money, you might make some poor choices. Well, data showed that 99% of men diagnosed with prostate cancer at any level, live five years or longer in the United States. In some of the Scandinavian countries where there was no testing, life expectancy was 50% for five years or longer – a dramatic difference. We obviously aggressively tried to educate the government. What role do you see the media playing and how do you see the media handling the coronavirus crisis?

That's a fascinating question, because on the one hand, no doubt the media has a very important role. The media is a critical tool for educating people. If people have the right information, they'll make the right personal choices more often than not, in my opinion. With regard to the corona situation we're in, the media has a critical role in messaging and socializing the safest reasonable practices people should take to avoid getting sick.

The media has an important role in sharing, in a format that people can understand and often understanding things based on data is actually pretty complicated, has a role to push out this information.

I think that in our day and age today, we have an issue with the media, which is, it's very much soundbite driven. It's almost like a Twitter feed. It's very hard to communicate to people relatively complicated thoughts in little teeny soundbites. In fact, we see more and more of this occurring. It's impacting in my view, society in so many different ways negatively. This is not even to mention the fact that it's very hard to distinguish between accurate information and inaccurate information, particularly when communicated in soundbite format. I think that the coronavirus media cycle has proven to be very confusing to people, and I think that that then causes people to basically start to ignore everything.

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So, what do you see as a solution?

I think that social media and the overall format of the internet and how we communicate has been turned into really just little snippets of information often without context. It's great that you have podcasts that can dive deeply into an issue, but as you know, a lot of people consume their news in 140 character segments. I really am not sure how we can convince our society to spend a little bit more time digesting what's going on around them. That would be a really important change for the better.

We have done a lot of analysis at the Milken Institute on this and had a series of research discussions and panels. We were looking at where technology today was able to analyze what your beliefs were, what your preferences were, and then would feed you news or send you to things that reinforced your belief. The other challenge we saw was that with a click economy as you've spoken about, that getting more people to come to your site results in a more profitable venture; the more outrageous or shocking the headlines or the information, the more potential people might come in. What we do see, particularly with the television news, is that their viewership could go up 10 fold during the crisis, so you want to keep that crisis mentality going as long as possible. Would you think of a way to get out of this cycle, since technology, machine learning, many of these things that you've deployed, are really giving an individual their potential

view of the world and reinforcing rather than giving them alternative views of the world?

I actually wrote about this years ago. It's essentially the business model of so many social media and other sites on the internet. It is actually an application of artificial intelligence, where people can study your preferences based upon your internet activity, and in a way, manipulate you to feed you what you want to hear. That will drive engagement, more advertising can be sold off of that engagement, [and] that will drive more revenue to the company. This application of machine learning is a data application, absolutely, that is highly effective and maybe a lot more manipulative than people would even imagine. I think ultimately making sure that people have quality education [is crucial]; the dangers of this have to be reinforced in K through 12 education and beyond. We have to make sure that our society does not lose its critical-thinking skills. Ultimately, the solution of course, is to invest in education and to make sure that people understand how to think for themselves, how to do research, and to distinguish between fact and fiction. We're probably not doing this enough in K through 12 education, frankly.

A passion of yours, I know and your family has been education, and mine for numerous decades, and the deployment of technology and education. We are seeing it much differently today. For much of our country and other parts of the world, whether you're in elementary school, middle school, high school, college, graduate school, you might be going to school online. Lori and I, as I think as you know David, have been blessed with 10 grandchildren, and the nine that are old enough are all going to school online. Are we going to accelerate the implementation of technology and education from this experience do you think?

Absolutely. I think that this experience is a grand experiment in online work, online education, online shopping. You really couldn't have created a better experiment and we're learning an awful lot. Not everything is working so well, and some things are working really well. Specifically with regard to education, I think that what we are seeing is that, you know, some of this I see from my own kids, is that certain subjects are really easy to teach online. The math and sciences seemed to go pretty smoothly. Other subjects that have more human factors to them, much more difficult. I think ultimately and something that my family foundation, the Siegel Family

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Endowment, focuses on are different forms of online learning and blending. People call it the blended classroom; blending online learning with in classroom learning. I think what

we're going to conclude from this experiment that we're inadvertently involved with is that we can make physical classrooms much more efficient by blending technology with the actual in-classroom experience. I think that that's really the high leverage point, frankly.

You are a great discussant, David, in many ways a good debater. I was an active debater as a young kid and I used to always ask myself, how do you change a person's opinion? I would always ask questions, factoids. One of the reasons behind it is that I find most people, if you lecture them, you're going to have a very low probability of changing their opinions. But if you send them off on an adventure where they're answering questions and wondering why they're getting them wrong, you have a much better chance that self-discovery will change their opinion. Do you see that application in our educational system or in life?

I do. I do. For years now, I have supported in many different ways, a project that originated at MIT and now is a stand-alone nonprofit. It's called Scratch. Scratch is a programming language for kids, but it's actually really a creative learning experience.

Kids create programs in a very simple kind of drag-and-drop way, and these programs have an artistic, very creative element. It's almost like you have a canvas and you're painting your program onto that canvas, and there's a community where kids can share and create together. Scratch is really about exactly what you just said. It is not teaching people through a lecture telling them what the answer is, but it's giving kids a blank canvas where they can create and explore something on their own and they may run into obstacles or barriers.

