INTERVIEW
WITH
DIMITRIS BERTSIMAS
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Sloan Oral History Series

D: Dimitris Bertsimas
G: George Roth
B: Bob McKersie

G: We usually start our interviews by asking people a little bit about their educational background, in particular when you first heard about MIT and how that led to you eventually coming here. As you've already described, you came here as a PhD student...

D: Yes. I finished my undergraduate studies in Greece in electrical engineering and computer science in 1985, and I applied to the Applied Mathematics Dept at MIT, and I was admitted as a graduate student in September of 1985. As soon as I entered the Math Dept., I recognized that there is a center here, the Operations Research Center, that seemed quite close to my interests. I decided to pursue a joint PhD, namely, to pass the qualifying exams in both applied mathematics and operations research. So I moved on this plan, and I graduated in 1988 with a joint PhD in applied mathematics and operations research.

Earlier, in 1988, there was an opening at the Sloan School, and I applied. It was only my third year, so I did not have a global search. I only applied to two schools. The Sloan School hired me, and I started as an assistant professor in August 1988. And I've been a Sloan faculty ever since.

B: What research did you do as a PhD student?

D: It was about routing problems, vehicle routing problems, when there is uncertainty. For example, take how UPS works. UPS delivers packages to buildings, and maybe buildings always have a package delivered on a daily basis. For example, on a daily basis there is always a package delivered to the Sloan School. But a smaller building elsewhere, might not

have a delivery on a particular day. So this was an extension of the classical deterministic vehicle routing to stochastic analysis. So I combined stochastic ideas and optimization ideas.

G: And your advisors for that?

D: Yes, I had two advisors. My primary advisory was Amedeo Odoni, who is a professor in the Aeronautics Dept. at the time. And to this day, Amedeo is my best friend here at MIT. He is a marvelous man

B: Amedeo is emeritus now, but still very active.

D: Very active. He is has been emeritus since 2015. So he was the co-director of the OR Center at the time I was a student. My advisor in the Math Dept. was Danny Klagman, who has since retired. Also a very nice man.

G: I was wondering if there was a Sloan connection in that, because we know other Sloan people who have been in the OR Center.

D: Yes, very much so. On my thesis committee was Tom Magnanti.

It's fair to say that I did not know the Sloan School very well. I knew its existence, I had taken courses with people like Jim Orlin or Rob Freund or Tom Magnanti, but I was not very familiar with Sloan. Even though it might seem that this was an internal hire, somebody who had a PhD from MIT hired to MIT, but I was not that knowledgeable about the Sloan School.

B: What appealed to you to stay at MIT? You said you had one other offer....

D: Yes, I had applied to Cornell. The appeal was primarily the fact that I thought then – and I continue to think now – that MIT is a very high-quality environment. Second, the OR Center was closely related to Sloan at the time, and it is even closer now, and it is one of the top, if not the top, places in my field in the world. And I also had many friends. So those were some of the intangibles.

G: Would that extend to coming to Sloan? Because Sloan was kind of an unknown for you at the time....

D: A bit unknown, but I knew the people. I knew the key faculty of the OR Center, and they are also members of the Sloan School. I knew that this was a very high quality place.

Something funny.... When Tom Magnanti made me an offer.... At the time we used to live in Providence because my wife was doing a PhD at Brown University. Tom called me and told me he would like to make me an offer. And I accepted on the spot. I didn't negotiate. I was very excited to join Sloan

B: [laughs] that's wonderful. So you ended up in E53, then?

D: Yes. At the time it was E53. I had my office in the OR suite. Jerry Shapiro, and Rob Freund, and Jim Orlin, these were my neighbors. Jerry passed, unfortunately, recently.

I stayed there.... well, I moved offices a bit, but not much. I stayed there until 2006. In 2006, I became the co-director of the OR Center, and my office now is in E40-111. My neighbors are all doctoral and master students at the ORC. On a daily basis I interact with young, extremely talented people. A happy existence I have now.

G: Yes, that corner of the building has always been the OR Center, hasn't it?

