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## **Session 13TS**

### **Futurism 101**

**Track:** Futurism  
**Key words:** Futurism/Forecasting

**Moderator:** PETER C. BISHOP†  
**Panelist:** E. TOM HUGHES

*Summary: This session is an introduction to common Futurism techniques, including examples of how actuaries can use these techniques in their day-to-day work. The new Futurism study note provides the basis for this session.*

**Mr. E. Tom Hughes:** I'm the Chairperson of the Futurism Section Council of the Society of Actuaries. This is the third Society meeting at which Futurism 101 has been presented, and it reflects the Futurism Section Council's belief that our principal effort, given our state of affairs these days, should be directed at delivering basic education about futurism to actuaries interested in this subject. This, in turn, is a reflection of the simple fact that futurism is not a part of the basic training of most, perhaps all, actuaries, other than a modest and aging study note in the syllabus. We're starting to rectify that, with the Education and Examination (E&E) Committee of the Society having accepted a new study note on futurism co-authored by our panelist, Dr. Peter Bishop, and Alan Mills, another member of the Futurism Section Council.

The most recent edition is up to 125 pages. I suggest and highly recommend this study note to you. It has some very interesting and updated reading on futurism and its application to the actuarial profession. I'd like to help set the stage for Dr. Bishop's presentation by giving you my views of some basic definitions and some assertions about futurism. First, what is it? And why is it important to actuaries? There are many definitions of futurism. The one I like is very straightforward. It

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†Dr. Bishop, not a member of the sponsoring organizations, is Chairman, Graduate Program in Studies of the Future for the University of Houston in Houston, Texas.

says, "Futurism is a structured approach to studying the future or thinking about the future for the purpose of identifying possible and perhaps likely outcomes." Note the absence of the words "forecasting" or "prediction."

Second key point. How is futurism different from traditional actuarial science? Actuarial science, as we've grown to know it, usually involves demographic and financial variables whose future values are predicted by a deterministic or stochastic means. Single-point estimates are often the output of traditional actuarial predictions. On the other hand, futurism can include the above, but also includes recognition of other variables that are perhaps softer. For example, there's human behavior, socio-economic factors, state of future technology, and so on. Ranges of possible futures are the usual outputs of futurism techniques. Those are some ways to make distinctions between the two types of disciplines.

The third key point I'd make is that I said that futurism is a structured approach to thinking about the future. What sort of structure is there in futurism? The structure of futurism enables one to best identify all the variables pertinent to the future being studied. Identification of all the relevant variables is one of the objectives of futurism. Second, having identified all these variables, the intent is to describe their future behavior as far as possible in quantitative terms using techniques that are the tools of futurists. Dr. Bishop will describe some of those tools.

Finally, why is futurism important to actuaries? First, if you're performing traditional actuarial functions, your work product can be enhanced by the identification of new variables that may affect basic actuarial functions such as premium calculations; or you may identify second-order variables whose future behavior may significantly impact the behavior of first-order variables pertinent to the actuary's work. We argue that you are a more complete traditional actuary if you're aware of futurism techniques. Second, some actuaries are in positions in which they're responsible for the operations of a functional department, a business unit, or an entire commercial enterprise. Managing such units effectively often calls for understanding what the future may hold for the business. The techniques of futurism, or futures thinking, are clearly of importance here. Consumer demand for my product, potential future regulatory impacts on my product, and changes in the way my product is distributed to the public are all critical variables affecting the future of the business. Futurism techniques can help identify the critical variables and quantify them, prioritize them, or otherwise describe their behavior in some structured way, so that various futures can be described, evaluated and, when appropriate, reacted to. In other words, there is a deliverable here—management can take action after the application of futurism techniques.

There is a final point under the importance of futurism to actuaries. The proposed new education system for actuaries to be effective, hopefully, within the next couple of years, has as one of its principal themes the notion that the actuary of the future “should have a full complement of modeling skills and techniques.”

“Modeling is a very powerful tool with potentially significant applications to a wide range of business concerns.” Those are quotes from the committee report recommending the redesigned actuarial education program. It’s my feeling that modeling is also a structured approach to dealing with the future and can be thought of as a form of futurism. But the important point is that knowledge of futurism’s tools and techniques will make you, the actuary, a better modeler and, therefore, a more effective actuary of the future. Those are my thoughts on futurism and its relationship to actuaries.

I’d like to now turn the program over to Dr. Peter Bishop, who is head of the Future Studies Program at the University of Houston. Peter has been actively involved in helping the Futurism Section Council achieve our objectives in designing basic education programs. Futurism 101 is one of those programs.

**Dr. Peter C. Bishop:** As Tom said, this is the third time we’ve had the chance to offer this session. We presented it in Orlando at the annual meeting and at the Palm Springs meeting. It is a particular treat to me, because I am working full time in the futures field, to meet and discuss futurism with you. I have to tell you that you’re the people that I talk about when we tell what futurism is because when most people think about the future, they think of actuaries. They don’t think of futurists. They think of complicated computer models and all kinds of calculations and things that are very esoteric that give them the answer about the future. Now, you know that’s not true. You know that you don’t do that. But, that’s what they think you do. So part of my job is to correct that impression. Second, I must offer them a slightly different interpretation of what dealing with the future is about. We are all futurists of a sort, but we are different types. It’s nice to be able to present future studies to the Society and to actuaries in general as what I believe is an important and complementary set of skills.

We are really dealing with two sets of problems. One set of problems is relatively tractable. In that set, we can use the techniques that you know and that you use every day. There are other sets of problems that are generally intractable, and for which those techniques, you know better than I, are generally inappropriate. Up until now, we have let those things go. We’ve said that dragons lie out there. We don’t want to go out there in the deep ocean because we don’t know what’s out there. We don’t know how to deal with that.

Our principle is that knowing something about the intractable future is better than knowing nothing. We do work at trying to understand those things for which these specific techniques of demographers and financial analysts and market research people and economists and all those who use the very sophisticated tools are simply inappropriate.

Let me begin with a little bit of an introduction to futurism. You'll read much more of that in the study note, which, of course, I recommend to you. Most of the presentation gives examples of some of the tools that we use in future studies that I think might be appropriate for you. We have the opportunity to, literally, touch the surface of these. But I hope they'll stimulate you to ask questions.

I actually use the terms prediction and forecasting, but I use them in a slightly different fashion. We tend to believe in prediction as largely the kind of single-valued, clear assumption, more scientific kinds of statements about the future. Forecasts tend to be statements about the future that are less sure and less scientifically valid. Though they may be true and though they are certainly useful, we don't claim that they have the kind of scientific validity or mathematical support that you all do. That's a basic distinction that we make.

