DAVID ALDOUS

MATH AND STATISTICS

AT UC BERKELEY SINCE: 1979
PLACE OF ORIGIN: Exeter, England

DEGREES FROM:
B.A., Mathematics, Cambridge University, 1973
Ph.D., Mathematics, Cambridge University, 1977

CONCENTRATION: PROBABILITY THEORY
Exchangeability, weak convergence, Markov chain mixing times, random walks on graphs, random discrete structures, continuum of random trees

HISTORY:
Rollo Davidson Prize 1980
Institute of Mathematical Statistics Fellow 1985
Loève Prize in Probability 1993
Fellow of the Royal Society 1994
Chair of Statistics Dept., UC Berkeley, 1997—1999
Sc. D. (Honorary), University of Chicago, 2000
Fellow of American Academy of Arts and Sciences, 2004
National Academy of Sciences (foreign associate), 2010.

"In some sense, everything interesting about the future is uncertain. You can predict the times of sunrise and sunset in 20 years. But those are boring things. What's going to happen to you and me personally, the state of the world in 20 or 30 years…All the interesting parts of that are uncertain."

**Interview conducted July 20th, 2011 at David's Lafayette home.*

DAVID: David Aldous, a math nerd. As the accent shows I am from England, went through Cambridge University in the 70s, came to Berkeley as an assistant professor in '79 and stayed. So there you are. So that's the short version. I do mathematical probability, so almost all of which is not interesting to anyone else as a sort of technical speciality, you know. In recent years, I've gotten interested in what are the connections between what we think about and teach as mathematicians and what in the real world—I hate using a phrase like "real world," because what does it mean, but it's the best that I can come up with, you know. The math traditionally started with throwing dice and tossing coins, certain very special things like this the math works fine for, and that's why casinos make money, etcetera, but most of what we think about in life is uncertainty about the future, course it's nothing like casino games, and the issue is whether mathematics has anything to say about that. So that's hopefully the more interesting side of what I think about, but it's all stuff that I'm not actually any academic expert on, maybe nobody is an academic expert on.

Abby: Why might no one be an expert on that? Is it just too new of a field?

DAVID: It's not new. It's just too vague. In other words, academic life goes through things you can teach, things you can research on. That's all sort of…definite things. It's kind of like if you look at physics books, they say a lot about gravity and not much about friction. Even though everything you actually need to know about gravity for everyday life you say in a paragraph. Friction is much more complicated because it's sort of not amenable to nice math. Those sort of physicists tend to think of gravity or black holes or things that hopefully are amenable to math rather than lots of actual physical phenomenon. They sort of ignore it and say that's engineering, that's metallurgy, or something else. So there's a kind of selection. You want to teach definite things to students so you need to do research on definite things and not on rather vague things.

Abby: So what are you working on, what have you been working on most recently?

DAVID: The technical stuff I do tends to be, again…hard to explain. One background is the theory of algorithms, the rules by which computers actually do things. The software people are actually writing code. The code is the actual thing but there's some algorithms and logical rules that the code is implementing. And some of the algorithms, both the sort of routing of the internet at one very practical level but even more, all the mundane things an operating systems does like being able to find a file when you ask for a file. Somebody at some point had to think about efficient ways of doing that and the first ways you think of tend not to be the most efficient. So there's some rather elaborate theory. The theory is probably much more elaborate than what's actually being used but there's elaborate theory on how to keep the million or so files that everyone has on their laptop. Most of them you

don't actually see because they are part of the inner workings of it, but it's how you actually organize those so that you can find things when you need them. So that's one area of technical work.

Mostly mathematicians are sort of playing around and not doing anything very real. You are setting up rules for how hypothetical systems might work and you are then trying to see if you can mathematically prove what their behavior's going to be in terms of the given rules. So there's a big difference. So if you think about something like chess, there's a difference between understanding the rules of chess and understanding how chess actually works, how to play it well. So mathematicians tend to study systems defined by a few simple-sounding rules and then try to figure out what happens when you actually run the system.

Abby: So, you write a bit about the everyday applications of probability and perception.