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When you're writing a program, if you're a coder, you know that you spend more time solving a problem, tracking down an error, than you do actually creating the program. It's an experience that helps you to navigate through life. Most importantly, and the way it's done with Scratch, is that people aren't telling you what to do. You figure out what you want to do and then you figure out how to do it. That kind of project-based learning experience I think needs to be incorporated into all aspects of K through 12 education. That will create people better equipped to deal with the challenges of our society. It will actually make people much more critical thinkers, which was something we discussed just a moment ago.

David, we've talked about AI over the years, and I know you have very strong opinions. Is it a positive force? Will it be a negative force? Where do we stand today on the development of AI, and when do you see its full impact being expressed?

Very often people these days are talking about AI as being potentially very dangerous and we should be afraid of it. Other people of course talk about the positive benefits. I think of AI fundamentally as a tool, and a tool, like a hammer, can have positive uses. A hammer can be used to build a house or a hammer can be used as a weapon. But no one would ever say that a hammer is inherently a bad thing, although it could do bad things. So AI is very similar. The applications that AI has had today, investment management in my business, but it's powering medical research; it's powering pretty much everything that you use on the internet. These applications are largely very good and helping to make the world a much better place. On the other hand, of course, you could take AI, maybe face recognition technology, and use it for purposes that society finds to be inappropriate, too much surveillance. So it can go either way, but it's not an issue with the technology. It's an issue with how the technology is being used, which is a different story.

And where are we? Are we, in a baseball analogy, in the third inning? The second inning? The fifth inning? Where do you see us there?

I really think we're only in the first inning. I think that the technologies that we use today are actually in the end, fairly primitive. Everything that is popular today, the technologies that have been deployed, are based upon neural networks, various machine-learning approaches. You've probably heard some of these words: deep learning, reinforcement learning. These methods, while very good for certain applications – face recognition is one of them – actually turn out to be pretty primitive. You may be surprised to hear that the best scientists in the world can't use today's current machine-learning technology to replicate the capabilities of a two-year-old child.

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Well nothing surprises me. But speaking of that David, there's a limit to what our computers in their current structure are capable of doing. One has to assume in the long run they'll be biological; it appears that you can store everything, all the information the world ever had, on a few strands of DNA that fits in a shoe box. And when you store things on DNA, as we see, that DNA lasts millions of years versus our other storage strategies. Have you thought at all about what the biological storage and what role a more of a biological structure for a computer might be? And that years of

collections of old computers or gadgets might someday be replaced by something that looks more like the human brain?

I like to say that the greatest mystery of the world is not a black hole or even maybe the origin of the whole universe. The greatest mystery that we know of is right on top of our shoulders - it's our brain. The level of understanding that we have of intelligence and what our brain is doing to make us intelligent, is remarkably low. We have knowledge of basic neural functions. We understand to some extent what cells are involved in the brain for various kinds of computations. The work definitely is proceeding, but when it comes to really understanding what sort of computations our brains are doing, and how it can result in this high form of intelligence that we have, we really don't have any idea. It is pretty clear that computers and even machine-learning approaches, even though a lot of people refer to them as neural networks, it's pretty clear that that's not what is going on in our brain and our own human neural network. I think that you're right that we should really invest very heavily in brain research, because the brain is a working example of an incredibly sophisticated intelligence system. It's a much better example than anything we've ever been able to build. If we could reverse engineer it, reverse engineering it completely is a really hard problem, but even partially, no doubt that that will lead to inspirations for new AI technologies.

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I remember having a conversation with Ray Kurzweil many, many years ago, where he let me know that a human brain was capable of doing 17 trillion calculations a second. I'm not sure we're all operating at that level at the moment. Maybe you are, David. The last area I'd like to cover is your family, your employees. How have you made decisions on your employees coming to work, going home, and how has the experience been with your own family, since you're living in an area that was close to ground zero in the world in this coronavirus pandemic?

Thank you for asking. I think this has been a difficult experience in many different ways. Thankfully, my family and people at my company are safe and we are working from home and we're all lucky enough that we can do this. But you know, Mike, this has really made me reflect on, and in fact it's something we talk about at dinner with the kids at night, on how in the world today we have a pretty big chasm between how different people live. Unfortunately, this episode that we're going through, is one that is not treating everyone the same way. I think we as a

society have to reflect not only on the curing of this disease, we shouldn't only reflect on pure economic issues. We also just have to reflect on the social contract that we have: is this working the way we want it to work? I luckily am healthy, but I am at great pains when I see the struggles that are going on in our country and around the world. It is something that makes me very, very sad.

One of the things that might come on this is a much greater appreciation of who is a first responder. Is that the person picking fruit in the field to make sure if people have it to eat? Is it the person that's the cashier in a grocery store? There are so many redefinitions of a first responder. Is it the person working in an emergency room who's admitting patients today? I think focusing on what you've said, David, will maybe give us a different view from both an economic standpoint, but also how important these positions are in a society that we maybe never realized before.

Absolutely. Absolutely.

David, I want to thank you for joining us today. I look forward to the day when we can spend more time together in person, and I wish you and your family and your teammates at work, good health and a safe environment

Mike, same to you and thank you for this opportunity. Take good care.