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Session 56 PD The Actuary of 2010

Track: Actuary of the Future/Futurism

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Summary: The business environment will change even more in the next ten years than it has in the last ten. The drivers for this change include genetic testing and genetic engineering, technology, globalization, medical advances, and the increase in life expectancy. These changes have an impact on the work actuaries will be doing and the skills they need.

MR. STEVEN W. EASSON: My name is Steve Easson. I am the upcoming Chair of the Futurism section. For those of you who attended the general session (1 GS) and had the privilege of listening to Dave Foote, hopefully you now have some more insights into what we might be doing in the year 2010, in which year we'll all be nine years older if you believe David Foote's assumption, and have more insights beyond perhaps DFA for the fish business and resting consulting.

We're privileged today to have two speakers. The first is Dr. Peter Bishop, who has been involved with the Futurism section for many years, and we're very appreciative of his efforts. The Futurism section has been around since 1983, and our challenge over the last 18 years has been to educate actuaries on how futurism

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† Dr. Peter Bishop, not a member of the sponsoring organizations, is a graduate program instructor at the University of Houston Clear Lake, Clear Lake, TX.

can be used. Actuaries don't consider very many extraneous or at least other influences on our work. An actuary attempts to predict the future; a futurist recognizes you can't predict the future and instead comes up with various scenarios in what we call open systems. An example is the U.S. Social Security system, in which generating plausible future scenarios for strategic planning would consider influences, such as the greenhouse effect, and how social security systems in Europe may influence the U.S. Social Security System. Also, the events of September 11 have an impact on how we view our work and our strategic planning. Dr. Bishop currently chairs and teaches courses in the graduate program in studies for the future at University of Houston-Clear Lake. He specializes in long-term forecasting and planning, focusing on the future of information technology and technology transfer. He also facilitates groups in developing scenarios and strategic plans for the future. He is currently serving as the executive director of the Institute for Futures Research and is the former director of the Space Business Research Center.

Dorn Swerdlin is president and chief executive officer of Swerdlin & Company, an independent actuarial employee benefits consulting firm based in Atlanta, Georgia. Dorn served as vice chairperson and chairperson of the Actuary of the Future Section Council of the Society of Actuaries.

MR. DORN H. SWERDLIN: I'd like to mention something about the Actuary of the Future Section. When I was on the council, most people couldn't understand the difference between the Futurism section and the Actuary of the Future section. The Actuary of the Future section focuses on looking to the future to see what kind of changes we as professionals have to make in order to survive, enhance our value, and be more productive for the future. They want to anticipate what's going on in the outside world and see what we have to do to make ourselves continue to be valuable to our public. When I was chairperson of the section a few years ago, we did a vision statement, and our vision of the actuary of the future is that the actuary will be used in any industry and by all industries where our skills are needed. What I mean by that is that we're currently focused on insurance—retirement, health insurance, that sort of thing—whereas one of our sister professions, accounting, is used by every business there is. Our vision is that it will

be much broader in the scope of what we do in terms of industry. We'll be applying our skills much more broadly in the future.

DR. PETER BISHOP: I'm with the University of Houston – Clear Lake. We are hosts of a unique program, a Master of Science Degree, called Studies of the Future. We are the only program in the United States and one of the few programs in the world with the word "future" in the title. At last count, there were 3,917 programs with the word "history" in the title, so we have a long, long way to go.

I'm a futurist. We prepare professional futurists for the marketplace. Our graduates go to work for government, business, independent consulting, keynote speakers, facilitators, and planners of all manner and sorts. I would say it's a high-risk degree. You don't walk into a placement agency and say, "I'm a futurist; have you had any openings lately?" In fact, when you tell people there are such folks they generally give you a quizzical look and say, "Well, what do those people do?" And we say, "We help people understand and create and influence the future." That's not such a bad thing to do because, indeed, what else is work all about?

Unfortunately, we as educators have dropped the ball. We have not prepared people in general for the future or for even thinking about the future, so I want to run through a very small set of assumptions and perspectives that we take on the future, many of which you share, some of which you don't, and in that sense we are very complimentary in our approaches to the future. Your assumptions about the future have to do basically with modeling, and therefore you make assumptions of continuity. You make assumptions that your views in the model will remain valid for the time period of the forecast and sometimes that's quite a long time period. Our assumption is that it won't. Now, we're both right. In some cases it does, and in some cases it doesn't. Of course, the longer you get out, the more opportunity there is for that type of thing to change.

I have to tell you that the Society of Actuaries is the only professional association to my knowledge that has a section on the future, obviously that being your business, and yet it is just like with education— something that we all do and we all need to do, but we don't do it very often and very explicitly that way.

One of the problems for futurists is that since we make strong points about discontinuity, lack of certainty, and the inability to make predictions, we are not as well respected within our colleagues in the academic community as many others. If you think about all the other professions, they believe there's an answer out there. Whether you're in business and marketing, whether you're in engineering, whether you're in education—all the students go to school to learn the answer or how to get the answer. But we don't believe there is an answer; we believe there are multiple answers. What kind of respect do we get within the university? Not a whole lot. By most of the people, we're placed with the humanities, the liberal arts. You're talking about perspectives and all that kind of stuff. Of course, the humanities people think we're a bunch of technocrats who are trying to force people into certain molds of the future, so we really don't have a home. It's not surprising that the department in Clear Lake was created in 1975, and we have yet to be imitated.