D: Yes. The OR Center was started in 1953, so it's 63 years now. It has grown significantly since that time at the time I was a student we had maybe 35 students. Now we have about 85. In fact, in terms of PhD students, there are about 70 PhD students, which is, I think, larger than the entire Sloan School PhD program.

B: That's something I need to understand. Do the PhD students....?

D: How does it work in the Center, right?

B: Yes, what is the structure?

D: The OR Center is an interdepartmental program. It gives its own degrees. There are only very few places at MIT that give their degrees, that are not departments. Another example is the old HST (Health, Science, Technology) Program. Students are directly admitted at the Center. For almost the entire history of the ORC, we reported to the Associate Provost. Maria Zuber is the current Associate Provost. This has changed, in August 2016. It now reports to two deans: the Sloan School dean, and the Engineering School dean, with primary emphasis on the Sloan School. In other words, the budget comes from the Sloan School. The strategic overview is from both deans, but the day-to-day activity is Sloan.

The Center has about 50 faculty, 30 from Sloan, 15 from Engineering, and about 5 from other schools – School of Science, one person from Architecture. And about 85 students. So it's an interdepartmental program that gives its own degrees.

How it will evolve given the closer proximity to Sloan at the moment, it's a very recent change, so I do not know. I have a suspicion it will continue to work the way it has worked.

B: Cynthia Barnhart was heavily involved....

D: Cynthia and I were co-directors.

B: She's moved up, she's Chancellor now.

D: So when I became the co-director the first time in 2006, Cindy and I were co-directors together. Then in 2010, she stepped down as a co-director to become associate dean in SOE, and from then on she became the Chancellor and a lecturer, recently.

B: Is there another co-director?

D: Now it's another co-director, his name is Patrick Jaillet. He used to be the chairman of the Civil Engineering Dept. When he finished being the chair of Civil, he became a member of the faculty in EECS, and then he came here as co-director of the OR Center.

The Center has 2 directors: a co-director from Sloan historically, and a co-director from the SOE.

G: Let's go back to 1988, and your responsibilities at Sloan.

D: Something I remember vividly – I defended my thesis on a Tuesday in early September of 1988, successfully, obviously. Then I taught the following day, Wednesday [laughing] -- I taught one undergraduate course and one PhD course. This was not my best experience for that semester. I taught it very fast, and the students were not happy.... I taught the way I would liked to take courses, but the students did not like it. After that, I improved. But the first time, I remember it very vividly.

I taught an undergraduate course in optimization, that's the only time, actually, I taught it. And then a doctoral course at the time.

Then something that was particularly important early on is that I started having quite a few doctoral students, even though I was very young at the time (I was 26).I was the only untenured faculty at that time in the OR group. So I started having more students. Fairly soon, I had a sizeable number, and continued to do so my entire career. That's an important component of my academic life, that I enjoy having very talented doctoral students. So far I have graduated 59 doctoral students, and currently I am working with another 16.

B: That's so impressive! That is such a special role that you play.

D: I enjoy it. I find it to be the major reason I enjoy academic life. And this continued....

G: You're supervising 16 now?

D: Yes, 16 at the moment. But I have a policy: if somebody wants to work with me, I say yes, and I find the funding. The way I see it is the following: I don't try to optimize graduate students. I feel it's our obligation. We get very talented people in our environment, and in a way we are responsible for educating them well. And we advertise that we basically try to give you the best opportunities we can. So if you then say, "Well, I cannot do it, etc. etc., " it does not sound correct to me'' On the other hand, there is an upper boundary of physical capacity, which maybe I have exceeded! But I enjoy it. I meet with my students – to this day – about an hour or two hours a week, so this means....

G: [interrupts] Half your time is right there...

D: Well, even more. Thirty hours a week I meet with my students. My primary responsibility is to the Center, at the moment I am co-director of the Center. As well as the students. And they become close colleagues. I write books with them, I write papers with them. I view it as my paramount obligation as an academic.

B: The selection of topics – is it like in science and engineering, where the professor has a grant and the students work on what this grant is all about?