DAVID: Yeah, so that's probably what's more interesting to talk about. And I got into this about 10 years when without thinking. I sort of volunteered to teach a course with this title, "Probability in the Real World," without having any plan of teaching something 9 months in advance, and then sort of realized that it's much harder to think of what to say in such a course. Teaching mathematics, the mathematics somehow…teaches itself isn't the right way of saying it, but because it's a logical structure, you have definitions, and theorems, and proofs. And they may have been hard originally for anyone to work these out. But once it's there, there's a sort of a logical structure you can go through and the stuff itself is somehow just there. It's like teaching someone how to build or repair a car. The car is actually there. You don't have to invent it. Trying to think broadly about probability in the real world, it's much less clear what it is you want to talk about. It's easy to think of the 10 standard things academics know. But the issue is how much more is there, and the standard things are always done by oversimplified models so in terms of what the mathematics tells you you can actually get money on if the predictions are accurate, it's much harder to find good examples. One of the fun things I thought about and got data on is, so if you want to know in what context ordinary people in everyday life think about chance. So that's probably the interesting question. 15 years ago it would have been very hard to think of any way of answering that other than by going and trying to ask people. And then you kind of have the elephant problem. Because if I want to know in what context you think about elephants, somehow it doesn't work to just ask you in what context you think about elephants because A) you don't know and B) I sort of put the idea into your mind and that maybe biases it. So to figure out in what context people think about chance, we now have sort of two ways of doing it that we didn't have 15 years ago. First, you can search people's blogs and you see where, on their own initiative, where words of chance come up. So we have some data on that. And also because I spent a year away at Microsoft, the year

before the immediate past one. I got someone to give me the file of all the 100,000 queries ever made to the search engine Bing containing the phrase "chance of" or "probability of." Search engines keep every query they ever made. They are somewhat anonymized, at least in what they gave to me. It wasn't identifying a person. Obviously they need that to see how well they're doing. Google and Bing are sort of interested in where you actually go on the internet after you've typed in a search phrase. Both to make their searches better and because they are selling the advertising. So all of this is kept a record of, somewhat anonymized.

Anyway, so you have this data, so you see what people care about. And of course it's very different from what we teach in textbooks on math probability. So it turns out that about half the chance queries have to do with health and medicine broadly, later, and about half of those have to do with birth control and pregnancy, so you know all this stuff is funny because once you see it, you realize what's going on, or at least you guess this is a kind of middle of the night panic. In the middle of the night, you actually want to know something because you're going to a search engine rather than something else. Then there are actually sensible questions about cancers. If you are diagnosed with a certain cancer, what are the chances of surviving. So you have sensible questions and you have then totally off the wall questions.

Academics don't do research on this because it's hard to know what the actual bottom line is. So to me it's fascinating to just look at this. It's like looking at a picture, but you don't get tenure thinking about this stuff because what is it you could you say about it that would impress anybody? That's kind of the advantage of being old in the academic world. You can do what you like and not care if other people think you're crazy. People sort of think I'm crazy doing this. Always people on the math side, because it's not math. But I don't care.

On a philosophical level, once you start thinking about it, it's very hard to figure out. In some sense, everything interesting about the future is uncertain. You can predict the times of sunrise and sunset in 20 years. But those are boring things. What's going to happen to you and me personally, the state of the world in 20 or 30 years…All the interesting parts of that are uncertain. Yes, sometimes we think in terms of chance and sometimes we don't think in terms of chance. And the more you think about this, the weirder it is.

Abby: You mention that you see a problem with the everyday claim that the position we are born into is a matter of luck at all. And I thought that was really interesting, something we take for granted.

DAVID: Oh. Ok. You're now getting into the very philosophical, speculative philosophy. People argue endlessly about what, philosophically, what is probability? What does it mean when you say that something has a 70% chance? So there are endless arguments about this sort of stuff. My take is that there has to be a person, an actual person, saying this, or at least a hypothetical observer saying this, for probability to make sense. So even though, in an informal sense, we all say that we're lucky to be born in the West in the 20th century and not in some other place in some other time, the trouble is that then we wouldn't be ourselves. So there isn't actually a person able to make this probability assertion about something that isn't known. So, I'm sort of claiming that things like that don't really make sense, except in some informal sense. And one thing, again, bizarrely, that philosophers do actually attempt to talk seriously about is the simulation idea, which is that…Ok. So we're now backing into weird stuff. In jargon, the Fermi Paradox is that we actually have, we see no evidence of intelligent extraterrestrials with technology. So, the sounding point is just there's no general accepted evidence of any technological extraterrestrials out there. Cuz, non technological ones you wouldn't have any evidence of, so that kind of doesn't count. So you now have various explanations of this. And there is a very fun book, actually. It goes through, in a sort of serious and popular way, 50 possible explanations for this. And it comes down to, what it really comes down to, is either the actual evolution of humans or intelligent technological species that happened on earth, maybe this is just such an incredibly unlikely thing to happen that it only happened here.