The problem, of course, that we all deal with and the fundamental problem of knowing about the future is the existence of uncertainty. Uncertainty, as I mentioned, is one of those things that we know is there, but we don't know what to do about it. We do work at it primarily with insufficient or incorrect information and insufficient or incorrect understanding. The basis of our information and the basis of our understanding can be refined; it can be improved with more work and more analysis. And what else is research into these techniques all about, except trying to get the best information and apply the best models, in order to come up with the best forecasts?

There's a problem, however, that not all uncertainty is open to that type of assault. Inherently unpredictable systems (chaos), inherently novel, self-organizing systems (catastrophe, complexity), and human choice are all inherently unpredictable. Therefore, all the research in the world and all the modeling and all the techniques in the world will not reduce the levels of uncertainty. Knowing that many systems, even simple systems, have a degree of uncertainty is called chaos (the Madison Avenue term for it); that means that even in the near term, any kind of predictions would probably be in error.

This understanding grows out of research that started in the 1960s, actually, in weather forecasting, of all areas. The weather system is a relatively well-known and well-studied system. Most meteorologists can characterize the state of the weather

system using three variables in three differential equations describing temperature, humidity, and pressure. Their changing rates over time are described by a series of equations that do model the weather system well. The problem with those three equations is that they are nonlinear and, given the recursive feedback involved in those equations, slight differences in initial conditions result in large differences in outcome, even in the near term, and I do mean the near term. In weather forecasting, the near term is no more than three or four days. After that, it is just about impossible to say what the weather is going to be. Meteorologists have mostly conceded defeat. They know now that they can't predict beyond three days.

Those of us in the social and human areas haven't conceded that defeat yet. We don't know what our three variables are or what our three differential equations are. We know what the thousand variables are and the thousand equations, as in the econometric models and whatever. But we haven't reduced it. So we don't really understand the nature of our chaotic systems as well as they do, but we futurists claim that human systems are equally unpredictable. The recursive feedback involved, the non-linear differential equations involved, whatever they may be, means that in the medium and long term, that type of extrapolative prediction is probably impossible.

There is also the possibility that human systems do something that other systems do only once in a while and that is create brand-new, novel, and unique circumstances. Where else did multicellular organisms come from except from a novel arrangement of unicellular organisms? Where else did sentient organisms come from, but a novel arrangement in evolution out of nonsentient organisms? Where else did consciousness come from? Now, there are other explanations, of course, that we won't have to get into here, but in the natural course of events, systems do become more complex, and they create things that are brand new. You know that there's no technique or model in the world that will give you anything brand new. It is all essentially working out of what you put in to start with. So how does one handle the novel and the new? Finally, are we free? Do decision makers make choices? Do people do surprising things if they are, indeed, even the least little bit free? If so, then they are, by that same degree, unpredictable.

My claim is that those three aspects—the chaotic nonlinear nature of the systems we're dealing with, their ability to produce novelty, and their ability to embed human freedom and human choice, means that at the margin, it's impossible to use any kind of standard techniques, yours or anybody else's, to understand the long-term future. Hence, we have basically two different approaches that are complementary. In those areas where most of the uncertainty can be reduced, certainly in scientific areas, and in many of the areas that actuaries practice, then additional time and money spent on reducing the uncertainty and gathering more

information and understanding it is worthwhile. But, in the medium and long-term, in any kind of human system that has any degree of turbulence, that's not enough. We have to then bring in another set of techniques, and those techniques are what we have in futurism.

Now, frankly, you're not going to be as satisfied with these techniques as you will be with the ones that you have now because they do not produce the nice, hard, definable results. By the same token, I'm saying something is better than nothing. What we have, then, is as Tom says, a systematic approach to doing this. We usually deal with uncertainty by making assumptions about it. I know assumptions are an important part of your business as they are in ours. The good news is, of course, that assumptions do resolve the uncertainty. We simply assume that it doesn't exist. The bad news is, however, that sometimes we ought not to make that assumption. The uncertainties are so huge that we should not let them go quite so easily. When we're dealing in a physics lab, the uncertainties of measurement can be assumed to not exist or to be randomly distributed so we don't have to worry about it. When we're dealing with human systems, however, we believe that there are such large uncertainties that we need to spend part of our time paying attention to those uncertainties and doing something with them. What we do with them, of course, is what futurism is all about.

This is, therefore, a slightly different interpretation of the three major aspects of a forecasting system. Most people think you make your assumptions, you apply your system, and out pops the forecast. Our view of these is, actually, that it is a recursive and an iterative process. The assumptions leading to the forecasting system are producing the forecast. The forecast is not the end of the process, however. It is the feedback to the questions: "Are those the right assumptions? What do we know now about our assumptions?" We return to our starting place to gain a better understanding. And around and around we go. I call this heuristic forecasting because it is a process of learning. It's not a process of predicting. The focus is on understanding the system, not in making claims and specific knowledge about the future of the system. Understanding is good. It would be nice to have more understanding even though we can't translate that understanding into exact predictions. It is certainly better to understand an uncertain and turbulent system and how it operates than to simply say "I can't predict; I don't know; and therefore I'll make these huge and gigantic assumptions."

This, then, results in the two branches of knowing the future, as I mentioned before. In heuristic forecasting, we tend to be interested in a more long-term horizon. Actuaries are also interested in long-term horizons. We cover not only demography and finance, but social values, political regulations, new technologies, international conflicts, and how they might affect both the demographic and the financial

assumptions that you're making. We tend to focus on more assumptions. We focus on the possibility of discontinuities. A mathematical discontinuity is a point in a mathematical equation at which one can't contain the same model or the same series. A discontinuity in life is exactly the same thing. It's where the assumptions of the past are no longer applicable to the future.

Now modelers don't talk about discontinuities because a discontinuity, by definition, destroys the assumptions of the model. So they can't forecast across a discontinuity. Therefore, a discontinuity is our stock and trade. We're looking for discontinuities. We're trying to think about what they might be and what effect they might have on the system. We can't reduce them to mathematical techniques because no one can. But ignoring the possibility of discontinuities is risky. That risk is something we try and mitigate by discussing the possibility. We can't predict where they will happen or even what they will be. Because we know discontinuities are always possible, our discussion of the future tends to be more robust and more interested in such possibilities.

The outcome, as opposed to a single-point forecast, is what you might call sensitivity ranges of plausible future forecasts. Plausible futures. Generally qualitatively different from each other. We sometimes call them a "new world." What does a new world look like after a demographic shift or after the cold war? What does a new world look like after information technology becomes really important and extremely valuable? So we're trying to get the essence of things and, indeed, we can work out what that future might be.