D: The way I do it is somewhat different. I separate funding and PhD topic. In other words, my philosophy on this is as follows: I need to convince the students that the topic I propose matters. The students can also propose a topic they are interested in. But both of us need to convince the other person. And if you are successful in addressing the topic we are discussing, so in other words, putting ability aside, and you are 100% successful, would it be something that changes the world for the better. The way I define it is, if it is a theoretical topic and you are fully successful in the research, can you teach this research in graduate-level courses? If you can teach it in undergraduate-level course, it is a big breakthrough. It happens maybe once or twice in a career. So that's on the theory side.

If it's an application, then the results of the research will then be used by companies in a reasonable amount of time. Not in 40 years, but 2 to 5 years. But at least we still

have a reasonable ability of this happening. If it doesn't happen, then we shouldn't be working. That's my philosophy on that.

G: That also then helps you get funding.

D: Yes, but the funding is not the same. Very often, 50% of my students work on the topic of their research, and that's the price you pay for having complete freedom. We have another topic, which we will also write papers, and also good for them if they want to find academic jobs, where in a way pays the bills. Sometimes it can lead to a PhD topic as well, because it gives us exposure to the world. But I view funding as an enabler of doing excellent work, not a constraint that these are the only topics you should be working on if you want to have funding. Otherwise, you might not be aggressive enough, or visionary enough, or ambitious enough. That has been my experience.

As a result, my constraint at the moment is not money. It's time. Typically I can generate the necessary financial resources.

G: Does that generate time??

D: Unfortunately, not! [laughs] At least you see how this works.

In the earlier years, when I was younger, I did not realize fully that the key aspiration is to have impact. But impact is a bit ethereal. So now I've defined it, then I can measure it. Of course we are not always successful. But if you aspire often enough, sometimes you will be successful..

B: It's remarkable that you're so successful in getting funding. How do you go about that?

D: Well..... [chuckling].... Let's see.... Well, with seniority, of course. Given a longer history of success, people trust that you do reasonable things. I have some credibility on that. More than when I was a younger person.

I would say people know that I do what I say. If I say we're going to deliver something, we deliver it. Quite a lot of my funding is continuing. For example, I have a large NSF grant in healthcare. This is based on a prior success with another NSF grant. Today 70% of my funding comes from companies and 30% from government agencies, I typically have two or three larger grants, and maybe three or four smaller grants. It sounds like I'm over-trivializing, but honestly, this is not my major constraint.

B: But for a lot of faculty, it is. So it's remarkable that it's not a constraint.

D: And also the Sloan School helps. For example, last fall, I offered the first on-line class that the School offered. This was a lot of work and I knew it would be. So I asked the School to give me some funding, to hire students to help me with the preparation. . I am very happy that I asked because it helped me to engage some of my doctoral students and I couldn't have done it on my own. Developing an online class was a significant amount of work. But that's an example of where the School helped.

To be honest, my experience with the School has been – I don't ask a lot. It's not that I'm in the Dean's office every year. On the rare occasions that I ask for some funding for particular educational matters, the School has always been positive. That has been my experience.

G: Say more. When you say, "the first online course," this was an EdX course?

D: Yes. This was the spring of 2014. I started developing the course in the summer of 2013. I proposed it to SP [Kothari]. At the time, there were only 7 EdX courses throughout MIT, so this was the 8th. It was in the early days, still, and the first from the Sloan School.

I developed a course called "The Analytics Edge". This is the use of data for building models to improve the decisions of value in organizations, in people. I developed such an elective course for the MBA program, it was very successful, had about 120 students and was subscribed for even more but we didn't have space. So I could see that this was well received by the MBA students who took it as an elective. That's not an obvious thing to accomplish. So I had developed material, and I knew it was a successful class.

With all this buzz about online education, I was curious about "what is this all about?" I consider that this is perhaps, from an educational perspective, the major development of our times. What will happen in the future I do not know. And by the way, nobody knows.

G: It's one of the ways to learn.

D: But just actually do it, so it's not an abstract.... I proposed this class. We had about 30,000 students enrolled the first time around. And 6,000 finished.