I point out, without putting too grand of a meaning on it, history was not always a discipline. It was created 2,500 years ago when people said, "Why don't we describe things the way they actually work rather than the way the myths and the legends said they were?" Hence we have now that discipline. So we may be in the century where we create a systematic and professional understanding of the future.

Let me run through a few of the assumptions that we make in the futurism section and in futures studies in general. Then we're going to apply those techniques to four different futures that we're going to consider.

There are two kinds of people in the world: those who divide the world into two kinds of people and those who don't, and I'm one of those who does. One of the most fundamental perspectives, which is pretty obvious but we need to think about it, too, is that there are two sources of change—change that happens to us and change that we create ourselves. The change that happens to us is basically outside our control. Those are the forces that we're all dealing with that happen to us. In some professions, lives, or companies, they have a fair degree of choice. They have a fairly unconstrained future. In others they are very, very highly constrained, and that's on a case-by-case basis. You can't say whether it's always big or small. It depends on the topic, it depends on the situation, but every future is a combination

of constraints that are handed to an actor, person, company, or whatever and the choices and the influence that they make on creating that future. We try to maintain that balance and not get caught one way or the other.

When we talk about the world's change, we use a set of categories that basically tries not to exclude anything. There are various categorizations and taxonomies you can use. The one that is pronounceable, which is not necessarily the best one, is one we call STEEP—social technological economic environment and political. We call them STEEP categories and that's our attempt to try and say that in the long term everything affects everything else. Technology affects the economy, economy affects lifestyle, lifestyle affects health, health affects the environment, and round and round you go. You get a very complex kind of environment, but we don't feel like we can justifiably leave anything out. And that's different from most other professions because economists tend to focus on economic variables and demographers tend to focus on demographic variables, etc. We're trying to cover everything in the world. That's a complicated mess, but we deal with it.

MR. SWERDLIN: You said before there are two sources working, the ones that we can't control and the ones we can. I wonder, does futurism consider the extent to which an individual or a company or an entity can affect its own future?

DR. BISHOP: We generally do not assign numbers to those things. I mean you obviously could if there's 100 percent, you can allocate it from zero to 100. We don't think there is ever zero nor is there ever 100, but it is somewhere in between. A lot of what we talk about is that every company and certainly every individual has what we call a sphere of influence. You can change something. Now some people will throw up their hands and whine that the boss won't let them do it. Well, that appears to be true, but in fact that, I believe, is an abdication of our own responsibility to try and make some difference, whatever our sphere of influence is, even if it may be quite limited.

MR. SWERDLIN: My point is that I think we have more control over our future than we realize.

DR. BISHOP: And that's the point I was making. The degree of our influence on the future is related to our creativity is point number one, Imagining that we have more control than we typically will see on a regular day and then using those resources and forces in a clever and pragmatic way, so we can increase our influence. Our influence is never 100 percent, but I believe that the world's influence on us is never 100 percent either. It is always a balance of constraint and choice within constraints. And, again, let's not forget either one of those, that we can't be everything we want to be because we do have constraints, but on the other hand, we can have a better future if we set some goals and pursue some visions than if we don't. Both of those things are true simultaneously, but a lot of folks will forget one or the other, and so we're constantly reminding ourselves of it.

Another two-part distinction involves rates of change. Continuous change we're very familiar with; we deal with it all the time and much of what actuaries do has to do with rates and changes into the long-term future. Those, of course, are the trends that we deal with. But we also have a principle that says that nothing goes on forever, and no trend will go on forever. We know, of course, that exponential trends can't go on forever. What stops a trend is the other part of the rate of change, what we call discontinuities for disruptions. Once in a while something comes along that so changes the fundamental situation that previous trends are basically irrelevant. Trying to forecast the future economy of the Soviet Union in 1988 or 1989 when it is on the cusp of the discontinuity is obviously a silly exercise—the economy doesn't even mean the same thing and there's no continuity. So we futurists, as I said, are trying to anticipate the end of the trends, the events, or the circumstances that will create a brand new transformed future, not just one that is different in degree, but one that is different in kind.

FROM THE FLOOR: Are the events of September 11 and the recent insecurity concerning terrorism a disruption?

DR. BISHOP: Absolutely. That is a classic disruption. We are still in the immediate effects of it, so we do not know how much that is going to change the world. If the level of insecurity remains high, then this could be as fundamental as the collapse of communism, as fundamental as the development of the World Wide Web, as

fundamental as the oil crisis of the 1970s, as fundamental as the Vietnam War, and as fundamental as the civil rights movement. As a result of the September 11 attack, there could be changes in finance, changes in lifestyle, and changes in government. Certainly, there's already significant change in the geopolitical situations in the world, but that's a good example of disruption.

FROM THE FLOOR: The collapse of communism obviously was a political disruption. Unfortunately there is still too much continuity, which makes the position very difficult.

DR. BISHOP: The collapse of communism was certainly the collapse of a political regimen, the break-up of an integrated empire, but everything doesn't change at once. There is always something that is continuous from one to the other and, in this case, that may be the Russian culture.