So that's one possibility, which people take seriously. Scientists are predisposed not to like that. Because they don't like/want to think of things in terms of unlikely things as having happened. Scientists like to think that well, ok, obviously earth may be special in some ways but it can't really be that special. Since the universe is a huge place, for that to happen on earth, there should be something similar happening in other places. So basically it comes down to either earth is incredibly special or lucky that intelligent life didn't arise anywhere else or, of course, it did arise somewhere else and we just don't see it. Now you can have great fun speculating on how it might be that there are some technological civilizations out there that we don't see. Pessimists tend to think, well, they just kill themselves off by nuclear war or climate change or whatever the currently perceived threat is. You can have huge numbers of science fictionish ideas. So Science fiction itself has lots of ideas about this and scientists have other ideas. And it's all pure speculation.

So I was off on a tangent. I was going to get to one of these sort of crazy and philosophical things, which is that most of us think there's some chance of there being more advanced technological civilizations out there. So if you assign any chance except zero to that, you then get the idea that since we can do rather crude virtual reality simulations, they'll be able

to do essentially perfect virtual reality simulations of anything they like, of any artificial universe. And again, we can run millions of things, they'll be able run billions of things. So now we have this issue. What we see here could be what we think it is or we could be in a simulation run by extraterrestrials. You now have a math calculation that somebody is trying to do this with probability. Somehow, whatever the probabilities are, because they could be running billions and billions of copies, you could do a sort of hand waving argument that says we are much more likely to be in a simulation than in the real world.

Now, of course arguments like this are of course ridiculous, but the philosophical issue is why exactly are they ridiculous? It's less hard to pin down why they're ridiculous. That's something that philosophers do actually think about occasionally. But again, my answer is somehow, in order to think about probabilities, you really need some definite standing point relative to what you know or what you assume. So kind of comparing two different possibilities. In some sense, it's just a more fancy smoke and mirrors version of just asking, how do we know that we are awake and not dreaming? We actually don't. But it just isn't useful to go through life thinking about the possibility that you're just dreaming at the moment.

Abby: How important do you think it is to collaborate with others?

DAVID: Mathematicians have switched, kind of over my lifetime. One could probably look up data, but I'm guessing a bit. Probably about 25 years ago, they kind of crossed the line. These things happened slowly of course, but before 25 years ago, most math papers would have been single author, and now it's switched over to most math papers being collaborations. The combination of email and TeX system suddenly made it, on this mundane, practical level of writing and editing, much easier to first write longer papers and collaborate with other people. I'm a bit of a cynic. Somewhere, I actually have it at work, I have a little fridge magnet with a picture, a sort of cheerful 1950s style housewife saying, "Drink more coffee, do stupid things faster with more energy." So that's actually my metaphor, because it's easier to do this. Things happen more quickly but they tend to be small variants of other stuff. So there's vastly more papers being written. You also have the arXive. People write papers and they immediately post them somewhere without them having gone through peer review or an official publication. So all these things mean that the number of papers written a year has probably gone up by a…I'm exaggerating, probably gone up by a factor of 3 since I started in 79, even though the number of people involved has probably has gone up a little but it hasn't gone up so much. So roughly speaking, I think there are twice as many papers per person being written than 30 years ago. But, it's kind of…The average paper is being written twice as much. There aren't twice as many good papers. Maybe because there is more communication. There's some fine line between

slightly new ideas and really, really new ideas. That is, an idea comes along, someone has an idea, and if there are fairly natural consequences of it, then in modern life, it takes about 2 years for someone to think of the consequence of someone else's work rather than 1 year. So, on this fairly small and incremental scale, things happen more quickly, but also the really important ideas are the ones that don't just follow from other ideas, they are sort of new thoughts that are not immediate consequences of existing stuff. And somehow the modern technology doesn't do anything to make completely new thoughts come out more quickly. To some extent, it actually mitigates against it because you have all this sort of bustle of activity and you have less of the being able to sort of sit quietly in your study and think about new and different ideas. So I'm a bit of a skeptic about to what extent the modern way of doing things actually makes theoretical knowledge grow. I'm skeptical about the technology actually helping with important new conceptual ideas coming along. I think with anything, with any level of practical development it helps, but with the beginnings of ideas, I think it doesn't help.