B: That's even better than some of the other courses, which have 100,000 and only 7,000 finish.

D: That's right. We had about 15-20%.

B: That's a better percentage.

D: Yes. It was an experiment. And the only way I could do it was because I had lots of help. I had several of my doctoral students participating. I co-taught it with one of my doctoral students. It's a huge amount of work.

G: I've been on the other end. I took the edX Challenges of Global Poverty, I think it was called.

D: Yes, I watched parts of it.

G: I'm interested in the topic, and I also was interested in EdX. That was the first social science course. Online courses involve a lot of work. It's a whole system behind it.

D: Yes, giant. So next semester, we are doing the same course again. But now in the Sloan class I have now two sections of the Analytics Edge. I used to have one, now I have two.

My intention is to experiment using some of the lectures, maybe 2-3, from the online. So I will assume that they watched it, and then have a discussion.

G: Yes, it might be a flip classroom but...

D: .... but it might flop! [laughing] I'm worried about that. Slow steps.

We are experimenting. Nobody knows, really. But so far, so good. This has been a success. If you look at the ratings of the course, it was very well received.

B: I'm doing a web course at Harvard Extension, so I'm very interested. The whole premise of edX is that we will learn something here that will make our classroom experience better. You just alluded to that...

D: It has already happened, actually....

B: Are there other things besides just taking the material and go over it, that you've learned?

D: Yes, I've learned the following. I actually did not use my prior material. All the lectures I developed, when I say "I", it was actually myself and the other people, it's not just me only, we developed them brand new. The content was correlated, but the delivery, the structure, we had to develop 8 4-minute modules. We had to package it in a different way to decompose the material. Basically, now, in 30 minutes we cover 1.5 hours. As a result, the delivery has been much crisper. It forces you to think: What is important? What is less important? How to sequence the material. As a result, all of this material is higher quality, in my opinion, from what I used to do. Now some of this material is now influencing the delivery in the classroom.

Another example we did a competition. This is on data, and we tried to get some insights about.... It was an interesting topic, actually. It was a company called Show of Hands, that asks questions of people. We have maybe 30,000 or 40,000 people who answer 500 questions. They have also answered "Are you happy?" So we took this out, and based on the answers, we asked "Can you predict happiness?" based on the answers to the other questions that

they answered. This was a competition. I've never tried this in a residential class. We tried it, we found interesting things, and we're going to do it again.

We are experimenting. The dust hasn't settled.

B: OK, it's a work in progress.

G: One of the things we wanted to understand was the progression of your teaching over time...

D: Yes. I have an unusual style. I actually do not like teaching the same thing year in/year out. So over time, I have developed many, many courses and have written books on these courses, actually. I'm not saying mine is better or not, it's just different.

To give an example: I started teaching in 1988 the doctoral optimization class. To be honest, I did not think it was taught exceptionally well – I inherited the class, so I covered it the way we had been doing it, the first time. But I taught it over a decade, and during this time, I developed a set of notes. One year the Sloan School teaches it; the next year the SOE teaches it. So another colleague of mine, John Tsitsiklis from the Electrical Engineering Department, we started developing a common set of notes. Then we wrote a book in 1997, about 10 years later, that was tested. And to this day, the book has been a success. It's now being used at 50 universities around the world. That's an example where the teaching went beyond MIT, in a way.

Another example is Rob Freund, a colleague of mine and a very talented educator who has received major awards for teaching, we were responsible (together with others, but primarily the two of us) for developing the core course for the MBA curriculum, called "Data Models and Decisions." We had a course called "Decision Support Systems," that used to be in the core, but it wasn't as successful. This is what we inherited. We developed it further. In 2000, after developing the material, we published the book, and it has also been a significant success. It's now being used in about 50 universities, including many US universities.

Another thing that happens, because of that – I believe a good book contributes greatly to a good class. Now what we have found is, almost irrespective of who teaches the course (of course, there are some teachers who are exceptional), even the average teacher from our group, he/she does very well.

