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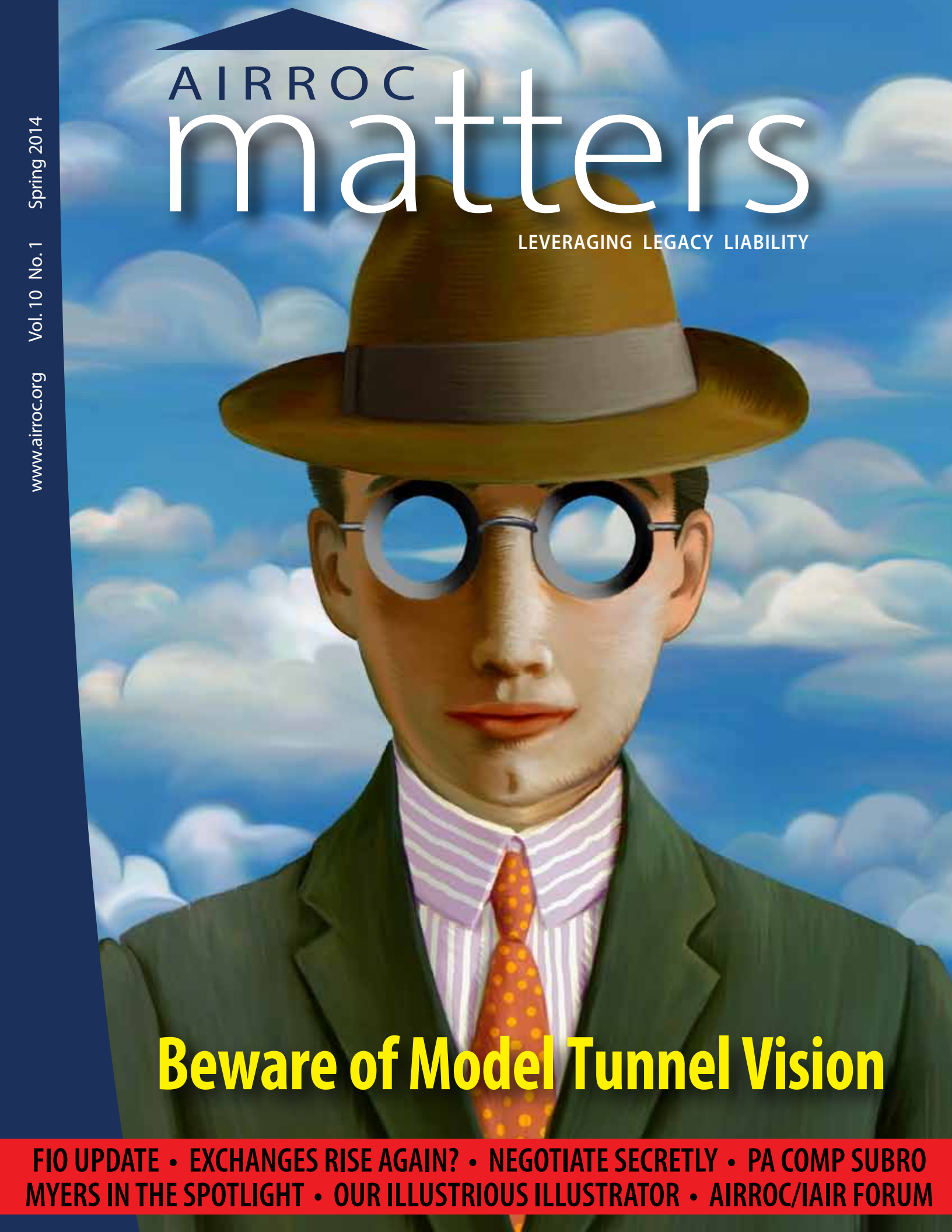

Beware of Model Tunnel Vision

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Beware of Model Tunnel Vision

Co-Chair Leah Spivey and Editor Peter Scarpato moderated a roundtable discussion on exploring the pros and cons of reliance on models. The distinguished speakers were Tom Edwalds, AVP Mortality Research at Munich American Reassurance Company, Kevin M. Madigan, Director at PwC and Guntram F. A. Werther, Professor of Strategic Management at Temple University.