Single-point forecasts, as you know, are hardly ever right. The fact that they would be right are infinitesimally small. We actually employ the old technique that the weather forecasters, again, employed. Their greatest invention was the 20% forecast. When they predict a 20% chance of rain, they're always going to be right. If it rains, they can claim that they did in fact say there was a 20% chance, but if it doesn't, they can also claim that they said that there was an 80% chance it wouldn't rain. They're right in either case. The defect for a futurist is when a future event occurs that we have not thought about and introduced to our client. If we've discussed it and if we've thought about it, then presumably it's going into our thinking and part of our plan. It is not necessary to predict exactly what will happen. Indeed, a range of forecasts can be a useful product for decision making, as long as that range captures all or most of the plausible forecasts. In general, what we're after is not accuracy in prediction and precision. We're after the lack of surprise. Surprise is the essence of risk. Surprise is that essence of uncertainty. If we can reduce the amount of surprise that decision makers have, then we feel like we are doing a valuable service and we're providing something that other folks do

not. It's still not satisfying or knowing the future. But it is knowing possibilities and plausibilities of the future.

Let me stop there and see whether you have any questions and, indeed, objections. I prefer a discussion to a lecture. And I prefer an argument to a discussion. So if anybody has anything that they want to raise now before I launch into all of these technicalities, please bring it up at this point.

**From the Floor:** There has been some suggestion that some of the techniques you referred to that are used in meteorology and also fluid dynamics have applications in the financial world. Will you be addressing that?

**Dr. Bishop:** Not any more than to mention that they are there. I'm not an expert on nonlinear dynamics, which is what you're referring to. I think the whiz kids on Wall Street doing the heavy duty kind of modeling are using some nonlinear dynamic thinking and programming to be able to understand the turbulence in stock markets and other types of markets. I'll only point out that there is an area there that somebody who knows the math can go look at. I really don't know. What that gives us futurists is a platform on which to say, "Hey, the Newtonian assumptions that more time and more effort can reduce the uncertainty down to any definable epsilon is an incorrect assumption." There is a kernel of uncertainty because of nonlinearity and novelty in human freedom that no amount of research is going to make go away.

I just simply make that claim and say, "Hey, we need to have another approach for these cases." We need a different approach. It isn't a substitute for the approach that you all have, but it's a different approach. There are those who claim that you can probably substitute, and someday we will get into how to use those different approaches for better forecasting accuracy and prediction. Frankly, I don't think we will. I see that as a third area of the kind of systems that may exist to describe the future. Prior to 100 years ago, we thought all systems were deterministic. Newtonian systems. Because of the introduction of probability theory and stochastic processes and inferential statistics we said, "Hey, there's this whole new area." Other people knew about error. They knew about randomness. But, like us, they just kind of let it go because they didn't think there was anything more to be known in that area. That was their chaos and, therefore, there's nothing known. Now we can at least map a probability distribution even though it doesn't help us predict every single event.

We're in a similar situation, I think, with chaos theories. I don't think it's going to get us to the prediction of the single event. But it is going to help us understand the pattern of change and certainly alert us when trying to predict the single event in



the medium or long-term is futile. Even that would be a benefit so we don't waste so much time and create so many expectations that aren't there. I don't know enough to say how those things apply exactly to financial and other kinds of situations.

**From the Floor:** The Society of Actuaries is holding symposiums next month on some of these techniques in financial modeling. Only one presenter is an actuary. The other presenters are theoretical physicists and fluid dynamics, chaos theory application, and other future studies. I guess somebody believes that they have something to tell those of us who are trying to financially model.

**Dr. Bishop:** Could you tell us where the meeting is and how to find out about it?

**From the Floor:** July 29 and 30, 1997. It's in Chicago. There are brochures on it available at the Society desk.

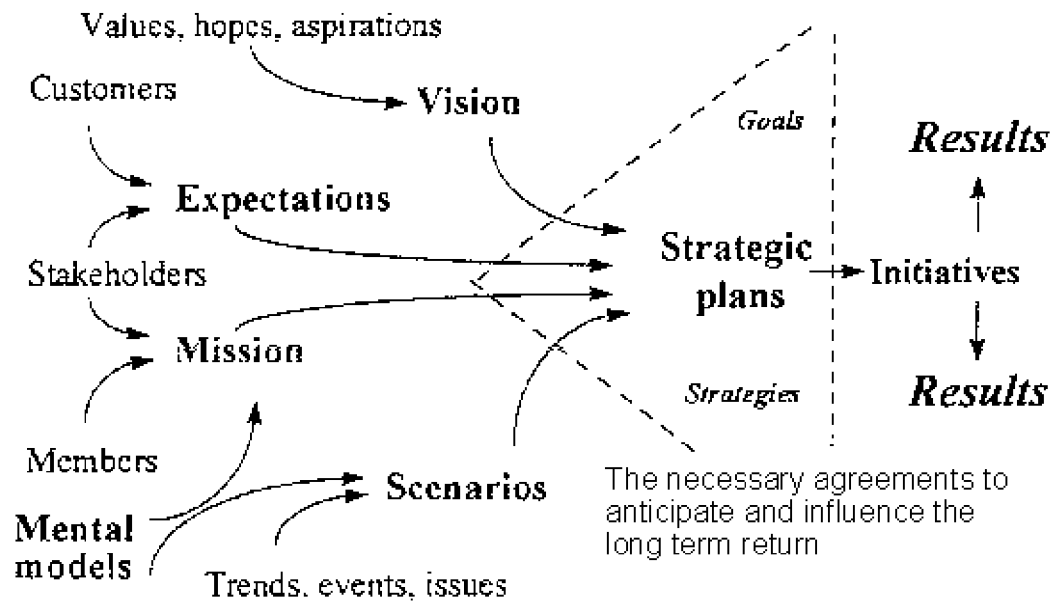
**Dr. Bishop:** And you're right. It's all coming out of some very arcane kinds of things. Where else did probability and inferential statistics come from? The same way. It was kind of unusual at that time.

Chart 1 is the eye chart that I carry around that tells everybody what I believe futurism is all about. It basically results in results. It is designed to produce more beneficial futures. That's the result of it. Initiatives result from strategic plans, both goals and strategies. Strategic planning has gotten an awful name recently. In fact, I go around slaying all the dragons of strategic planning these days because it's not that it wasn't done or that it's a bad process, but that its application was bad.