Another example is that I also taught a PhD-level course "Discrete Optimization over Integers." This was part of the PhD curriculum at the ORC. Unlike other people in the Sloan School, we can teach PhD courses with regularity as we have 70 doctoral students. So after writing notes, I wrote a book also on the topic.

I have also finished a book The Analytics Edge one of my doctoral students and a colleague from IBM.

G: And not the Red Sox?

D: There's a chapter on baseball analytics.

I developed a new class called "Robust Optimization Methods" that I'm preparing a book on the subject. This is very much related to the research I've done the last decade.

G: I'm looking at your bio, and it's the largest list of publications....

D: Yes, I spent a lot of time in that. Down the road I'm also preparing a new class on statistics and optimization.

Generally speaking, my style is that I like teaching new things. On the way, I also learn. I don't like teaching the same thing year in/year out. Sometimes I have to do it. So as a result, my teaching load has increased, not because of points. It's because I care about these courses, and somebody has to teach them. So I now teach 4 courses a year. Nobody forces me, but we have to teach the courses. So that's why I feel obligated that we should do a good job in that.

G: That's a significant load.

D: Yes, and I also work on research.

G: Your research is easily integrated into the courses.

D: Yes, it's integrated. For example, these days I am also working on healthcare analytics, and quite a bit of material from the research has entered these courses.

B: Do you have a group of some of your PhD students together where they themselves interact with you? You have so many PhD students....

D: How do we work it? The traditional mode in engineering is the professor meets once a week with the group, and the students supervise themselves.

G: PhD students and a couple Masters students?

D: Yes. But that's not my style. I meet with every one of my students, one on one, once a week for about an hour. Maybe twice a week. But on certain topics – for example, we have a project with a company about HR optimization. In addition, I have a separate topic with each one of them. But on this particular topic (because all of us work on the same) then we meet on that only. So this is yet another meeting with a sub-group. But I don't meet with all my students as a group. That's not me, because one works here, another there....

B: This topic – you said it was HR?

D: HR optimization. Who to hire, how to predict future demand. They are all practical topics. So that's my style, Bob. Other people have different styles.

B: In the choice between a theoretical topic and an applied topic, do the students tend to choose?

D: Yes, they have a say. I expose them to questions that I think are important.... In the beginning, I have a higher role in choosing topics, but by the time they graduate they work in multiple topics, not only one. So later, as they become more mature, they have much more say. In a way, I try to educate them on what type of research is important. When they are young, they are top students in their undergraduate institute, but most of them have not done much

research. Some of them have, but not many. In a way, the biggest contribution is not the specific topic they work, but the values of what research is important. They can convince me to work on whatever they decide to work on, but they have to convince me on the topic's impact in either theory or practice, as I have to convince them as well. And some do. In fact, some of them, I would say one-fourth of them, we work on topics as they have defined.

B: In terms of your own choice – as I read down your publications, it's an interesting mix of theory and practice.

D: True. How do I select? In the beginning of my career, when I was not mature enough I would say, my objective was, I didn't realize this, it was not a conscious decision, to try to impress my seniors. I was trying to impress the world that I am a very good researcher. I've succeeded, to a degree. That was my intention.

I did not pick topics naturally. Some of them were important, but I didn't pick them because of that. It was a different objective. Slowly, as I became more mature and recognized why I was an academic, and when I was in my mid-thirties, 10 years into being a professor, I realized that the world doesn't really care to be impressed! [laughing] I was now established as a full professor here. So I said, "Let me try to do things that I think are important. Maybe the world doesn't think they are important, but I think they are important." As a result, I think I became a better advisor. I think of myself as a good advisor, that's why I have a lot of students, because I care about my students very much. But if you guide the young guys with this emphasis, independent of the success they have on a specific topic, the value system is affected. And then I see, with great satisfaction, that some of them do fantastic things later.

G: You've started them on that path.

D: Yes, I start them on that path, and then you see maybe they become the top people in the world in certain areas. So I get a lot of satisfaction on that.