Abby: Now, do you find that you or other professors in your community are consulted by politicians in any serious way?

DAVID: Right. For a typical mathematician, no. I'm in the Statistics Department so people on the statistics side who want to get involved in consulting can do it, and there are various levels. On the governmental level, yes, several of my older colleagues have been involved in this ongoing census adjustment debate. So basically, every 10 years there's a census and every 10 years there's some argument about…we sort of know we're missing 1% of the population and you also have some idea of the types of people that you're missing. So, the answer then is that you can do a statistical adjustment trying to guess as well as you can who you are missing. And of course the words of the Constitution, whatever they are, kind of refer to an actual count. So you have constitutional issues as well as the arguments, of course they are all self-motivated particular arguments. Nothing's of any principle whatsoever. So there's an actual sort of political fight based on political self-interest of the Democrats and Republicans. This fight is sort of disguised as sort of legal and statistical and constitutional arguments.

If you ask a statistician, in fact one of my friends in England proposed this and of course got shot down, it would work much better to run the census as a sample. The actual idea of trying to count everybody, from a scientific point of view, is a kind of a crazily inefficient way to doing it. One of the best rules of statistics is that, you know, a smaller amount of good data is much more useful than a lot of bad data. So, making an effort to randomly sample 10% of the population and ask them a lot of questions…it happens at the moment that there is a short form and a long form on the census, but the information on the short form, somehow you don't need to send that to everybody. You can get just as much information if you send it to 10% of the population. And again, with the long form, it's effectively doing this random sampling all over again.

Yeah, so we are not on the government's radar. Math is so small in the science community. The money in the sciences is kind of in the labs. More than half of science is biology and medicine, so the high school course listing, where people typically said sort of math, physics, chemistry, biology, in that order, kind of has it exactly backwards in size and prominence. All the science is in biology and medicine. Physicists have sort of conned people into supporting their big cyclotrons and things and spending lots of money on that. There's money there. Whether it's the best use of money…like the manned space program is a sort of a vast waste of money…from a scientific point of view.

Math departments are like kind of like dentists. People recognize they're necessary so you actually…There is no particular motivation to anyone with a dental school for saying, oh let's save money and close down a dental school or something. So math departments trundle along because sort of everyone just perceives they are part of the background and doesn't pay too much attention to them, mostly.

Now things have gotten more interesting. So I say, sort of humorously to my graduate students, that Luke Skywalker only had one dark side to tempt him, but you are going to have 3 dark sides. So, one is sort of hedge funds, of course, all the math finance, or Wall Street. The second one being Microsoft, Google, Facebook, all that world, which uses…Google's based on algorithms, so they are sort of more serious about math than IBM or AT&T were a generation ago. And thirdly, the world's biggest supplier of mathematicians. Can you guess? The National Security Agency. Nobody knows of course, by nature. The National Security Agency sort of has an immense amount of mathematicians doing that. I humorously call them all branches of the evil empire, especially when I was

working at Microsoft, of course. (wild laughter)

Abby: Ok. Versus global evil, how can statistics help alleviate global needs? How is it working on a large scale?

DAVID: Oh, ok. Well, you can try and keep people honest. Right. So, the best, the good side of statistics is to try and actually put good objective data on the table, which politicians in some sense are maybe better than the press makes them out to be. It's easy to have political rhetoric that doesn't pay any attention to actual data. So, talks about taxes and the budget and what the government should spend money on…but you actually need some factual information on what the government *is* spending money on. And you know, most people have a very bad idea about what the government spends money on. So it's just sort of very….putting actual data up on the wall of a room and you're discussing anything like this is I think the best social service that statisticians can be dealing with. So the positive side is just this sort of boring reminding people of factual information, as a background for whatever arguments they might want to be doing.