In the Russian culture, there may be the expectation of people there to be more paternalistic, to want more authority than we are comfortable with, and to accept a lack of individualism, which has been continuous right from the czars to the communists to whatever there is now. Some things change and some things don't – but a disruption changes a lot and it changes it to the point where it creates some kind of a new and transformed world.

The last distinction that I'd like to make is when it comes to our own influence—how we go about influencing. We have three kinds of responses to change. One is called "to react" and that, of course, means to wait for the change and then do something about it. That's all too common. Often, by the time the change comes, it's too late. The second is "to respond to the change," and we use that term to mean anticipating change, which might be a category of contingency planning. What if this would happen? What if that would happen? What would we do about it? That response, of course, is a little bit more forward thinking and a little bit safer because you are ready for change, you're not just waiting for it to happen and you're probably not too late. The third response, however, is a creative response, which is not just to wait for a change and respond to it, but to actually go out and create a future. That response is led by vision, by goals, and by a preferred future.

We also have three kinds of futures that we deal with. First of all, there is what is called the expected future or the official future; we call it the baseline future. It is the future where we're headed. Futurists don't expect to get there, but if you extrapolate the existing trends, that's where we would be. If nothing surprising happened before the end of the time horizon, that's where we would end up. Of course, the longer the time horizon, the more likely that something surprising will happen.

Herman Kahn had a famous phrase, which was, "The most probable future isn't." Under the probability distribution, even the mode is not oftentimes 50 percent probable, so it is more probable that something other than that most probable future will happen. Our business is getting into all the other futures. Alternative future scenarios, we call them, or the plausible futures, which is the second kind of future. What's a plausible future? It's not likely. Of course, even the official sometimes is not. It's not likely, but it's possible.

The final one is the preferable future. What we really want. A preferable future is basically our vision, and then we organize our thinking about the future.

The image that we use is an expanding cone of plausible futures. The baseline is the center line of that cone, which is where we're headed. All the other futures are around it, some of which are more preferable and some of which are less. Our job is to try and steer the future towards the more preferable futures.

MR. SWERDLIN: When you mentioned these occurrences, I was thinking of jumps in biology that are not expected. Didn't Darwin look at things as if they were going to come along continuously, but in the 20th century we found that there were these big jumps in species that became distinct out of nowhere and then the species grew up out of nowhere.

DR. BISHOP: In biology that is called punctuated equilibrium. We often think of continuous changes as Darwin did, but if you look at the fossil record, in fact there have been what biologists call five great extinctions— the last of which was 65 million years ago in the transition from the age of the dinosaurs to where the

mammals came on due to a comet or a meteor hitting the earth. A great extinction is defined as a time in which more than 50 percent of the species become distinct, and a whole new genre or family or phyla comes on as the dominant-form species. Ironically, most biologists consider ourselves to be in the sixth great extinction right now due to the activities of humans on the planet, but that's another story. In any event, a punctuated equilibrium is the combination of trends and discontinuities that goes on for a period of time in a relatively well-behaved fashion, but at the beginning and at the end of those eras, there are discontinuities that change the situation and start a whole new series of trends, arrangements, values, or lifestyles.

MR. EASSON: Can you give an example of a discontinuity in the past that would be particular to our industry? What comes to my mind is the late '70s. Did anybody anticipate AIDS? The other question involves September 11. Can you give your opinion on the three different scenarios—expected, plausible and preferable—for September 11?

DR. BISHOP: I'll defer the answer to the second question to a bit later, but let's look at the arrival of AIDS. We're conducting a research project right now, and as a futurist I'm doing real research, believe it or not. We're in the field with a survey that is directly related to the actuarial mission and it is looking at mortality. There have been disruptive changes in mortality since World War II. One of those was the introduction of antibiotics and another was the introduction of treatment for cardiovascular disease. The antibiotics occurred in the early 1940s and became public right after the war, and the cardiovascular treatments and prevention became apparent in the 1960s. Following both of those basic disruptions, there were 10 straight years of mortality improvement, then back to the baseline background level. Does mortality improve as Darwin said in a gradualist fashion? To some extent it does, but there are also leaps forward. If actuaries are looking to mortality in the future, I suspect they are all pretty much using incremental models in terms of mortality improvement. But if there are leaps in that, if there are kinks in that curve, times where the curve changes its slope, then we're obviously making assumptions that may not be true. So we're in the field trying to estimate the effect of genetic technology on aging research and new emerging diseases on future mortality. It's an ambitious project, and it's one that we're having some difficulty

gathering the data. The whole intent and the rationale for the futurism section is to continually remind us that the assumptions that we're making in doing the forecasting oftentimes have alternatives and, if they have alternatives, that means there could be an alternative future out there.

I want to take four of those domains that I mentioned—four of the STEEP categories—and talk about their future in three ways. The first part of each of these five sections will be basically the driver or the trigger; what might occur between now and 2010 that would set off the disruption? The second will be the difference that that would make in the world. How is that going to affect the actuary? The third will be the implications. What would the actuarial life and work be like in 2010 following that kind of a trigger?