I'm reminded of a quote from G.K. Chesterton, the English philosopher and essayist who said that, "Christianity hasn't failed, it has just never really been tried." It's the same with strategic planning. We have that as part of our tool kit. The strategic plan, then, is informed by a whole array of preparatory materials. What we're talking about today is this material coming from the world. What is happening out there that will affect our plans, our strategies, and what goals we should select to be successful. Our mission, our customer expectations, our visions for ourselves and our customers also feed into those plans. This is the forecasting area of future studies, which, of course, you're most interested in. This is more the action area of future studies. People in the management departments and people trying to bring about change tend to focus on this part of the plan, whereas the forecasters and those who are understanding or trying to describe the future, tend to focus on that part. So it's a whole broad range of techniques and tools that we use.

For this presentation, I'm going to focus on just four of the tools and four of those that tend to be more notable in the area of description and forecasting. The first of those has to do with scanning. Scanning is something that we all do. We read. We hear. We listen. We talk to other people. We gather information about the world. It's a natural human process. We believe, however, as you certainly would agree, that those things that you think about and those things that you do systematically, you probably do better than those things that you simply do in an unconscious activity. So scanning is something that we raise to the level of a process. People go about the world scanning. They identify what their sources are, and the frequency with which they are going to get them. They identify what they're looking for. They identify how to keep that stuff in one form and, indeed, how to use it and turn it into value for their clients. There are futures organizations that do nothing but that.

CHART 1  
TOOLS FOR THE FUTURE



One of the more famous futurists, John Nesbitt, publishes something called *The Trend Newsletter*. It comes out of his work in *Megatrends*. They read all the newspapers and magazines in the world and they clip out those things that they think are valuable. Most newsletters do a form of that. We try to take those things out of the world that are valuable for a client. But scanning is something that futurists do. It's really the first step in the process. It is because of where your information comes from.

What are the sources of change? Here is my description of a human system: people in a natural environment, using technology, under the rules and discipline of an economic system, under the watchful eye of some type of government regulation that tries to set the playing field and call the referees, in a matrix of culture and values and social structure. We tend to deal with all the interrelationships and all the factors involved in that.

You happen to be involved in the people side and in the economic side. Other people are involved in government regulation. One of the things that a chart like this helps us do is realize that everything affects everything else in the long run. We can't say, "Oh, that's politics. Oh, that's technology. That's social values." In the long run, it all affects one or the other. Now, if you put these in a matrix, you would get a seven-by-seven matrix with 50 cells and understanding all of those complex interactions is clearly beyond us. This is more or less a metaphor. It's a check list to be sure that when we start a futures project, we're covering where the uncertainties might come from and where the changes might come from. Remember, we're after surprise. We don't want to be surprised.

So we're just like the lookout on top of the ship. That person doesn't necessarily know the course and doesn't know the actions that the captain has in mind, but if the lookout sees something unusual, he or she shouts it down to the deck and says, "Hey, there's something unusual out there." And then the crew reacts. If the person is a good lookout and the people believe him or her, they will begin to prepare. Just because the lookout sees a little dot on the horizon, though, doesn't mean they're going to turn the ship around. They're not going to stop or panic. They're simply going to say, "Hey, there's something out on the horizon. Let's keep monitoring it. Let's watch it to be sure that it's not something bad. If it's something good, we'll go towards it. If it's something bad, we'll avoid it. We'll have time to do that because our lookout is on a high place and we're not going to get to that thing for a long time."

Often people start talking about the future and hit the panic button. They think the world is going to change. It might, but it's not going to change tomorrow. It will change in due course. Keep your eyes open. Listening to our lookouts is part of what we do in future studies.

We capture this in a very simple little device called a scanning journal. A journal is, basically, a repository. It can be a database for expected versus alternative images of the future and implicit or explicit images of the future. That's the outcome. The outcome is not the fact. Say this fact and this statistic changed, this trend went up, this trend went down. What does that say about our image of the

future? Our actions and decisions are based upon those images. We're trying to inform people about those images as much as possible.

Futurists don't want to be surprised, and want the ultimate future image to be in their set of plausible alternatives somewhere. It's scanning that allows us to create and think about alternative images.

There are basically three kinds of hits. This is the kind that we see most of all because we tend to believe in the things that we tend to know. We tend to see only the things that confirm what we know or confirm our preconceptions. Do this with students and say, without any kind of instruction. "Bring in the things that you came across in the last week or the last month." About 80% of what they bring in is confirming their preconceptions about the future. If they tend to be kind of a New Age consciousness person, they bring in all that stuff. If they tend to be kind of a gloom and doom environmentalist person, they bring in all that stuff. And that's OK. I mean, we do need confirming things. I see a graph, it's "Oh, I've been looking for that one. I'll get that one, too." But I realize that's not teaching me anything. Confirming and affirming material is essentially, you know, the evidence that you don't learn anything from. It simply confirms what you already knew.

It's the disconfirming hit that is potentially rich. Those things that actually confirm the opposite from what we thought. These are the "I don't agree with that" kind of hits, the surprising or the counter-intuitive ones that are the most valuable. That's where the real nuggets are. It takes some practice to allow yourself to see, though, because we tend to filter those out. We say, "Those people are crazy," or "That can't be true," or "That's impossible." Those are the things going on and, in scanning, we try to quiet that filter. We try and put that filter aside for a while and say during the scanning period, we're going to take any and all bets. Maybe 10% of what these crazy people are saying might be true. I don't necessarily believe in UFOs, but imagine if out of all the hundreds of thousands of reports of UFOs, if just one of them is true, that would have amazing implications. You would have to say that all hundred thousand are somehow a fabrication and can be explained by other more natural kinds of causes. You could say that, but that's a stretch. Only one has to be true. So it's a very small percent. We're not looking for representative stuff. We're looking for nuggets. We're looking for ways of saying, "How could I be wrong? And how can I be surprised?" Because if we're surprised in the scanning phase, we're not surprised in the implementation phase. It's much less expensive to be surprised when you're thinking about things than it is after you've made the decision and you're spending lots of money.

In terms of the design, we need to get the design right and the implementation goes much better. Frankly, people who don't scan, whose minds are already made up,

who are dealing with a locked in image of the future are prime candidates to be surprised. We're trying to be the antidote to that. We're trying to say, "Wait a minute. You're probably going to be wrong. Now, let's figure out ways in which you might be wrong." We try and reverse that type of process.

There is going on right now, it turns out, a large scanning project sponsored by one of the founders of our field. A man named Ted Gordon. Ted founded a futures organization in Hartford called The Futures Group. You familiar with them? It's located in Glastonbury, Connecticut. The company does mainly technological forecasting and competitive intelligence for businesses. He's one of the inventors of the Delphi Survey, which you probably have heard of. It's the reincarnation of the Delphic oracle from Greek mythology. He created this project that is literally pulling together futurists from around the world so they can feed information into a central database in Washington, D.C. It's called the Millennium Project. It is an auspicious title for sure.