Another book I don't know if you've looked at is Taleb's Black Swan, which is kind of his, amongst other things, is his very opinionated and fun to read books, whether you agree or disagree with the author. One of his themes is that people have over-sold the ability of mathematics and statistics to predict the future. People make predictions that you don't have any particular reason to believe are right. Historical retrospective analysis shows that people are really bad at predicting many interesting things that they try and predict. Since mathematical and statistics ideas started being developed 100 years ago, the sort of smart people who invented this were perfectly aware of the limitations and perfectly aware that they were sort of doing things that were oversimplified or worked in a particular context but wouldn't work more generally. But when things start getting in textbooks, they kind of get treated like the Ten Commandments. There are things that are not universally true. There's an awful lot of bad academic statistics out there which is kind of not getting the point of….or sort of based on professional statistics rules for doing things that are only really sensible in rather specific circumstances. So, yeah. The statistics practitioners somewhat over-sold its ability to

predict what's going to happen in the future. That's on the bad side of things.

Abby: What would you say is on the frontier of math and statistics right now?

What's the new big thing or the next big thing? Or is it not like that?

DAVID: My bit of it isn't like that, I'm afraid…What I do on the technical side…again, too technical to make much sense…One thing I say, what would win you a Nobel Prize, if you could work it out, is to simply ask, again, we're going back to there are lots of math moguls in the stock market…So you actually have data on what the typical daily fluctuation of S & P 500 or whatever your stock index is, and so for mathematicians, you just take that as given. But the scientific question is why are the daily fluctuations of the size they are and not three times bigger or three times smaller? And that's something that no one has any motivation to ask— it won't make you any money. If it's going to make you any money, you would have figured it out. It's like asking why is the average temperature of the earth's atmosphere what it is and not more or less? Scientists never had any reason to think about this until eventually they think about how hot Mars and Venus are. At that point, you realize that Venus is very hot and Mars is rather cold. You say, wait a minute, so why is this happening? And in particular, why is earth this temperature and not so much hotter or colder? Of course people understand that. Earth, there is a scientific explanation, but the stock market fluctuations, there's this sort of…You have competing stories of rational response to information about the future versus animal spirits, emotion, and momentum, and psychology here. But again, none of these sort of gets to grips with this basic numerical question: why are fluctuations this particular size and not bigger or smaller? So, again, more intellectual questions that nobody knows how to think about.

Abby: What would you have to say about the curriculum [at Cambridge]?

DAVID: The British system is a bit…it's hard to say the word, but it had more of this long-term air to it. It's a long-term process of learning to do something, rather than the checking off the boxes approach. And in my time, there was still some air, I mean it's probably fading, but the kind of traditional Oxbridge, traditional probably meaning the first half of the

20th century, emphasis that you kind of spent your mornings working, your afternoons playing manly sports, and your evenings sort of drinking and discussing philosophy. Somehow it just wasn't the engineering nerd idea. So it was somehow this different view of college life. We went to two hours of lectures a day and we did our work for another two hours. The sort of default picture of how much you were working was sort of 4 hours a day. So even the people that worked a lot harder, tended only to be working for about 4 hours a day. And again, the Cambridge ethos was still that you were actually expected to have intellectual interest outside of your actual courses. It wasn't a trade school. You were going there for intellectual development, and of course the main part of that was actually doing a particular subject like history, but someone who showed no intellectual interests outside their subject, i.e. the engineers, were looked down upon, you know. The engineers were stereotypically regarded in that way, and no one else kind of wanted to be lumped in with the engineers as having no intellectual interests outside their own subject. Yeah, so then you actually had fashions of attending lectures, on architecture, or whatever. So this was, in some sense, I think that it's a lost world. I don't think that it happens in Cambridge anymore. So it was a different atmosphere where people either were or pretended to be or ostentatiously pretended not to be kind of interested in general intellectual things.

If you're doing philosophy in Cambridge, you'd actually, you'd be doing one thing a week. So you'd go to whatever, as many lectures as you cared about, but your only actual duty was to write one essay a week, and then go on to a professor's study and have to sort of read out, you'd basically have to read out your essay to them and have them comment on it. It's both, it's good. It's labor intensive and maybe not an economically viable system. But firstly, you can't bullshit. American students will try and write essays on bullshit, but if you actually know you have to read it out to the professor, you know you can't bullshit. You can't talk about things you don't really understand, because if you do, you're going to get a question about them. So, on the humanities side, a good system. It's a good system for producing future professors. On the math side, the math was kind of right or wrong, so then the personalized feedback was less useful somehow, but it worked anyway.