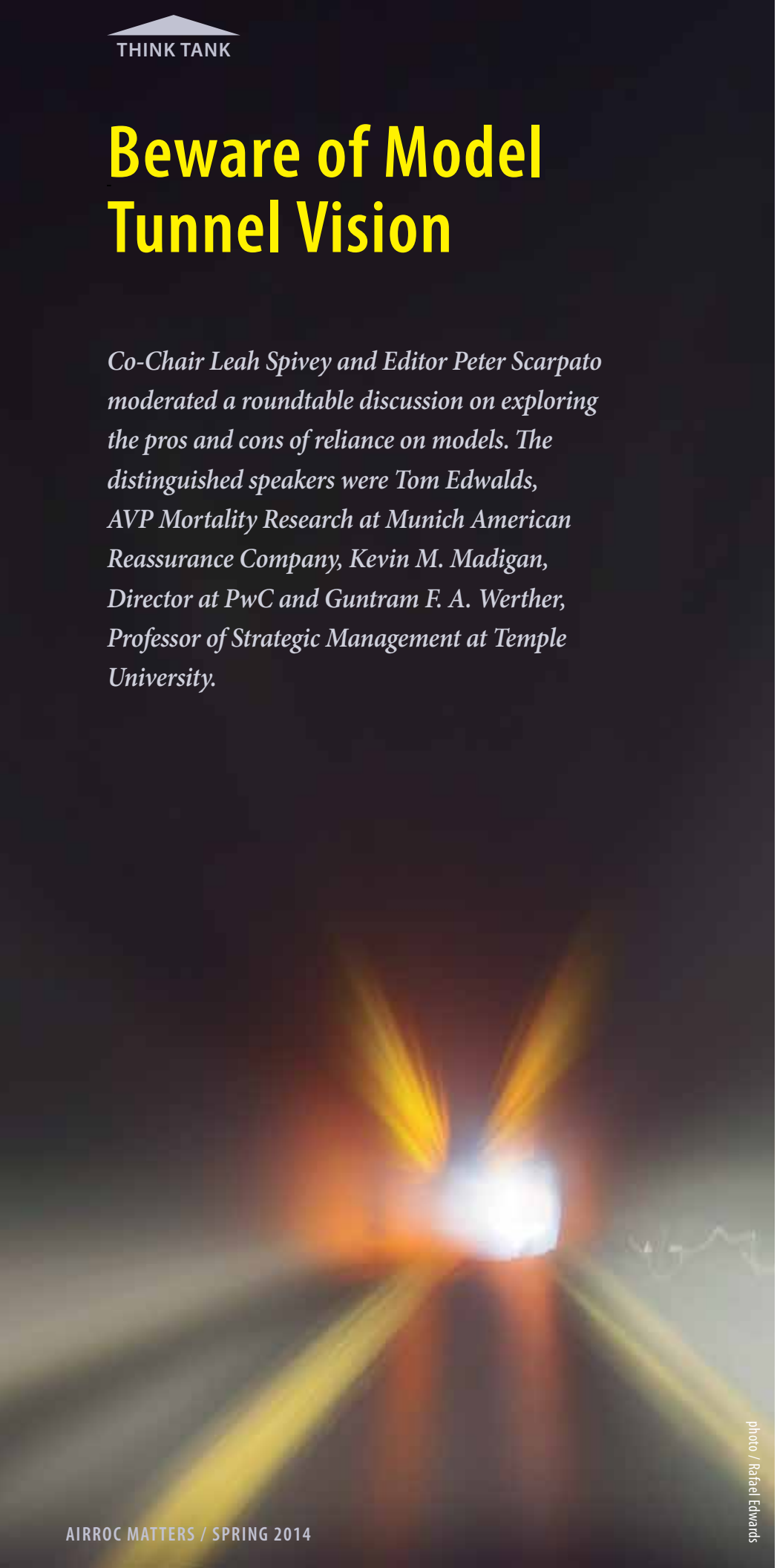

photo / Rafael Edwards

Reliance on Models in Insurance and Reinsurance

Peter Scarpato: *Leah Spivey and I are very happy to have our distinguished panel here today.*