But that was a qualitative difference. So as a result, Bob, I don't put a lot of emphasis on theoretical or applied. Is it significant? For example, I am working (motivated also by a personal matter: I lost my mother to diabetes), I have focused on doing optimization on

diabetes. Nobody can convince me that it's not an important topic. Half my family chain was lost to that disease. It's a serious matter.

And it's easy for young people to be motivated. Many of them are idealistic, they would like to impact the world positively. So that's an example of what my personal example, from my family, has moved into the research area.

B: Since you mention that, I think we should get on the record a little more detail about this, because it ties in with the health initiatives within the School.

D: I'll answer the question, but I need to give an introduction, if I may, Bob. Foremost, I have been an academic. You've heard the story. I've generated courses, books, students' research. That's the majority of what I do.

When I realized that impacting the world is important to me, I thought the best way to impact the world on applied topics is to actually start a company. You can do consulting.... But a company, especially with a good idea, can impact the world more. I have been a serial entrepreneur for over multiple efforts.... It's not something I advertise a lot, to tell you the truth, because people think I do it because of money. I make enough money. That's not the major point. The major point is that I have found that if you start a company, and you develop it, you can affect the world far more so than one individual person can. Because the only way you can affect the world with a research topic or a paper is very indirect. You influence some of the researchers, who influence other researchers.

G: And eventually somebody uses it in their company!

D: Eventually. But nobody would even remember what.... This is a bit pessimistic, I don't really believe it to the same degree.... I have decided I would try. I started my first company in 1998, Dynamic Ideas. The second one was on healthcare, in 2001. And this is the connection, Bob.

So in 2001, together with a physician here at MIT, Chris Kryder is his name – he has since left. He was a Sloan Fellows in the 1970s. Also a physician for many years. We started a company called D2 Hawkeye. If an employee of a company visits a doctor, for the doctor to

get paid, he needs to submit what happened: what was the diagnosis, what are the procedures, what drugs? We get this data and then we can try to predict how sick the person will become next year. Can we do something to intervene? What's the quality of the healthcare he/she has received? We developed this and in 2009 we sold the company to another public company. We had at the time about 20 million people who we were managing on a daily/monthly basis. So this is almost a decade of experience, and it exposed me to the healthcare system. That was one influence.

The second influence was my personal. I lost my mother to diabetes, and my father to cancer, in 2009 – about the same time we sold the company. So I decided that would become a significant portion of my effort, trying to fight these diseases using the things I know, specifically, quantitative methods. The use of data. I'm not a biologist, I'm not a physician, although I learned some things because I look at these things.

I started doing research in these areas. We developed a diabetes system in 2009, which we completed in 2013. Then we started a company with this objective, together with my student who had since graduated, I don't involve my students before. But once a student has graduated, then I feel it is OK if the student is inclined to start a company. The idea is we implemented this as a smart phone application, to help people deal with diabetes. Basically trying to advise people when to eat, what to eat, when to exercise, what exercises. We have already seen that it changes the life of certain people. You have to be committed to do it.

Another idea is to advise people on treatments for cancer . The idea there is the following. In 1970 President Nixon declared war on cancer. Almost half a century later and trillions of dollars, , the situation regarding cancer has not materially changed.. On blood cancers, we have made progress, as well as in an isolated, non-metastatic solid cancers, we have also made progress because we take them out. But only marginally in other cases.

I thought of the following idea: We have data on a particular cancer. The way research on cancer works in this country and in the world is the following: researchers around the world have seen some success with some drugs on some cancers. Then using intuition, they say "We have tried the combination of drugs (A, B, C), also (B,C) and (D,F). Perhaps we can try the combination (A,C,D). But doctors make the decisions on what combinations to use with intuition. But nobody designs experiments using the totality of human knowledge – because

nobody has it. The government does not have an inventory of what are the trials and their outcomes , it doesn't exist.

With 20 MIT undergraduates and several of my doctoral students, we actually developed such a database. This was in 2008. We developed, paper by paper, thousands of papers, we created a database. For example, "This is gastric cancer, this is phase 4 of advanced gastric cancer. This is the demographics of the people who were involved in this trial. These are the drugs that have been used and these are the outcomes." . So we created a systematic database. We then use this database to predict the outcomes. Given that the majority of clinical trials use drugs in different combinations that have been seen earlier, we use machine learning methods to predict outcomes of different chemotherapy regimens. And we have found we can predict fairly accurately the outcomes, thus saving the cost of doing it, and now focusing on the most promising ones.