The Millennium Project is a scanning project sponsored by all these sorts of people. We're not going to dwell on the 15 major issues and trends that they have come up with. We are trying to distill what all these people are saying about the future. You could do worse in coming up with a list of potentially important impacts for almost any domain of the future. Things that are actuarial, demographic, technological, political, economic, or social are all things that could be very important. The beginning of the futurist enterprise means going out and collecting all the things that most people are avoiding or denying and saying, "What implications could that have for the future?"

Now, we all know there's a difference between knowing or realizing something and incorporating it. What difference does that make? One of my jobs when I give talks about the future is to take these indisputable facts and bring them down into people's lives and show them where it connects to their particular business or enterprise. In this case, the world population squeezes into the United States in the form of immigration. We in Texas and those across the southern part of the U.S. are very conscious of this. The number of refugees today throughout the world is many factors larger than it was 20 years ago. The unfreezing of the world from the cold war has put people in motion. We suspect that motion will continue. That will create social conflict and social problems in many, many different areas of the world, our own country included.

That's just an example of taking a fact and spending a little bit of time drawing the causal links to "Is this ever going to make any difference to me?" It sure will. Certainly the world's economy, our environmental habitat, immigration, and the

movements of people are extremely important for the long-term futures that we're talking about.

**From the Floor:** How come they're all full of bad things?

**Dr. Bishop:** That's an excellent question. I gave many seminars for IBM in the 1980s. I would like to have claimed to have saved it from its fate, but I was not able to do that. In fact, one of the feedbacks I received was there's too much negativity. Unfortunately, we as a culture are addicted to bad news. This is the same as the news media, though they don't present things at this kind of level of analysis. Most of the stuff on the news is bad. So it may be cultural.

Secondly, it's an occupational hazard, I believe, of futurists to be negative. If it's positive, then we don't have much of a role to play. In fact, during times of relative optimism, like the 1980s, futurism was not as popular as it is now or was in the late 1960s and the 1970s. The movement was really created in the 1970s when we thought we were running out of everything. That's when the forecasts were much more dire than even they are today. So there is an occupational hazard of being too negative. I'm always having to counteract that by always thinking of a positive and a negative side.

When I teach how to write scenarios, I encourage people to make them value neutral. If they're natural optimists, I encourage them to think of the downside risks. If they're natural pessimists, like me, they must try to think of how something could turn out positively. We have something bad and we look at it and we solve it and things actually get better. Raising negative points is not necessarily a bad thing. But you're right. Our lists tend to be kind of gloomy. You can call them pessimistic or you can call them challenging. It's all about your attitude.

Let me turn now to a second category. After the scanning process, the futurist typically packages our results in the form of a scenario. A scenario is jargon. It's a jargon word for a story. In fact, we're not ashamed to talk about the fact that we talk in stories. You talk in numbers, usually. We talk in stories. We are able to communicate the qualitative essence of things. We're able to communicate the dynamics of change. We're able to communicate what it will feel like to be in a different kind of world. Remember, surprise is what we're trying to minimize. Part of that surprise comes from the images we use and the feelings we have.

We have a whole set of implicit assumptions we subconsciously make when we think about the present and the future. If we can we need to give a scenario that begins to bring some of those assumptions to the surface. You know, you assume that school—I talk often to educators, so a lot of my examples come out of

that—schools are buildings. People learn on their own if they have the right resources. School involved a set curriculum that everybody goes through at the same time. Wait a minute, some students have certain aides and interests in others, in learning styles, and all of that kind of thing. It's those kind of assumptions that the scenario is able to surface and get folks to reflect on. So there's a knowledge component to it, but there's also a feel to it.

Scenarios were used very well by the Royal Dutch Shell Corporation, which is kind of like our poster child for scenarios. It's described very well in the definitive book on this topic, called *The Art of the Long View* by Peter Schwartz, who is president of a group in the Bay Area called the Global Business Network. If you're interested in one book on futurism, this is the one that I would recommend. It's a nice business-oriented one. It's easy to read, and it has many good war stories in it. It also described the essence of the future's enterprise.

These are some of the scenarios that they were looking at and some of the decisions they had to make while Peter was the Director of the Strategic Planning Unit for Royal Dutch Shell Group during the 1980s. They were making various decisions such as developing a gas field in the North Sea. In that process, they had to consider the possibility of Soviet Union gas coming into Europe, which it almost did during that pipeline controversy. Remember, this is the 1980s. They even considered the collapse of the Soviet Union in that time frame. Their most notable success was the introduction of the implications for collapsing oil prices. In 1979, they developed scenarios where the price of oil actually went down dramatically. This is what actually happened. One of the implications that they made from that was that there would be the emergence of a spot market for oil. I don't know enough about the economics of oil markets to know how they came to that, but they knew that once the oil price collapsed, there would be a spot market. Prior to those collapses, there wasn't. It was all long-term contracts.

Having thought about that and, literally, having laid the blueprint for a trading company as part of their business, they were able to implement that trading company within months and about a year ahead of any other major oil company. Even in 1981, where their in-the-ground assets went down by 50% in value, they made money. They were ready to move when, in fact, the future had changed. It's an example where a little bit of planning, a little bit of foresight, and a little bit of getting ready can give people the opportunity to move more rapidly and more surely when things happen.

What were the other oil companies doing while the price was falling through the floor? They were scratching their heads, trying to figure out what was going on and

what they're going to do about it. While they were scratching their heads, Shell was out executing a trading company and scooped them by about nine months. They tell me, in the oil business, the Royal Dutch and the international Shell Company was one of the least effective oil companies during the 1960s. If you had the Seven Sisters, they were probably the seventh. When I talk to international oil people today, they now wish they could be at the right place at the right time like the Royal Dutch Shell Group is. They are a leading company around the world and are becoming so even in the U.S. Part of it is, not all of it is, but part of it is this strategic thinking. Part of it is at the board of directors level. They're conceptualized strategic planning. One of the very last quotes I'll give you is one of their director's quotes:

"Strategic planning is about learning. It's not about predicting. It's not about planning as we think of it. It's learning what's going to happen." So they considered themselves to be teachers or, more or less, the facilitators of learning for the Shell board of directors. If the board of directors could understand the dynamics of change and what the possibilities were out there in the future, then they would make better decisions. That has been borne out and, indeed, the whole corporation follows that now. A few other corporations are doing it. I'm surprised, given that success, that more people have not instituted this as a strict part of their strategic planning process. They haven't checked with me to get my permission not to do it, so I don't know why they're not.