The first of the STEEP categories I want to cover is the demographic trends. We actuaries are very familiar with demographic trends. The two gigantic demographic movements that have occurred in the second half of the 20th century are immigration and aging. Aging one is the one I'd like to focus on. Is it plausible to consider a disruption in that? Let me just point out that one possible source of that disruption might be the research that is going on in the attempt to understand and perhaps even control the aging of cells. Cells seem to have basic clocks that tell them when they are old and when they should stop reproducing. Scientists believe that the part of that clock is something called a telemirror, which is a part of the chromosome in which every time it reproduces, a little piece gets knocked off of it. When there are no more telemirrors at the end, it can't reproduce any more. Is it likely that scientists will find this kind of magic fountain of youth and be able to stop cells from aging? No. But we've had medical breakthroughs before, and it is possible that we could actually begin to control it. Through the manipulation of these telemirrors, scientists have created what are called immortal cells, cells whose telemirrors do not get reduced during each reproduction. They've gone on for years and years and years through hundreds of reproductions without any decline in functioning at all. That's a laboratory experiment, but isn't that where everything starts?

Let's talk then about a future of 2010, where the world has all of a sudden found out that it is possible, and a few experimental subjects are actually under treatment to slow down their aging process so that when they are chronologically 60 years old, they are physically 40. When they are chronologically 70, they are physically 55. When we are chronologically 90, they are physically 70, so that we are now talking about life expectancy that is easily in the 80s, 90s, and maybe even over 100. There's a huge controversy about whether that is even possible given biological constraints, but nevertheless let's imagine that it is. I'm going to ask you to think about what would be different about the world and the life of the actuary in that future. I actually have a name for that future and it is, "Granny, how young you look," paraphrased from *Little Red Riding Hood*.

If you woke up in that world, what difference would it make?

With only traditional discoveries, mortality improvement has only had a minor impact as compared to changes in interest rates and expenses.

DR. BISHOP: You have found, mortality, interest, and expenses being the three major components of pricing. Because mortality improvement has been fairly gradual it has not been a very significant change. Interest and expenses change much faster, so that you're looking at those as components. It would put mortality back into the equation with a bigger weight in that kind of a future.

FROM THE FLOOR: Those of us who are now 60 would still be working.

DR. BISHOP: Well, it would change the career path. There would be a much longer career path because you'd be working to 100 or 110. Are there openings for younger people to come?

FROM THE FLOOR: Social Security retirement age would have to be extended.

DR. BISHOP: That's certainly a big change.

FROM THE FLOOR: I'm not really sure I'll have all the jobs that will be available to me.

DR. BISHOP: Right, so the point is that with a basically expanded life expectancy, you have a larger supply of labor. Will the number of jobs be there for people to be able to work? If not, will there be either retirement or Social Security or some form of support for people who don't? So it's going to put the labor supply and the number of jobs out of whack and, therefore, there could be serious disruption in the labor force.

FROM THE FLOOR: The other thing to deal with is a huge market for private savings product that people could be worried about.

DR. BISHOP: Okay, a huge market. We could have the kind of recession that is going on in Japan where you can't stop people from saving. They have zero interest, right? You get no return whatsoever. It's like putting the money in a mattress, but they're saving anyway. They can't get out of it, so you might have that kind of liquidity crisis where people just simply start hoarding their money, and the economy would have a big disruption.

FROM THE FLOOR: Are we assuming that the quality of the life will improve as well?

DR. BISHOP: We're not assuming. It doesn't improve, but it doesn't deteriorate with chronological age the way it has before. That being the effect – sure, there's still mortality. People die, accidents, disease, and all of that, but that a 70-year-old would not suffer the kind of chronic conditions that we normally would expect. They would have more the physical fortitude, stamina, and resistance of, say, a 45- or 50-year-old.

FROM THE FLOOR: One interesting impact for actuaries is around the valuation of liability—there's a mortality guarantee on the payout side.

DR. BISHOP: In terms of insurance and annuities, one is celebrating and one is not, right? Yes, there would be a reevaluation of all of those things.

This is an example of positing a plausible, though not likely, future and imaging a different world. We're going to do this four more times. This is mental calisthenics; this is preparing for change, not exactly getting the right change necessarily, but realizing that there's a different world out there, and we can't simply use our models of today, whether they're actuarial models or lifestyle models.

FROM THE FLOOR: When you talk about the disruptions, you're talking about things that are available to the general public, maybe not in third world countries, but in most areas that would affect everybody?

DR. BISHOP: Yes, if it were just small numbers, then it wouldn't have a big effect. If it were restricted to a very small number, then it wouldn't change your overall mission. I've asked Dorn to reflect on the future of the profession because that's their mission in this section, in the Actuary of the Future, and what the profession may or may not be doing today to prepare for this kind of disruption for future.

MR. SWERDLIN: As a pension actuary myself, I think just to be thinking about the way we've always done things may need to be reconsidered. It's been a long time since I thought about constructing a mortality table., Although it's been fine for the past, I'm not sure it's going to be okay for the future. We tend to extrapolate rather than include a broader range of assumptions, and we need to start thinking—not that we need to become futurists—but we need to be thinking a little broader on this.

FROM THE FLOOR: In a pension plan, is the mortality assumption a minor part or a more significant part?