Entities use models in different ways and at different levels, but is blind reliance on models alone the best approach?

Leah Spivey: *Kevin and Tom, in your areas of casualty and life business, have you seen a change in companies' reliance on models?*

Kevin Madigan: There's been some positive change lately in terms of catastrophe models. For a while, a lot of corporate decision makers weren't really making sure they understood what the models do and don't do when they found themselves in trouble.

So one good thing that's happened is that a lot of companies have spent time trying to make sure they actually understand these models and how to use them, recognizing that even the model vendors will tell you that you're not supposed to accept their answers as the gospel truth—they're just another form of information.

Another development in both life and casualty is the rise of capital models, and that's been driven forward by the new regulatory regime.

Tom Edwalds: The life industry is behind casualty in the application of predictive models. Models are being investigated and used to look at alternative methods for underwriting and pricing. There's been a push for a long time to change the way life insurance business is valued, such as adjusting the actuarial assumptions to give individual companies more flexibility to reflect their actual experience when calculating their liabilities.

One of the major areas is what's referred to as the middle market. Historically, many insurers have focused on high face value policies written for people looking for wealth protection. But for people near the middle of the income spectrum, there's a lot less life insurance protection than

perhaps there should be, which presents the opportunity for both direct writers and reinsurers to use predictive models as actuarial tools.

Madigan: You're right. Predictive analytics has exploded across the P&C industry, and now we're starting to see the use of predictive analytics outside of personal insurance.

Spivey: *Do you have any examples of how over-reliance on models causes problems?*

Madigan: The immediate headline is the number of companies that found themselves with way too much catastrophe risk, especially after Hurricanes Katrina, Rita, and Wilma. But I'm also seeing companies accepting the model answer as gospel and thinking they need to hold a lot less capital than they should. Because they think that they are diversifying risk, the model shows their capital requirement dropping.

Guntram Werther: Outside the industry, I think over-reliance on the models has caused problems in everything from war fighting to understanding international change and so forth. So I think these are generic problems that go across your industry and lots and lots of other industries.

More Sophisticated Models Don't Necessarily Produce More Correct and Reliable Analysis and Data

Werther: If you look at philosophers, they often emphasized that mathematical techniques are at the middle level of analysis (yielding general truths in human affairs), not at high levels of precision because of the interaction effects seen in social change. Statistics and models are 'for the most part true' approaches, not usually true for any specific case.

Edwalds: The one thing I always observe is that whenever you are constructing models of any kind, the primary concern is data quality and data integrity. If the

Predictive analytics has exploded across the P&C industry...

– Kevin Madigan

data is flawed, there is absolutely nothing that's going to come out of your model that will be of any value.

That is often overlooked; a lot of energy goes into building the structure of how the model is going to generate answers from data without paying enough attention to what data is actually getting put in. But if you have your valuation models set up and somehow you get totally wrong info in there, that flows straight to your books and six months later, you realized that was wrong.

Madigan: I think the more sophisticated the model, the more care you have to take. Generally, the more sophisticated the model, the more difficult it is for decision makers to actually use the results.

A really good, sophisticated model can produce lots of fantastic information, but a lot of decision makers who use model results don't think the same way the model builders think.

Edwalds: One issue you get into with sophisticated models is over-fitting the models to the data — where you actually picked up not true effects of the predictive variables on your outcomes, but you've picked up just noise in the data. And, you get a model that is too unstable for what you're trying to use it for.