Peter also has some kind of standard plot that he finds in many of the scenarios that they create. You can see those and see what some of those are. Scanning, monitoring, looking for stuff that's surprising and disconfirming and putting it in a way that people can use. Secondly, packaging the alternative futures that come out as a series of stories about what might happen. Any comments or questions about that as a second category of futures tools and how we approach it?

**From the Floor:** What's the global teenager?

**Dr. Bishop:** The global teenager is just the fact that most—we're concerned about the graying of the society, but most of the rest of the world is very, very young. Large proportions of developing countries are 15 years and under. Some countries are more than 50% that. The way Peter says it, is that we had our baby boom from 1947 to 1963. They're having their baby boom right now. That will have an equally transformational effect on the global social and economic picture as has the baby boom domestically in the United States. It's a kind of forecast to look at.

**From the Floor:** What is *The Economist*?



**Dr. Bishop:** Well, basically, it's the optimistic scenario. That technology, in fact, is effectively indefinite in terms of its application. It reflects the issues of all the gloomy things about carrying capacity and lack of resources that will be solved by the combination of technology done in a capitalist and free market and that we're clever and we're ingenious. We can essentially raise the carrying capacity to just about any level needed. *The Economist* is a publication known for this view.

Julian Simon is an economist who you may have heard of. He is somewhat of a renegade for his very optimistic forecasts. His basic belief is the more people, the better. More people mean more workers, more consumers, more minds, more Einsteins, more Picassos, more ingenious solutions, and a more wonderful world. If it were not ten billion, he'd rather have it be 15 billion or 20 billion. The more the better. So there are extremists on either side. That's basically what that scenario is. You have to admit that's a possibility. Having gotten involved in futures studies, frankly, I enjoy being surprised. It's really a treat.

**From the Floor:** When was the last time you were surprised?

**Dr. Bishop:** I'm teaching a class from Texas in Oklahoma, which is one of my most interesting current adventures. Oklahoma State University has a very well-developed distance learning capability. It wanted to have a futures course.

It did some scanning things and one person came up with a survey where the popular belief is that we are becoming an uncaring society and that we don't really care about each other. A student reported on a survey, and I don't know what the citation or the validity of it was, but this student reported that the survey showed that there were about three times more people today taking care of folks in their home than 20 years ago. Twenty-two million people are caring for people in their homes who are not relatives or their own dependents and they are not being paid for it. I asked him for the citation to look that up. That's an example of a nice little scanning hit.

Most of the popular images of the future we carry around in our heads are almost certainly wrong. It's more complicated than that, because most of it we get from NBC. NBC can't deal with anything that's complicated. Consequently, what we get is simplistic views of the future. But we make decisions on these views. Wow. I mean, as entertainment, that's no problem. But, to make decisions based upon our preconceptions, that's what the scanning stuff is all about.

Now how do we stop people from using their preconceptions in filtering and interpreting the data that they get. Let me give you a space example. We're a big space community down in the Clear Lake area. The ozone depletion is a clear fact

of today. It was discovered in 1989. It came as a surprise to me to realize that the data series that started showing the depletion of the ozone started in 1980. In fact, the Nimbus satellite, which records the ozone levels going around the world, was dropping consistently and incrementally from 1980 to 1989; however, the analysts were saying the instrument was getting out of calibration. They could not conceive of the ozone being depleted. That was a fundamental fact of life. They saw the data series and they attributed it to the calibration of the instrument, not to the change in the phenomenon. But it didn't start in 1980. It started long before 1980, but our perception was different. Then, what do you do about that problem? What can I say except that humility is not such a bad thing to have when you're forecasting. Unfortunately, it's also counterproductive because if you're a humble forecaster, nobody is going to believe you. In our society we don't get paid for talking about plausibilities and possibilities and multiple interpretations. We get paid for making definite, right, clear predictions that turn out to be accurate, which is a clearly impossible task. But that's what we get paid for.

**From the Floor:** So, intellectually, actuaries know the possibility of a "surprise" coming to pass. We are changing our perceptions in our literature and our education. We're trying to change also even the functions of valuation and financial reporting by trying to tell our communities that what we really ought to be giving you is not a precise estimate, but this is the range of possibilities. If you want a 60% estimate, this is the number. If you wanted 99% estimate, which is very fragile, this is the number. We are beginning to get to adopt this kind of thinking process.

**Dr. Bishop:** Certainly, I'm not here to say that's not happening and applaud everybody's work that's doing it. There are two kinds of plausible forecasts, though. The kind of forecast you're talking about is generally the result of what I call sensitivity analysis. The model and the assumptions of the model remain the same and we adjust the boundary conditions or some of the parametric assumptions that we make; hence, we end up with a range of possible values. Futurists go further than that by questioning the very relationships of the model. They do not explore whether there is going to be 5% inflation or 3% inflation. Let me tell you one of my assumptions. When you emphasize any one variable in any system to the exclusion of others, you tend to throw the system out of whack. Right now, fighting inflation and maintaining low inflation is the number one purpose of the financial system and the Federal Reserve. Even the White House doesn't complain very much because people haven't figured out, yet, that what they use as an indicator is increasing competition for wages; which keeps the wage flat and keeps people in the current position of working as hard as they can and not feeling like they're getting anywhere.

I talk about a different political environment when that becomes an issue. When people realize that they are paying the price of this low inflation, they will want to know who is walking off with the cookie jar. Is it the financial people, the investors, the winner-take-all Michael Jordans and Michael Eisners of the world? I guess being Michael these days is not a bad thing to be.

There is a different kind of sensitivity analysis which says that just assuming the level inflation will not capture the true range of possibilities. That's a scenario, but it is a scenario, a plausible story about how things might happen. If you say, "Well, I never thought about it like that before," I am successful. There is a broader range of possibility. I appreciate that you are doing sensitivity analysis, and certainly the more of that, the better, up to limits of plausibility. But there are whole new models and whole new arrangements that we have to consider if we're going to conceive the long-term future.

I was finishing a course in quantitative forecasting. The kind of stuff we do in quantitative forecasting is what you learned in the first three pages of your first study note. It is just a little bit of trend extrapolation. If you have a cycle around an upward trend, you can look at those two curves. There is the trend and there is the cycle around that trend. Let's imagine that curve for you. I must point out to students what the reality is. Is this an S curve, meaning that it's a one-time change that will level off? Or is this cycle around a trend? Which is the reality? There is no mathematical technique that will tell you what the reality is. Is this an underlying upward trend and a cycle around it? Or is this an S curve that is going to level off and be level in the future? That's an assumption.