MR. SWERDLIN: I think it's still a minor part of the return. But again, if life expectancy is going to go from 75 to 95 or something like that, that's so significant that I think it would make a difference. It would make the mortality terms a lot more significant, relatively speaking.

DR. BISHOP: Obviously, all of this is dependent on the rate of change. If this is a gradual change, then everybody who's doing this will begin to adapt. If it's not a gradual change, the pension funds, for example, could be put into a bad position where they're paying out a great deal more than they expected. It's not likely, but it is plausible and something you may want to think about.

Let's look at a different domain, our habitat. Environmental consciousness and environmental improvement have been going on for 40 or 50 years in industrially developed countries, and there have been lots of success. We are much cleaner, and we have a much safer environment than we ever did before. The big issue right now, of course, is the warming of the planet due to the introduction of greenhouse gases. That warming has been going on for 150 years that we've been recording, at least, and most scientists in the world, although you'll still find a few to dispute it, are in agreement that that warming is a function of the human activity of burning fossil fuels and hydrocarbons. One of the interesting disruptions, however, is not a warming, but a rapid cooling, and I call this scenario, "Little Ice Age II." It turns out there is an ocean current, which runs in the Atlantic Ocean called the North Atlantic circulation. The warm water, the Gulf Stream, moves up through the western part of the Atlantic Ocean and leaves warm tropical water farther north than it would normally be. It's a gigantic circulation. That circulation is driven, however, by the fact that water after it cools in the North Atlantic dives down to a deeper level and basically returns to the tropics, so it's kind of a circulation. The diving down has to do with the salinity of the water. Salt water is heavier, so saline water will dive down faster than fresh water. Should the planet warm, the North Atlantic would get more fresh water because of the melting of the polar ice caps, which means that the water wouldn't sink and the circulation would stop. Europe would become the same temperature as Canada because they are on similar latitudes. There was a similar effect, we believe, in the 16th and 17th centuries. Those were very cold times in Europe and there was a problem; could we have that again? Scientists who measure the ice cores and temperatures claim that you can change the temperature of the planet by any number of degrees within a space as short as 10 years should that circulation stop.

Let's imagine all of a sudden a deep freeze occurs. Let's imagine rapid climate change within a 10-year period that changes a lot. How would that affect your customers, your work, and the actuarial profession?

FROM THE FLOOR: There would be a lot more demand for home heating. People aren't generally going to move to a southern climate because people generally don't want to move.

DR. BISHOP: Yes, you don't want to leave your culture. You can't leave your whole continent, right.

FROM THE FLOOR: So home heating costs would go up.

DR BISHOP: Energy costs go up for winter, so there could be an economic disruption because people in Europe particularly are using a lot more energy, a lot more hydrocarbons. The price of fuel goes up and therefore less money for other kinds of things.

FROM THE FLOOR: We would be more likely to be indoors.

DR. BISHOP: Yes, leisure industries would take a hit in those parts of the world, so there would be less travel, less desire to go to those places because it would be colder and less pleasant to be there.

FROM THE FLOOR: Colder weather and older people don't go together.

DR. BISHOP: Okay, so there may be an increase in mortality and mortality improvement might level off or even go in the other direction because of more infectious diseases and less healthy climates, colder, less resistance, and things like that. You might have to reverse the actuarial improvement in the other direction.

FROM THE FLOOR: The use of the Internet will increase

DR. BISHOP: Okay, people would be at home more. There might be more teleconferences and people getting more information from the Internet, so that would be good for telecommunications stocks and a lot of other folks there. A bump in fertility rate could occur because people are indoors more.

FROM THE FLOOR: But countering that, food production would be much more difficult.

DR. BISHOP: Food production, right. So the food prices go up as a result of that.

FROM THE FLOOR: Don't forget, necessity is the mother of invention. I think with higher heating costs, it would be more economical to develop conservation technology.

DR. BISHOP: Right. We talked about a bump in fuel prices, but that of course makes conservation, insulation, solar heating, and all of that a more economical and a better deal. So there are lots of possibilities. We know now how integrated the global atmosphere and the global climate are. The El Ninos in the Pacific change weather all over the world. When this change occurs, forecasting it might be easy, but the winds and the currents and all of that would change the rest of the world, so the tropics could get hotter, they could get colder, food production would be disrupted, etc. But don't different storm patterns, different rates, or different whatever people use to estimate risk of weather-related phenomena have an impact on the casualty business? There might be fewer hurricanes, there might be more. For some reason cold people tend to work harder, right? It's not as much fun to sit outside at the piazza and have your cappuccino. You tend to stay at work more, so there may be an increase in productivity as a result of it.

Let's look at the third scenario. It is the basic disruption that we're all dealing with and that's the introduction of information technology. Information technology has been going on a long time; we've all adapted to it. I remember how different the actuarial profession was before the introduction of large-scale computer programs. Imagine jumping ahead that much again. I for one don't believe we're done yet, and it could change equally as much in the next 20 years. In fact, let me posit a

trigger, and that is the introduction of what we call artificial intelligence. And I say real artificial intelligence because what we've had so far are called expert systems. They are basically gigantic combinations of if/then statements. If this happens, do this; if this happens, do that – and you can create huge chains of those things. The problem is they don't work very well. The world is more complicated than we can conceive in a set of if/then-type conditions.