Werther: If you view this across cultures, we think in numbers a lot more in the West than they do in other parts of the world. Some of the data that you get in other parts of the world are fictitious or they're figments of somebody's imagination, rather than precise. People need to remember that, especially when comparing data that's scattered across different cultural systems.

Scarpato: *Is there a way to make the models better, or make the people who use them more prepared, or to make these models as close to foolproof as possible?*

Madigan: I think, no. You have to make sure that people who use models understand their limitations. It's not about making the models better, because every model that's been used, as far as I can tell, keeps getting better. The issue is that they get so good that they're able to produce all kinds of wonderful information that people don't know how to use.

So instead of saying "I'm going to make the model better," you just say, "I think the model says the number should be X." But in reality, the model doesn't really say it should be X. It says it should be anywhere between Y and Z, but X is the best estimate between Y and Z.

Werther: The analyst part of this equation has really been underemphasized. I believe getting people to think creatively, insightfully, has received a lot less attention than producing greater and better models. I think that's where the industry and education need to improve.

Kevin wrote an article in 2012, which I think has it right. He used qualitative data, experience judgment insight, and the models as tools. And that's all it is.

Beware of Model Tunnel Vision (continued)

It's a tool. It can be a great tool, but it is nothing more.

So what you're looking for there is the calibration: it should fit with the other types of investigative insights and methodologies we use. Qualitative data, experience and judgment — wise judgment — are very important, and are typically displayed by the people who actually do foresight well. And we need to recognize that and put the models into that mix as a way to make human judgment better; as adjuncts to the analyst.

Madigan: If you're in the position of relying on a model to make a decision, then you already have a certain amount of knowledge, expertise, and experience. The model is a tool. When we say models, we're really referring to computer models that have some sort of a mathematical, theoretical, engineering, and scientific basis to them.

Everything you use in your decision-making is a model, including the softer, more qualitative things. You have to think about all the different ways there are to analyze. Since it's just an analysis, you've got to synthesize all the information that you have, not necessarily focusing on having fantastic analysis, because then you miss a lot of other stuff that you should be looking at.

But it's really more understanding that you have a decision to make. What's the ramification of the decision you're supposed to make? What's all the information you can get? Why just pick some model that you may not even understand?

Nobody is making any decisions today that are much different than they were making 100 years ago or 50 years ago, including in the insurance industry. How did you make it before you had fancy computer models? So why throw all those other tools away? It's not like those tools aren't any good. It's that these models just give you even more tools.

Werther: Synthesis is an art-like experience of putting things together,

In the application of any model, you really need to have a decision maker who is extremely familiar with the subject matter.

– Tom Edwalds

whereas analysis is taking stuff apart. And those are different skill sets. The kinds of people that are good at synthesis are generally quite broad, artful thinkers.

Edwalds: In the application of any model, you really need to have a decision maker who is extremely familiar with the subject matter. You need to apply experience, judgment, review and assessment: Is this a reasonable result? And if something is surprising it requires investigation. Is it surprising because we found something new? Or is it surprising because you have serious errors somewhere either in your input data or in the model itself? You must look for other ways of confirming whether what you found surprising is a new factor or if it is simply a mistake.

Madigan: I was doing some work for a client around risk management of natural catastrophe risk. They recognized that none of the models out there were actually going to give them anything close to the real answer, but they could give them really powerful information.

They found ways to use these models to provide information to help decide what kind of risk they want to take based on the risk they already have. They use the model to figure out where they fit in relative to the P&C industry. They focus on the exposure the model says they have, regardless of what the actual number might be, or where they want to be if the model is "right". It's an interesting way to turn the model sideways and say we know the numbers are going to be wrong. But what can we live with in terms of where we fit into the overall world in which we operate according to this model?