Let me turn to the slightly more mathematical form of future studies. Alan Mills, who briefed me before the Annual Meeting when we first had this presentation, said, "You have to put some numbers in your presentation. They won't be happy unless they leave with some numbers." So I did, but, again, the purpose is not to predict the future. The purpose is to understand.

I went through our tool kit and picked out three basic types of tools that we use that all have a mathematical, numerical basis and that has these criteria. Systems dynamics is a modeling technique approach that is very similar to econometric or any kind of modeling. The beauty of it is that you can run it on a PC. You can learn it in a day. You can throw models together and look at them by yourself or as a group and say, "Is this reasonable or not? Is this the way we think the system operates or not?" And you can go through an iterative process of learning. La Prospective is from the set of tools that are developed in Europe by futurist Michelle Godet. Expersim and EZ-Impact are a set of tools based on impact methodologies.

Why do we talk about kinds of systems uses? When you ask people why something happened, they generally come up with two explanations. Somebody did it, or something from outside did it. When you ask them, "What should we do about that?" they say, "Fire the person who did it, or, somehow get the people outside to do it differently." Those are two very common explanations and they are often true. They are also incomplete. What we look at is the structure of a system. A system has a particular kind of built-in behavior. The reason I put it below the surface is that it is rarely identified as the reason.

Alcoholism, for instance, is a structural explanation. People are not alcoholics because they want to be. People are not alcoholics because their world or their wife or their boss made them be alcoholics. There is something about the reinforcement patterns of their behavior. Maybe it's social, or maybe it's biological, but, it's basically, in their structure. The only way of changing is for them to give up the stuff completely. There's no other way that they can handle it.

We do a simulation in our systems class called the beer game. It is a simulation that comes out of MIT. It's a basic little beer distribution simulation model where the students actually participate as a wholesaler or distributor or retailer. It's a gorgeous simulation because you set up parallel groups—say three or four groups—in one class. Each group gets exactly the same input and exactly the same structure. They chart the results, such as results inventory and orders at the end. Every chart ends up being almost identical. Everybody has a good start. Suddenly, the inventories start to rise and then everybody collapses, but then they go back up again. Are we talking about housing markets? Are we talking about financial markets? Are we talking about the chemical industry, which is, you know, any kind of cyclic industry is that. Is it because people are involved? No, it can't be because everybody is different, yet, the curves turn out to be the same. Is it the inputs to the system or the turbulence from outside the system? No. Because the simulation has exactly even input. It comes in exactly evenly. Yet, this turbulence happens anyway. It is in the structure of the delays and the system of people operating separately that creates those kind of fluctuations. This is an example of how structure is important.

One of the things that we are looking for in systems dynamics is how to map that structure and how to understand that structure. Systems dynamics, as an approach, was also created at MIT. In the 1960s, Jay Forrester started to model factories. Then, he wanted to model the industrial economy in general in the U.S. Finally, he is most famous for modeling the world system as a whole in that big best-selling book of the 1970s called *Limits to Growth*. It was a runaway best seller. Quite unexpected to be. The Club of Rome, which funded it, was a set of European industrialists. They didn't even see a copy of the book before it was on the front page of *The New York Times*. It just literally took off. But, for some reason, this

really took hold and went gang busters. It influenced a great deal of policy in the 1970s. It dealt with how the world was going to run out of everything in not too long a period of time.

Basically, the approach is to model a system using a series of stocks and flows. I'm sure you're familiar with a causal diagram, in which arrows and things go from one thing to the other. The problem with a causal diagram, though, is it's easy to do. It's a nice paper and pencil exercise. It's like electricity. It's instantaneous. Everything affects everything else as soon as something changes. The world doesn't operate like that. The delays are what's the most perverse about it. We thought we were doing something and we pushed on it. It didn't happen. We did something else. Three weeks later, here it comes. It finally took effect. There are stocks and flows in a natural process. A stock is like a water tank. And a flow is the input and the output valve. Well, you know the stock can only change as fast as the capacity of the input and output valves. It's an ingenious solution to the problem of how natural systems actually operate.

Just to give you something to boggle your mind, here's a very simple—I created Chart 2. It doesn't have an actuarial stamp of approval on it, so take it for what it's worth. If I were to model the Social Security system using this type of a process, there would be essentially four sectors: population, wages, government, and financial. One little thing. I've listed a source for this chart. Pete Peterson is one of the major writers about Social Security. I'm sure you're familiar with him.

CHART 2  
SOCIAL SECURITY SECTORS

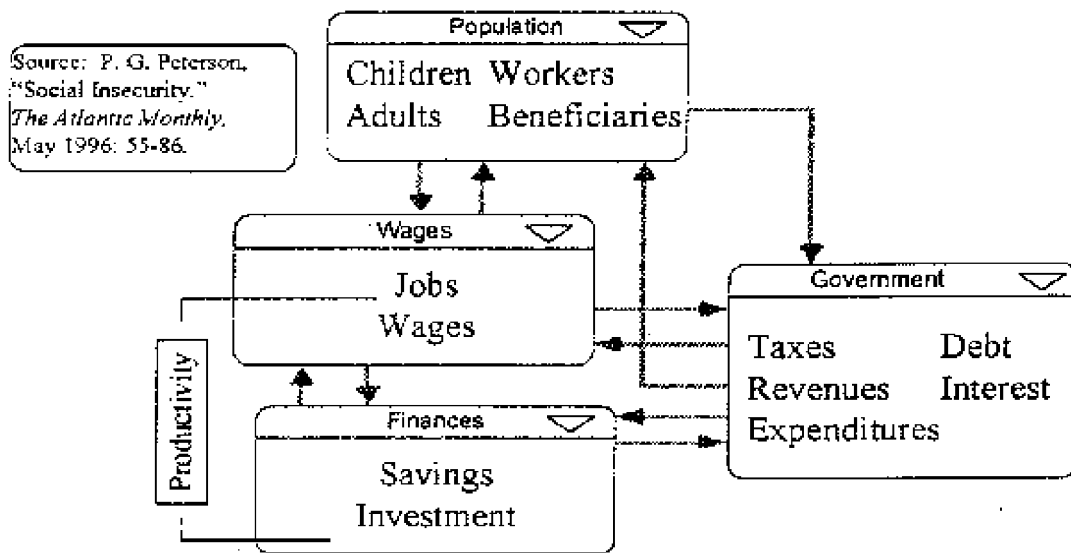
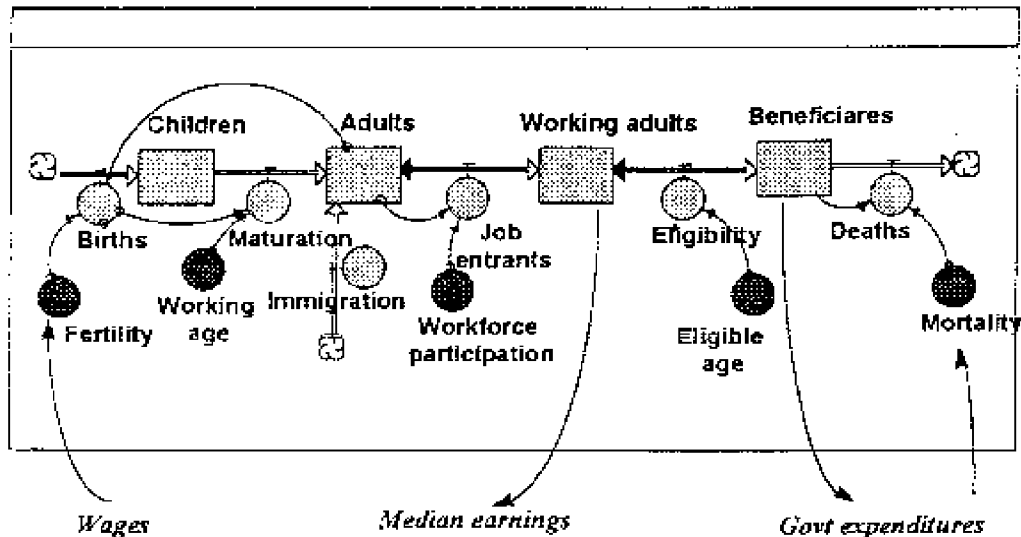