There is a different form of artificial intelligence, however. It's not brand new, but it's not very well distributed at this point. It is a completely different kind of a computer. that is built on what are called neuro-networks. They're pretty mysterious kinds of black boxes. If you imagine a computer with many, many processors—very small processors—say 100 or 1,000 processors and those processors all have connections to each other. Many are connected, with a series of weights, very much like the neuronal structure that we know of the brain where one neuron fires and it then fires others and out of that emerges the miracle of consciousness and thought and attention. Well, we're certainly not to the point of consciousness, but there are programs now where you can put input into a neuro-network and basically get an output out and you train the network. It's not a program. It's a training process where you send in inputs and out the other side comes an output and you say, "That was right; that was wrong." Any time it's wrong, it goes back and readjusts the weights of those connections so that there's a higher probability of getting a right answer the next time.

Thousands and thousands of cases are used as the training case to where the program or the computer gets pretty good at predicting what the right answer is going to be. Is that not problem-solving? This has been put into use in financial institutions in loan approvals, for instance, where you can take the characteristics of borrowers and all the history, and you can train a neuro-network to identify the characteristics of those loans in the future that ought to be approved and those that ought not be. That's the good news. The bad news is the neuro-network has no way of describing or explaining to the user why it's making those decisions. It's exactly the same process of the brain. We have ideas, but we can't go to a particular neuron and find out why that is, and we can't go to a particular place in the program and say why that is. But it's been very successful. It's been used a lot by

stock analysts; they are called the rocket scientists of Wall Street. They have these very complex programs that analyze the inputs of stock movements and basically come up with ideas on what's to be done.

Imagine now the widespread distribution of neuro-networks to solve and provide answers to complex problems. They work, but nobody knows why. They work, and people begin to trust them. People begin to say that this is something that we could use to enhance our ability to make actuarial forecasts. How might that change the world of an actuary?

Where are the applications? Where in your profession, in your work, in your discipline, might a neuro-network be applied?

FROM THE FLOOR: I would think in underwriting, they continue to have more splitting of categories and categorization.

DR. BISHOP: Sure. That might be an example. There are other applications, so that would certainly change underwriters.

FROM THE FLOOR: It might change a lot in the area of actually sending it to the customers, so that there is more customized product. It might actually deal in conjunction with some of our other scenarios, things like mid-life sabbaticals, being funded through some of our products. It would very much customize how much savings, future earnings, control, funding, differences, etc.

DR. BISHOP: So the outcome is that the customer can actually put in their data in through a Web page and get the same thing they get today, but much more cheaply. So it does the bulk of the easy stuff rather than actuaries doing it.

DR. BISHOP: One of the things that's happened in the accounting profession is that what are called systems people have grown considerably. These are not accountants who are working with accounts. These are people who are supervising computer systems who work with accounts, so there are systems auditors now and there are systems operators who run the system. The system itself does the work,

so it's one step removed from the actual work, and maybe we're talking about actuaries being one step removed from the calculations, managing the machines that are doing the calculations.

FROM THE FLOOR: Actuaries would have to train the computer.

DR. BISHOP: You're right. You always have to train it to do it. How would actuaries be different in this industry?

MR. SWERDLIN: We'd have to obviously know how to train the computers – program, train, whatever the terminology becomes. I think it's going to also push us further into the requirement of focusing more on our people skills, our creative thinking. We're going to let the machines do a higher level of our basic thinking. We have to learn how to do more creative thinking and use some of the people skills. If we're going to work with our customers to provide them with tailor-made scenarios for their financial growth, we have to be able to communicate with people better, and so I think our communications skills and our people skills are something that we have to be more concerned with in the future than we have in the past. In the past we sort of get away with it. We're becoming less and less able to get away without having these skills.

DR. BISHOP: It will do more than just change the world of the actuary; it will change the world of many professions in many industries, which will then have secondary impacts on all the other systems. Raising the issue of interconnectivity of all this stuff—we're dealing with each scenario more or less as an isolated event, but it has effects on demography, ecology, industry, politics, and government. Those effects need to be understood. The issue is they can never be economically or definitively described because there are too many of them. The complexity overwhelms our ability, but that doesn't mean we ought not to try and appreciate the fact that we can't just deal with it in a segmented fashion.

FROM THE FLOOR: Just missing the point, because they may have a much profounded impact and immediate impact of the change.

DR. BISHOP: The secondary impact may be more profound than the primary impact. Absolutely, there is no doubt about that. We're just doing this as a kind of an exercise. If one were to take this seriously, you would create tools for managing this complexity, and provide a systematic way of thinking about it. It's not mathematical usually, but a systematic way of thinking about it so you can assess the primary impact, the secondary impact, and the tertiary impact. I'm glad you raised that point, and that's the point that when one of these things changes, the direct impact on the actuary might be one thing, but the round-about impact could be even larger.

FROM THE FLOOR: What's your opinion as to whether the neuro-networks are probable or plausible?