My theory is if you were setting up a colony on Mars, you'd choose some very different. If you're starting with a blank slate, you'd choose some very different educational system from the one we have now in many ways. Whether it would be better or not is a different question.

So far, universities have segued from finishing school for the few to something you want 50% or more than 50% of the population to go through. And there's just this vagueness about what universities are supposed to be doing. If you really write down what you want universities to do, it's very hard to figure out. The view, there is a clear notion of technical training for a particular profession, and mostly of course, universities don't do that. Pre-med or pre-law, they're not…The professional schools are doing that but universities are not, and if you have an idealistic view of general

intellectual capabilities...but to me, the connection between the system of teaching a course on a subject as a self-contained entity, the connection of this to any conceptual assertion about what universities should be doing just isn't so clear to me. So you can teach people about anything from medieval history to evolutionary biology. People are reasonably smart, intelligent. They can learn it and pass an exam on it. But then the issue is, what's the cumulative effect of 32 of these courses? And to what extent the cumulative effect of what actually happens corresponds to any articulation of what you want to have happened just isn't clear to me. Maybe it's just mathematicians liking things in more black and white. But I kind of think that universities are what they are because of some historical evolution, and again, I think if you were trying to start off with a blank sheet of paper and think of what do we want to do with people between the ages of 18 and 22, I guess I don't think you'd come up with the modern university. Who knows. The cynical view is that we don't actually have…you have the economy organized so there aren't actually jobs for these people. It's keeping them out of the job force.

Abby: So, it doesn't sound like you think there's any duty to learn...

DAVID: I'm more thinking about the big picture. You take courses and you learn stuff, but then the issue is in order to think about what you should be learning, you then have this…Are you judging this by sort of practical issues, or by tangible practical issues, or getting a job or things you are going to use somehow later in life, are you judging it as sort of developing intellectual curiosity, developing knowledge for it's own sake? There's just, in my mind, some sort of incoherent mixture of these things.

There is a sense in which people who teach medieval history, I think, are conscious of the fact that most of the people taking their classes aren't going to go on to be academics doing medieval history. There is some sort of a general intellectual interest reasons you are teaching this. Mathematicians, I think, are sort of less consciously aware of it. Or they are consciously aware of it but they sort of don't take note of it. Mathematicians tend to teach undergraduate math as a logical prerequisite to graduate math, which is a logical prerequisite to teaching math. And they do this sort of automatically without thinking that most of our undergraduate math majors aren't going to become mathematicians, and so what should we be

teaching them with that in mind? And colleagues are very reluctant to start thinking along those lines, partly because they have no idea where it'll lead.

Abby: It's kind of radical.

DAVID: Well…with me, I just like a clear alternative presented by students. The other thing about students is…why are undergraduates actually at Berkeley? So there's a kind of switch. If you ask somebody who's in law school or in med school why they're there, they'll answer that with, 'Well, I want to grow up to be a lawyer,' the obvious reason. But they actually have some definite reason. If you ask someone in high school, the right answer is, 'Duh.' You know? They have to be in high school. It's just part of the system. So where does undergraduate school fit in this scale? I think, for most of Berkeley students, it's this Duh answer. Mostly they're there because that's part of the system. They were good in high school, and everyone expected them to go on to a good college, and Berkeley was a good college.

So, I occasionally…It's not my job to grill students about these things in office hours but occasionally I do anyway. Yeah. That's my impression. They might have thought about Berkeley rather than some other college, but none of them have ever thought about whether or not to go to college. It's just sort of a natural progression. That they're there because it's the thing to do. Whereas in my time only 10% went to university at all. And if 1% are going to Oxford or Cambridge, then I think there was more of a definite reason. It was more like med school and law school, nowadays. Again, if you go to law school, you actually at least think you have some interest in doing it. You don't actually have to have an interest in anything to go to Berkeley. You have to declare a major eventually, but your first two years, you can just go there because you're academically good. So people are just going with the flow.

Abby: Now, how competitive do you think it is, in your career and academia? Is it fairly altruistic, and harmonious, and civil?