Steps Senior Executives Take to Properly Choose Which Models to Use and How to Use their Output

Werther: I'm going to reference Mr. Kahneman, winner of the Nobel Prize. He used this idea of knowledge of broader experience – knowledge of the board – as the primary guide. But I would like to fold in some other work – if you know that each individual model is imperfect, if you know that each model will fail just as a crisis is arising, then you can use it the way that Kevin talked about, but you can also use arrays of imperfect models around the specific issue as a crisis foresight tool because – and the critical insight in here is – each individual model is going to fail in a different way.

Since models fail in different ways, you can use that information to triangulate what's going wrong in the system and use each model, as Kevin said, in the sideways way.

If you look at senior executives and dealmakers using an array of models around something they're interested in and understanding that they're all imperfect but they will fail differently and succeed differently, you get much more robust information that you can apply

as improved judgment to whatever it is you're interested in.

Scarpato*: Dr. Werther, it sounds like the concept we're using to judge these models is business judgment – possessed by someone who can take a step back and assess what the model says and doesn't say.*

Werther: Yes, but this is where I would cross out the word 'business' and leave the word 'judgment'. Because what this comes down to is philosophical, and usually societal, cultural, political, legal judgments because no business operates in a vacuum – they operate in a specific culture and society, which has specific values and cognitive ways of looking at things that differ from all others.

So the model remains, to quote Andrew Ilachinsky, merely the adjunct to the analyst. Human judgment ends up as the key to all of this. When you look at Immanuel Kant, he tied this point together very precisely in his book Critique of Judgment. And I think we have to emphasize that these technical tools revolve around using wise judgment across multiple realms in which models can help us, but don't ultimately solve.

Scarpato*: Do models make everything seem significant and leave no way to tell which is more important, if you've got variables or different scenarios?*

Edwalds: On the life insurance side, the data has routinely for a long time been analyzed on millions of records. Of course, now with the advent of big data, it's in a much larger order of magnitude.

But it seems the issue you're referring to is that if the input data set has billions or trillions of observations and you're looking at different predictive variables that differ in frequency by a tenth of a percent, it's statistically significant based on the number of observations you have.

That's where models coming off the big data sets can be confusing. You'll get statistically significant results that perhaps are not that meaningful.

Werther: I think what's missing is the notion of perceiving 'internals' or 'ideas' to guide interpretation of the data. Kant, Sir Isaiah Berlin and many others used the terms 'thread' or 'string' to make this point about what usefully holds raw information together to yield meaningful understanding.

What should be happening here is that idea, the internals – the broad experience – are well perceived and the models make assessment more robust; make it better. Too many people are now saying they have more and more data – big data – so we'll just run things until something fits. Something will fit. That's also probably the wrong something.

> ***You have to make sure that the actual business folks making decisions that are executed in the business environment recognize that they're actually more important than the folks running the models.***
>
> ***– Kevin Madigan***

Spivey*: How should new employees in the industry be trained to avoid this problem?*

Edwalds: Certainly, having new employees combine some academic background with some statistical techniques is a plus. You need to make sure that anyone that you're assigning to be part of your model buildup team, or the head of that team, is somebody whose primary skill set includes business judgment. Somebody who can look at the results coming out, and ask the question: are we seeing something surprising because we have a new fact, or because we just made mistakes?

Werther: The Director of National Intelligence has emphasized the need for three skill sets. One was synthetic thinking ability, which is what Kevin just said, tying things together. Second was knowledge of cultures and other people's social, political systems. And the third was linguistic and cultural skills. What they're after is being able to think as other people think in the various societies, as well as being able to put that together and synthesize it.

Madigan: Tom is spot on. In fact, I think it's a problem everywhere in business that we get people who really know the technical framework, but don't really understand the environment in which models are being applied.

But at the same time, you have to make sure that the people who are using the results of the models know enough, that they're able to understand. And it doesn't mean they have to be experts in statistics or science, but be able to analyze and appreciate what any intelligent adult human being can understand – here's how the modeling process works, here are the weaknesses, here are the strengths, and move on.