Chart 3 shows the population sector. This is a kind of an assembly-line aging process. It's not perfectly valid, and I can critique it as well as you can. Essentially children come out of something called a source which is undefined. You can define that for yourself. There are a certain number of children which then mature. They become adults. They go get jobs. They become working adults. They retire and become eligible beneficiary deaths and then die.

CHART 3  
POPULATION SECTOR



Let's lay out exactly how we think the system works so that we can talk about it. We will have at least a common language in which to discuss things.

I've shown below what some of the equations look like. These are difference equations that worked out over time, kind of one after the other, and they define an initial value for fertility. There's an initial value for children and the birth equation there so you can see what it looks like. It's a very simple system. Even futurists can run it. So it's one that I'm very happy about. This would be a piece of cake for actuaries. It allows you to articulate your own thinking and articulate other people's thinking and discuss your assumptions about how the system is working in a kind of round-robin iterative fashion.

Systems Dynamics Equations

$$\text{Fertility} = 2.0 * \text{Wages}/20,000$$

$$\text{Children}(t) = \text{Children}(t - dt) + dt$$

$$\text{INIT Children} = 0.15 * 250,000,000$$

Births = Fertility/30 \* Adults/2  
Maturation = DELAY(births, working\_\_age)

Now futurists have their assumptions, too. There are two kinds of everything. Those who divide the world into two kinds of everything and those who don't. I'm one of the ones who doesn't. So I'll give you the two kinds of futurists. There are applied futurists and normative futurists. I fall into the applied variety, which means that I'm open for hire and I'll tell you anything you want.

Frankly, normalists stake their whole career and their whole reputation based upon *Limits to Growth* and their reputation following it. I would have been surprised had they said, "Oops. We made a mistake." There is a most fundamental error that I'd love to get with them to talk about. I've never had the opportunity to. Using the formalism of stocks and flows, resources is obviously a stock for the world system. They call it nonrenewable resources. That stock only has outflow. It doesn't have inflow. Oil is oil. When it's gone, it's gone. Coal is coal. There's one interpretation, however, that states that through increasing technology, we add quantities to that stock. What was not a resource in the middle ages, with all the oil in the Middle East, is now a resource in our time. There may be resources in the future that are in the air or in the dirt or in the water that we don't even know about. The driver of their whole model is that in every single curve, the stock of non-renewable resources can only go down. The only thing that you can change is the rate at which you use nonrenewable resources. You can never get that to level off, much less to go back up again.

They say, "Market and technology are not going to actually do it." They have a particular focus and a message to send and, unfortunately, they are not immune to the kind of biases just like everybody else I think.

We need to remember that futurism helps to understand how much uncertainty there is in the system. We are focusing on something that everybody has been taught to make assumptions about. How else do you get even the most simple physics lab experiment to work? We all melted ice cubes in calorimeters. We assume that the thermodynamic system was isolated from the rest of the universe. We had insulation around it, but it was not isolated from the rest of the universe. That insulation was not perfect. It was not a closed system, but we have always been taught to say that's good enough. We can make those assumptions.

The problem is, in human systems, it's not good enough. We can't simply say we don't know what's happening here so we will assume that everything else is equal. That's a wonderful position to be in. There are a billion things that could happen, but we simply won't focus on them. You can't focus on a billion of them, but you

can focus on a few of them where your greatest sources of uncertainty are. You can develop scenarios about them, and how they might emerge, and you can develop a set of plausible forecasts that go beyond a range of numerical sensitivity analysis into fundamentally different worlds about how things might be. You can't do a billion, but I believe that if you even had a couple, you've broken through the illusion of certainty. You've broken through the illusion of prediction. Once you've broken through that, people become humble. You've actually pointed out a good, rational basis for them to be humble and say, "Hey, we don't know the answer to this."

We were taught in forecasting school that when you don't know what's going to happen, you go look for things where you do. That's a fundamental assumption that futurism reverses. When you don't know what's going to happen, that's when we zero in on that and say if there's literally a 50/50 probability that the European monetary union comes together then that is where we do our work. Most everybody else is fleeing that spot as fast as they can because they have no way of approaching it and it is pure uncertainty and pure chaos. We go towards the uncertainty to try to understand it and to see what the outcomes may be when other folks go away from uncertainty. We are attracted to uncertainty. They are repelled by uncertainty. That's why it's complementary to the cases where the levels of uncertainty are relatively low in short-term or very well-understood systems such as many actuarial techniques.

There are optimists and pessimists about these nonlinear things. Ted Gordon, in fact, is an optimist. He says just like with probability, we will work out some set of tools that will help us. They won't predict exactly, but they'll help us. I tend to be a little more pessimistic. I think certain things are fundamentally irreducible. We'll see what happens on this.

In summary, then, futurism, is an alternative approach to a certain set of problems—those problems in which it's not possible to assume away degrees of uncertainty. When that happens, we focus on assumptions. We focus on possible outcomes and put those in the form of scenarios. These techniques are ways of mathematically describing systems more for the purpose of communication, articulation, and feedback, and iterative learning about potential future outcomes than they are for the purpose of prediction.