DAVID: People worry about getting tenure. And again, people worry much more than they should. Some of the Ivy League places basically have a policy of never giving anyone tenure, but you kind of know that when you go. So, it's kind of…unless you have some totally unrealistic assessment either way of your abilities, you kind of mostly you know if you're going to get tenure or not. So people stress about it unduly. Yeah, once you're established, generally there is some feedback. At the research level, people who are motivated by research get to go on doing it. And, by the time you get to mid-career, you either have gotten enough positive feedback and appreciation from people and invitations to give talks

at conferences, etcetera. If you get a lot of those, you are happy with your career, but if you don't get those, then you are unhappy and feeling unappreciated, at which point most people kind of just taper off and go on to do other things. So by and large, it's somehow self-regulating in some modest way.

Of course the lab sciences now have this terrible situation whereby sort of once you've made a reputation young, once you get to mid-career, you're running a lab which means you spend all your time writing proposals to get money. You're unlikely doing any of the science. Your post-docs are doing all the actual science. So this is kind of a, you know, a terrible system…It's kind of a crazy way of doing things. But anyway, math is a totally different world. Partly cuz mathematicians don't actually need money. In the humanities, of course, as you know, there isn't any money. Somehow, you kind of have…there's some sort of different form of competitiveness. The Little Miss Sunshine Second Best Proust Scholar…You have the personal competition there, which is, according to the stereotype, more prevalent in the humanities than in the sciences.

A minor fun thing…I'm in the Royal Society of the British Scientific Society. So, you have to imagine the Hogwarts book of spells, this sort of giant thick book with the old leather bindings, and every 50 years they take off the cover, put in 50 blank pages and seal it up again into a thicker book. And each year, the new fellows get to sign their name in there. So you get to sign your name in the same book that Isaac Newton and King Charles the II and every other scientist you ever heard of has signed in. That's cool. It really is. It gives you this sort of sense of tradition. I often say that not one person in a hundred knows who the CEO of the world's largest corporation is. In one sense they're important, but nobody has any idea who they actually are now. Scientists have some hope of fame. They've heard of Isaac Newton.

Abby: So, along that line, what purpose do you think it serves, this tradition of giving awards and receiving them, and how is that important in the academic community?

DAVID: Oh, that's a good question. There's this wonderful book. I don't know if you've ever read the book *Bobos in Paradise*?

Abby: Oh, I love it.

DAVID: There you are. It's wonderful. And the academic things are so accurate. There's a page there on awards. And it's exactly right, and it's appropriate to me cuz I actually run one of the main awards in my subject via some weird chain of coincidence. There was a professor, Professor Loève, who had been at Berkeley for many years and died just before I came in '79, and I in fact thereby inherited his office because nobody wants to move all their books. So, I'm in his office. He had a long and happy marriage based on him being in Berkeley and her being in Paris. They were French. He went back in the summer. So he died and around 1990, his widow was diagnosed with cancer and given a year to live, and decided…In England and America you can write a will and leave your money to whoever you like. In France, this is very hard. There's this Napoleonic Code, it's basically kind of expected that you leave your money to your children, etcetera. Even if you write a will saying no, they can challenge it. So she didn't get on with her son, so she decided she'd leave money to us in Berkeley, but because of this legal aspect she had to kind of physically get rid of the money before she died, so it wouldn't do him any good to contest the will after she died. So yeah, she gave us a million dollars, half of which is sort of supporting graduate fellowships and half of which is, again, establishing a prize in our subject.

And bizarrely enough, I was the first winner of this prize in '93. So then the guy running it, another Frenchman, somehow devolved upon me without…it's actually there are some legal authorities administered by the Berkeley administration. Anyway, regardless of any legal niceties, I run it, and I'm firmly of the opinion that anything that can be run by one person should be, rather by committee. So I don't actually, I don't choose the winner, but I sort of basically appoint a committee of people to vote on a winner. I sort of behave totally dictatorially. I say, you're gonna do this. I tell them, I want you to vote on this, and I don't want you to argue. Anyone who argues, a one strike rule, anyone who argues or doesn't follow instructions is thrown off the committee and not used again. (wild laughter) It works well. I just think this works better than any other system.