DR. BISHOP: In terms of neuro-networks, part of the expected future I think is much more "intelligent machines"—machines that are able to do more complex problem-solving. The machines we have today would be perceived as incredibly intelligent compared to the machines of 40 or 50 years ago. I expect that trend to continue. I don't use the word probable because I don't think anything is, but it is expected that we are living in a world of much more capable machines that can do a lot more stuff. What has happened over the last 20 or 30 years is that machines have taken over things that we thought people could only do: language processing, translation, and certainly calculation. So what does it mean to be a human? What does it mean to make a human contribution? Whatever is routine in the expected future sooner or later will be part of the machine, and that's a threat to lots of different professions. We go to school and we learn processes and procedures and we do them not over and over again, but they're algorithmic and to the extent that they're algorithmic, they can be put into machines. What are we left with? Well, we're left with the human stuff—communication, problem-solving, and the use of judgment and discretion. But a lot of people either don't want to, can't, or don't find an opportunity to exercise that kind of judgment and discretion. So, I talk about it as the partnership. Let the machine do what the machine can do best, which is very fast, algorithmic processing, and let the people do what people do best, which is non-routine problem-solving of various sorts. That is a change going through all professions, having to give up the routine functions to the machine and then

looking in the mirror and saying, "What's my job? What am I supposed to be doing?"

FROM THE FLOOR: Around here some of these techniques might be more useful for short-term forecasting and long-term forecasting and if that's true, does that make the actuary more of a role of the futurist in the future where he's more concerned with long-term planning and looking at scenarios and trying to create situations where the preferable scenarios actually occur rather than short term forecasting using models?

DR. BISHOP: Forecasting whether you ought to make an underwriting decision, what the price should be for various insurance products, are examples of routine short-term things, but my view of most professions is that that's what most of the work is. Most of the work is basically turning the crank and turning out these kinds of things. Now the machine takes over, and what do you do for a living? It's not a threat, but it is a challenge to say, "When the machines become smart, where are we? Did they just put us out of work, or do we then graduate to some other form of work that the machines are not doing?" The machines will be doing the long-term work, while the actuary will be involved in those things that are not yet routinized. I think there's still tons of opportunity there, but you have to change your mental set about what the profession is about. What are we good at? Well, we better be good at stuff that we didn't go to school to learn. This is what Alvin Toffler called, "Future Shock." It's living in your own future; it's living in a transformed future. It's living in a future in which all of your certifications are being done by machines.

FROM THE FLOOR: Regarding the impact of the new computers on the labor, on the work force and only we could imagine each of us would have a person...

DR. BISHOP: Your point is about a personal neuro-network. There's another development called agent-based systems, where people can adjust their tools, the ones they use at work, to learn along with the person. They become suited to that person, and they basically grow together, so you can't give your program to somebody else. Voice recognition systems is one example. Your system can't understand somebody else's voice. It's trained to your voice. I almost think that

people might put their tools on their resume. You're not hiring me—you're hiring me and my tools—and that's not so farfetched.

DR. BISHOP: We're going to move on to the fourth scenario, and we're going to change the approach a little bit because in this scenario we actually have a demonstration. In this scenario, we have a person who's arrived from the future. This is a visitor from the World 2010, and you get to ask him any questions that you would like to try and discover what the visitor's world is like.

FROM THE FLOOR: How many automobile manufacturers are there?

MR. SWERDLIN: One—Toyota.

FROM THE FLOOR: How many insurance companies are there.

MR. SWERDLIN: 912.

MR. SWERDLIN: A decline in the number of insurance companies of 11.2 percent over the nine-year period.

FROM THE FLOOR: I'm just curious—are you here live or are you a hologram?

MR. SWERDLIN: I'm a hologram, and you all are holograms.

FROM THE FLOOR: How big is the tent?

MR. SWERDLIN: Luckily back in the last century and the beginning part of the current century, some of our forward-thinking actuaries thought about where we should be, and the tent is getting bigger and bigger every year. There's one actuarial society, it's called the Global Actuarial Society (GAS).

FROM THE FLOOR: In the United States, how have governmental regulations changed?

MR. SWERDLIN: Governmental regulation in the insurance industry? It's less than it used to be.

FROM THE FLOOR: What is the hottest selling insurance product?

MR. SWERDLIN: Loss of business due to terrorist's attack.

DR. BISHOP: Let me ask you about your suit there. What's the purpose of this suit?

MR. SWERDLIN: Well, it actually looks a little bit like a NASA space suit, but, of course, we don't have space suits any more. You might remember September 11, 2001?

DR. BISHOP: I remember that day, very well.

MR. SWERDLIN: There was a significant and tragic event, and at that time people were worried about biological warfare and stuff, so this suit keeps all the bugs out. You have to keep it closed though.

DR. BISHOP: All right, so this is your chemo/bio/radio protection suit.

FROM THE FLOOR: Do you have an insurance policy for risk responsibility for your act?

MR. SWERDLIN: For my personal acts? We're a lot more responsible in the future. You can't buy an insurance policy for it because accountability is big in the future.

FROM THE FLOOR: Who bears the cost of genetic testing?

MR. SWERDLIN: Individuals.