You have to make sure that the actual business folks making decisions that are executed in the business environment recognize that they're actually more important than the folks running the models.

Scarpato*: As they promote people to management and senior level positions, companies must ensure that they've got somebody with enough experience to see the forest for the trees in the business. How do you do that?*

Madigan: Make sure you don't have a bunch of specialists and that the people actually doing all the tangible stuff understand the business that they're employed in. You've also got to make sure that the people applying the results of whatever kind of analysis understand enough about this analysis to know when it is absolutely giving you an answer and when it's just giving you information, and when that information is more or less trustworthy. It's really just about raising people to be more broadly educated.

Werther: That's exactly right. I've been looking at people who are successful with this. And what we see is that they have multiple career choices, they do more than one thing. They're generally older; 35 and up seems to be about a cut line. And they are also broad thinkers. They know

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lots and lots of things. Now, if you think about this, universities are becoming more specialized and less generalist, so we're actually training people the wrong way.

Edwalds: One thing I have observed is that this has been an issue in the actuarial profession for my entire career and maybe longer. And that's because we have this credentialing process that involves a series of examinations and there are separate exams depending on what your specialty is. Entry level candidates get their career advancement by successively passing technical exams.

Before they get fully credentialed we must make sure that we build into the examination process—and some other things like the fellowship admission course—ways to assess the ability to look more broadly, to make sure there's an understanding of the underlying business.

But fundamentally, the exam process isn't going to fully evaluate that. So there is a challenge with the newly minted fellow who is almost always in high demand, but doesn't really have the understanding they need. But if they join the right organization, they can get the mentoring they need to develop that broad thinking and be able to understand the greater depth of the business they're in.

Madigan: That's what makes an actuary who's developed that broad understanding of the business in such demand. We've got the technical stuff and we can put that together with the really important stuff. It's just understanding how it's all used. But it's really hard to make much use of an actuary who only has the technical expertise. There's not a lot I can do with that person. And they hit the glass ceiling fast.

Edwalds: I agree with Kevin. The actuarial societies have made a real effort to try and make that part of the credentialing process, with some degree of success. But as I've said, it can't be perfect when you're fundamentally working around that examination-type process.

So if you know what you don't know, or at least have a clue about what you don't know, you're in better shape than if you don't have a clue.

Don't rely on historical patterns. They don't repeat themselves—they perhaps rhyme.

– Guntram Werther

Werther: If you think about it, technical expertise is absolutely necessary. But the way we train musicians and artists is essentially a mentoring process by which once they know how to play an instrument, we teach them how to make music, better music, higher quality music. And maybe that fits under this kind of a mindset.

And there's still more and more credentialing until, at some point, we simply say, okay, you know how to do the basic stuff, now we're going to make you into a musician, we're going to make you into an artist, we're going to make you into an analyst that understands how the world works, and that's essentially a mentoring process.

The solution is to do this inside your profession. Set up formal mentoring processes where the people who are actually good at this stuff teach other people how to improve over time.

Do Changes in the Global Economy and Technology Affect the Impact of Historical Patterns on Future Projections?

Werther: Don't rely on historical patterns. They don't repeat themselves—they perhaps rhyme. There are better ways to do futures foresight. But you have to take cognizance of those historical patterns and experiences.

The concept here is syndrome change, right? And the related concept to that is syncretism which is going from one form to another. Basically you start with these historical patterns and experiences and you move from there; you don't rely on them in terms of judging futures.

Edwalds: In the short term, if you are aware of the environment and can assure yourselves that certain key elements in the environment are reasonably stable, you can make these types of projections well enough to do your financial statements and price your [product] based on your historical patterns. But you need to be sensitive to changes. If you go back 50 years, the life insurance industry was based on fixed interest rate assumptions.