You know, the other thing is, there's once every four years a worldwide international congress of mathematicians, which is sort of the real big deal. And being one of the main… where they both give the field's medals and Nobel Prizes, as well as just being invited to be a main speaker there is a big thing. But that's done by committee, and somehow it's a sort of a painful process and you have committees saying, well, isn't it this person's turn or you didn't pick enough people from that country. Somehow it's a very tedious thing to be involved with. It never comes up with the right…There's this old line about the camel being a horse designed by a committee. In other words, what the committee comes up with is worse than what any individual person would have come up with, because of the compromises.

Right, so there's a kind of competitive issue here. So there's a dean of physical sciences, so math, and stats, and physics, and astronomy, and earth sciences, so he has five or six departments in him. And if now he sees that people in some of these departments are sort

of getting lots of prizes and awards and others are not, then there is somehow a natural reaction on his part just to sort of say, these are doing well, so I've got more money and resources for them. The point is that there may be more prizes and awards in those subjects. So, for a discipline like math, somehow the more awards and prizes there are in math, again it may sort of devalue their worth within math, but it sort of increases the prominence and visibility of math to deans or to other people that are comparing departments. It kind of looks good on your website when you say our faculty has won these awards, etcetera. I just had a fight with our people about how much of this stuff we should be self-promoting on our website. I don't believe in all this, so I don't like too much of this stuff.

The same goes within a department. Because in the math department, math divides itself into 3 or 10 or 100 subfields, depending on how finely you want to divide it. But when there is a job up, there will maybe be three serious candidates in different subfields, and there is some argument about which one to hire, and now again if one has won a prize and one hasn't, it's hard to say that that has no effect, but again it may just be because there is a prize in this subfield and there isn't a prize in that subfield. So, again, there is competition between subfields. There's an advantage in having prizes. So they exist partly as competitive necessity and partly it's sort of nice to honor people. It's kind of an excuse to honor people, partly it's making people feel good.

Abby: Do they practice affirmative action at Berkeley? If it's a matter of public record…

DAVID: My sarcastic view is that…it's kind of like the Christian doctrine of the Holy Trinity, God is one and God is three at the same time, so we both do and both don't, we simultaneously do and don't. You know that you have somewhat conflicting federal and state laws on this sort of thing. California has state laws that sort of prohibit consideration of race and gender in hiring, but affirmative action laws at the federal level are saying something subtly different, that you have to make a positive effort to kind of make sure that women and minorities are in the pool of candidates that you are actually considering. So there's a tension here. You know, most of the mathematicians are a bit cynical. In Soviet Russia, you had to pay lip service in Marxist-Leninism when you were teaching mathematics and people paid to have lip service, their dean told them to, and ignored it the rest of the time, but…So there's the, there's a cynical view is that there is always some sort of tax from society on political correctness that you need to pay attention to.

But putting aside the cynical view, here's the bottom line. There are the various cultural pressures we all recognize that traditionally have reduced the number of women and minorities in math and science. Almost nobody objects to the principle of trying to counteract these pressures, but it's the bureaucratic hassles involved in conforming to rules that create the cynicism. In my Stat department, we have maybe 5 out of 20-odd faculty being women, and they're all perceived as having been hired on merit, not because of affirmative action. As for minorities, at the faculty level there are so few that it's not on the radar.

Abby: So what's ahead of you? What would you like to do before you retire? Do you think in those terms?

DAVID: I'm getting old and slow. I'm conscious of it. No, until very recently I had a very firm mental image of myself as 29. Yeah, so I have some technical projects, again along this line. I like to think about things that no one else in the world is thinking about. I don't think I mentioned that before, but yes, my research style since I was young is this sort of intellectual curiosity style, so instead of working in fields that other people are working in, it's more fun to try and create your own little idea, these are very little fields of course. So some of the things I've worked on, one of the initiators of, have become little fields within math probability. It's just more fun to do that, so I have a couple of projects along those lines. I sort of just say, here are an interesting set of ideas just to think about, the first interesting thing to go on in the area and then encourage other people to work on it. It's more fun to have minions doing your actual work here. Again, the probability in the real world stuff is sort of more what…I humorously started referring to this as my retirement project when I wasn't thinking of retirement at all. Now, I'm getting…now I'm no longer 29 and retirement is a little more than a vague theoretical possibility. Yeah. So it's sort of writing that up and putting it out there.