Then we use optimization to say, let's say we have 50 possibilities of combinations. Which are the best 10 to try, as opposed to all 50? We aren't going to cure cancer that way, but we are going to be far more effective in the treatments. And we will learn faster.

We have received the 2013 award for best paper in health care. I am particularly proud of this award because of the connection to my father and the fact that it was collaborative work with three of my doctoral students.

G: It's what they're going to do for their careers.

D: That's right. They have been very excited to do it. That was an example for more recent activities.

B: Is the medical community accessing your database?

D: Somewhat, yes. At the moment, we are doing experiments, we are doing a trial in Nashville with a hospital there. We are going to start another one in the Cleveland area, and one in Massachusetts. At the end of the day, we propose things. We need to examine whether our proposals work in practice.

It's a long, long process to convince people who don't think this way. Doctors, they mean very well, but they don't think data, machine learning, optimization.

G: They don't have access to it. They don't have the understanding of the algorithms.

D: No, they don't. They don't think this way. But I have found enough people who are convincible. When they see the evidence… We shall see. It's a long struggle. But I'm very devoted to that. I would like to make it work. I am very exciting to apply analytics to medicine. As another example, take blood pressure, people who have blood pressure issues. Nobody knows what the appropriate drug is for you.

B: It's a trial and error.

D: Yes. But I absolutely believe – it's not a theoretical belief, I've seen it in the data – that looking at personalized traits of people, you can actually design appropriate meds for them, personalized. Diabetes, the same. It's a multi-drug therapy.

B: This is terrific.

D: I can stay for another 10 mins. And I've be glad to do more if you like. I'm at your disposal, really.

B: One question we always ask: You've had a lot of things that any faculty member would be proud of.

D: What am I the proudest of? My students. Recently I wrote a document, 3 pages. I am now 53. I wrote three pages reflecting on the years past, and where I should I focus on in the future. It took me a long time to write the 3 pages! [laughing]

In fact, the only thing I am particularly proud of is my doctoral students. When I meet them they are in their early 20s, and are uncertain of their future. Very intelligent, but it's not like they have a specific view of what their life is going to be. Affecting them, teaching them what is important, at least in my opinion. That's what I'm most proud of, Bob.

B: Do you help them with the employment?

D: Yes, I do. 60% of my students become professors. I have roughly 35 of my students are now professors around the country. Quite a few at MIT; I view it as my obligation to help them on that, regardless of where they end up, whether in academia, or in industry..

For example, the meeting I'm going to is one of my students who is graduating, and he's giving a talk and I would like to rehearse with him, so I will be able to help him on that given my experience. I view it as my obligation to help them.

B: That's one of the reasons they seek you out. They know...

D: I'm very committed to them.

G: I have a question for you: Do any of your students work for Google?

D: Three of them when they started. But they don't work with Google now.

G: Because if you think of analytics and application, you think of Google. They are going to have 3 million applications for 7,000 jobs next year.

D: My students observed the following from me, and this has influenced what they do afterward. I'm not a huge fan of large organizations. I have worked with large organizations. Google is perhaps an exception, but what I'm about to say is generally true in my experience. As the size of the company increases, because you need structures, the creativity and the inventiveness goes down. I have found this empirically. I don't have a theory about it, but I have loads of empirical data about it. Because we are in the creative and inventive business here at MIT, I tell them So as a result, many of my students are not too keen on these large organizations. Although some of them do. Some go with Goldman, so with McKinsey, etc. But the majority of them enter academia or smaller companies or start their own.

G: That's more the MIT model....

D: Yes. But it is definitely based on my own experience on these matters.

G: In your 25-year reflection, I'm curious on your thoughts about the impact of analytics on the MBA teaching here, and the MBA program. I know you've run a successful elective....