And when that really changed radically in the late '70s and early '80s, everybody was scrambling. Now what do we do? What interest rate do we assume as opposed to totally having to change our approach?

And that's the kind of thing you need to watch out for. You need to be aware of what the underlying assumptions are in your business. What are you absolutely relying on? Make sure those assumptions are still stable. Is that changing? In health insurance, the passage of the Affordable Care Act was a long time coming. That was discussed for at least 40 years before it actually passed. Various efforts were made to get there.

For the health insurance business, you need to be aware of what stresses are causing this conversation to take place. What do we need to do? Even though we may not to be able to fix the outcome, what do we need to do to be able to survive whatever occurs?

Spivey: *If actuaries have a clear understanding of this open reliability of data going into their model, why are there pages of disclaimers in the actuarial report?*

Werther: I don't think that anybody knows the reliability and scope of the data, which is why one ought to diversify the use of multiple methods and all the rest of it. The best you can do, in my view, is to have some sense of the reliability and scope of the data and think holistically from there.

Edwalds: I do think there tends to be, within our profession, a sense and understanding that your data is what makes or breaks your whole endeavor. Actuaries are always looking to get better data, but always realizing that they're going to have to make their decisions and recommendations on imperfect data. That is where all the disclaimers come from – comparing the data they actually have with the data they would like to have, and putting in disclaimers about what was lacking in what they received and why that limits the potential application of the results.

Madigan: If somebody from outside the company is writing a report or opinion, there is a recognition that "even if you guys have the best data in the world, and the best model in the world, I don't actually work inside the company, so there's a lot of stuff that I just don't know." You can't do the qualitative evaluation. You can't do the synthesis. You can plot your judgment. It will automatically not be as good as when it comes from inside. There are always assumptions that have to be made. There are always adjustments that have to be made.

Edwalds: My comments were from the perspective of the internal actuary. Even when you're the one who's at least able to talk to people who are responsible for the actual data entry, you can get all the way down to what happens at the individual transaction level to get this data entered into our data stream.

Actuaries are always looking to get better data, but always realizing that they're going to have to make their decisions and recommendations on imperfect data.

– Tom Edwalds

But still that will only get you so far. It's going to make you aware of where you are – I think somebody used to refer to where the fish hooks are. They are the things that will snag you when they come through.

Spivey: *When I've been in a room with business experts and actuaries who have run certain models and come up with a pick, what they think is the right answer, I often sense some contention. What I have used at times as a remedy is having the actuaries open up the process a little earlier on, before they've come up with their pick, even before actual peer review, just to share with those business experts the thinking and reasoning for certain assumptions. Do you think that might be a good remedy?*

Edwalds: I definitely agree. I have seen many cases where there has been open consultation with the other business experts. Actuaries developing assumptions, talking to the underwriters, and talking to marketing people, to get a sense of what's in this particular business that we're trying to value or price. I've seen other cases where actuaries are coming up with that number in a vacuum instead of working with other business experts throughout the process.

Madigan: I used to do a lot of asbestos reserving. I spent most of my time talking to attorneys and claims analysts. I would say, "based on everything you showed me, these are the assumptions that seem reasonable, what do you think?" I would spend a significant amount of time doing that before I ever gave them a number. Once I gave them the number, we would then reassess all those assumptions.

Werther: Looking at people who are actually good at this in everything from stock market to international relations, that's what you see. The reason the intelligence community produced 'fusion centers' is to try to inject sharing and integration into the judgments of the most secret organizations imaginable. And they're opening up to really a startling degree. They're literally reaching out and talking to people to look at assumptions and things like that, because in-house doesn't make it.

So this is not just happening in the actuarial profession, this is happening across the spectrum because the problem is the same.

Scarpato: *Thank you all for a very candid and robust discussion. This will be of great value to our readers. Leah and I greatly appreciate your collective experience and the time and the energy that you put into this discussion.* ●

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