DR. BISHOP: Thank you very much. Obviously Dorn is pointing out a future that is not a very happy one frankly, and it might be the result of actions that began last

month and that could go on for some time. It's a future of increased personal risk, a future of increased insecurities and threats because, in fact, the open systems that we have come to enjoy are very difficult to protect. In the anticipation of the Y2K problem, which turned out to be a non-problem either because it was never a problem or because we solved it before it came about, they identified 56 different infrastructure systems in our society—56 different systems, which had they been affected by the Y2K problem, might have gone down and caused some disruption. We obviously have now been treated to the attack on two such systems – one is the airline system and the second is the postal system. We have 54 other systems yet to go—food, water, power, information, broadcast, auto transport, mass transit, shipping—you name it and you can go through the whole list. Are we in the next 10 years going to have systematic attacks on those systems? Though they're not yet world-threatening, they could create a background of insecurity that I believe has a big impact on actuarial practice and on products. What could be some of the products, new products, that you might think of to offer to the consumer in a society that had not yet figured out how to protect itself against evil intents—terrorism or otherwise?

FROM THE FLOOR: I think there will be exclusions for acts of terrorism in insurance policies, just like there's exclusions for acts of war.

DR. BISHOP: There are already such exclusions coming out now, and you expect that to go forward. Certainly one of the plausible outcomes of terrorism is less insurance, not more, and therefore people less protected against risk.

FROM THE FLOOR: Bigger market for life insurance.

DR. BISHOP: Maybe not a bigger market, but certainly higher premiums.

FROM THE FLOOR: And probably people willing to buy it.

DR. BISHOP: Yes, willing to buy it and willing to protect themselves against it. You foresee more government backing for businesses. There's backing for airlines. I think there was a proposed backing for the insurance carriers for the World Trade

Center. Now we have more government intrusion and more government insurance, like national flood insurance programs to protect the private sector from having to carry the costs of the casualty due to these types of things.

FROM THE FLOOR: Do you think that the people responsible for the terrorism are focusing on secondary targets or are they pretty much focusing on the primary targets, the victims who were directly impacted by the acts.

DR. BISHOP: What I know of terrorism is that the acts themselves are purely means to another end. During the turbulent times of the 1960s, people would blow up research laboratories not to kill the people or to blow up the laboratory, but to get a response. The problem now is that in doing what we're doing militarily in the Middle East, which is to find and to bring those perpetrators to justice, there may be secondary impacts that are clearly raising the level of heat in some very unstable parts of the world. I think it is a game of secondary and tertiary impacts, all with the intention of trying to inflame and therefore overthrow at least some regimes in the Middle East, if not capitalism in industrial societies themselves.

FROM THE FLOOR: To what extent is human affairs predictable as a function of astronomical events like solar cycle, tides, and things like that? For example, in 1990 there was a solar peak activity, and there were significant events in the world, culminating in the collapse of communism.

DR. BISHOP: That's a source of some degree of study within the social sciences. People have tried to relate, for instance, crime rates or incidents of mental illness with the lunar cycle, the full moon, and all of that and there are those who think the data for that exists. Solar cycles clearly have an impact on some physical processes like satellite communications and things like. But I have not seen evidence linking it to more tragic and more momentous events like the fall of communism. I've not seen that ever be defended.

DR. BISHOP: The Futurism Section's mission is to point out continually and respectfully that the assumptions that we make about the future tend to be too narrow. There are ways of dealing with those. Not predicting them or making new

assumptions, but basically questioning the assumptions we have in a what-if framework, so that we don't become too wedded to them. The section on actuaries of the future is about what you as actuaries need to be doing to prepare for futures that are not predictable and yet are still plausible. Applying this to your work has been a very difficult task because your work is extremely quantitative and largely based upon models and assumptions that when they're overturned, what do you do? I would urge you to check out the materials in Course 7, which Mark Rowley from the Principal and Stuart Klugman from Drake University have put together. There is an excellent set of scenarios about potential investments in Latin America.

MR. SWERDLIN: I'm a very strong proponent of the big tent, and I think we need to be really changing our views about ourselves and our profession in order to survive in the future because the way we've operated in the past has been in a fairly enclosed and cocooned-like environment. In insurance companies, actuaries were the king, but now that insurance companies are owned by banks, the lines are getting fuzzier in the financial institution arena, and we're getting competitors from other similar professions, we need to be thinking about the future more and thinking about how we need to change our own thinking to be successful in the future.

FROM THE FLOOR: Just to pick up on one Peter made. We did have a session at the annual meeting in Chicago in the year 2000. Peter talked about this case that Mark Rowley and Peter was involved as well presenting, investments in Latin America. There is a write-up of it online. I think it's PD44. I would encourage you to visit the Web site and read through it. It's really just scratching the surface. Again, we've been in existence for 18 years and the challenge has been to find applications for actuaries and I think it's a good start.

MR. SWERDLIN: One more thing I wanted to mention. I mentioned people skills and career development. Our relatively new section, Management and Personal Development, I think the name of it is Professional Development. That's a real good section. They're doing some good seminars and they've got the Actuarial Career Handbook or Career Planner. They're doing some good work and I think those are areas that we need to be thinking about for arriving at our skills.

DR. BISHOP: Great. Well, the bottom line for the future is a lot more interesting than we imagined.