D: There has been a shift, from the moment I arrived here in 1988,to today. MIT, the Sloan School believed then, and believes now, that quantitative issues are important. It's a distinguishing characteristic of the School. I don't think this is a new realization. As a result, the course "Data Models Decision" the class I told you about, has been core then and is core now. But we didn't have as much success with electives. But now, like the elective I told you about on analytics, it attracted 120 students. It was the capacity of the room that was the binding constraint. In fact, it attracted up to 180 students. Now I have two sections and I teach both sections. This is going up against other, very popular courses...

G: But they are very constrained by the options they have for electives.

D: But this suggests that analytics, at the moment anyway, justifiably I would say, the world recognizes that this is an area of importance.... In my view, this needs to be a center for the School. In fact, we are in collaboration with the dean's office, we have recently launched a new Masters program in analytics for 60 students.

B: Is this a parallel to the MFin?

D: Yes, it could be a parallel and collaboration with the OR Center within the Sloan School. We are going to develop this area. And we will become, I believe, the predominant school in that field.

G: And that will spill over in the MBA program with access to the students. They won't make that full commitment, but they will have access to it.

D: That's right. So that's the hope, anyway.

G: Very exciting.

D: It's exciting, yes. This is a field in which I think the world has moved our way.

B: Does that move the Sloan School a little closer to the rest of MIT?

D: I hope so.

B: Because that's always an issue. And you've straddled it well.

D: Yes. In fact, among the faculty at the Sloan School, I am perhaps one of the closest to Engineering. I'm a member of the National Academy of Engineering. But what I have found is that, by and large in the main campus, the Sloan School is well regarded but perhaps it's not considered the central piece of MIT. Engineering is the main piece of MIT. If you look at the Institute Center – historically, not only now – with the exception of Howard Johnson, I don't believe in the last 60 years we've had anybody else leading MIT who is not from Engineering. We've had the occasional science, the occasional management, but by and large it has been an engineering-centered institution.

B: Jerry Weisner comes to mind...

D: But you would agree with me, Bob, that what I am saying rings true.

B: Yes.

D: We have had other initiatives. We have recently launched an undergraduate major in Business Analytics.

B: That's alongside Management Science?

D: To replace Management Science.

B: OK. A new major called Business Analytics.

D: I expect we'll have, out of a thousand – at the moment, MIT has about 1,100 undergraduates a year. I expect perhaps – and I may be optimistic, but I expect 10-20% of undergraduates in this new elective, new major. I would not be surprised on that. We shall see, but that's my expectation.

G: I think it's very appropriate. If a young person is going to major in business, then it ought to be the more technical skills, and they ought to be really well-equipped in that.

D: To give you an example about undergraduates., I told you I had about 20 undergraduates helping with the cancer database. I had 2 Wellesley undergraduates, 2 young women, and I involved them in analytics. They were teaching assistants in the online course. They did not know much about analytics prior to this engagement. One was a junior, the other a sophomore. They had difficulty finding jobs prior to the course. After the course, one of them worked at Google, the other at Amazon, and they were extremely well-received. In fact, it changed their lives. It wasn't intentional on my part. They were interested, I asked them. But I've seen the effect. The world has moved in this direction. There are many jobs that are very hungry for these skills. And at MIT, these are very smart kids, why not?

G: And young people can bring that. It's very technical skills.

D: In addition, you need some business experience to understand the impact, the organization....

G: But you need the math…

D: Yes, you need the math. And this is at age 22. So that's the hope, anyway. It's exciting.

B: As you mention this new major, do you have any thoughts as to why our minor in management has not been more successful?

D: I have some thoughts. [laughs] The world changed in the direction of analytics, but the minor in management did not change with the appropriate speed. For example, there is a tool called Hadoop to read big databases. We have to include it in the curriculum, and we have not done it yet I believe both at the undergraduate and the master level in Business analytics, we will change and adapt to the changing environment.

B: Well, we're right at the time. Your career here is just fantastic! I can see why you are so proud.

D: The students, really. Not me.

END OF INTERVIEW