actuarial REVIEW
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THE OTHERS *Part 2*

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VOLUNTEERS AND THE WORK THEY DO

The CAS Microinsurance Working Party

In Celebration of Volunteers: The 2017 CAS Volunteer Honor Roll

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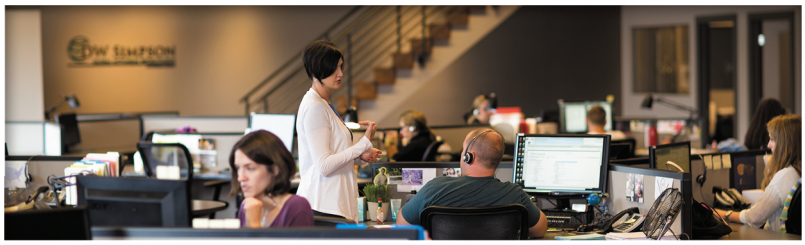

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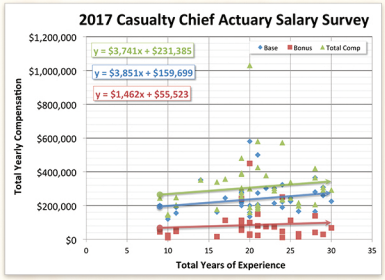

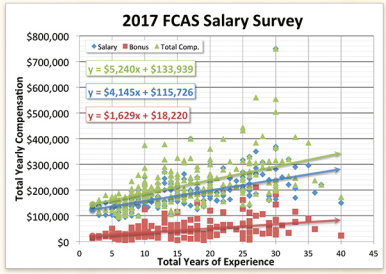

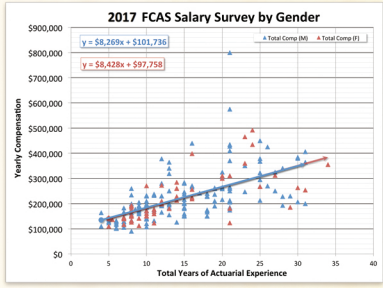

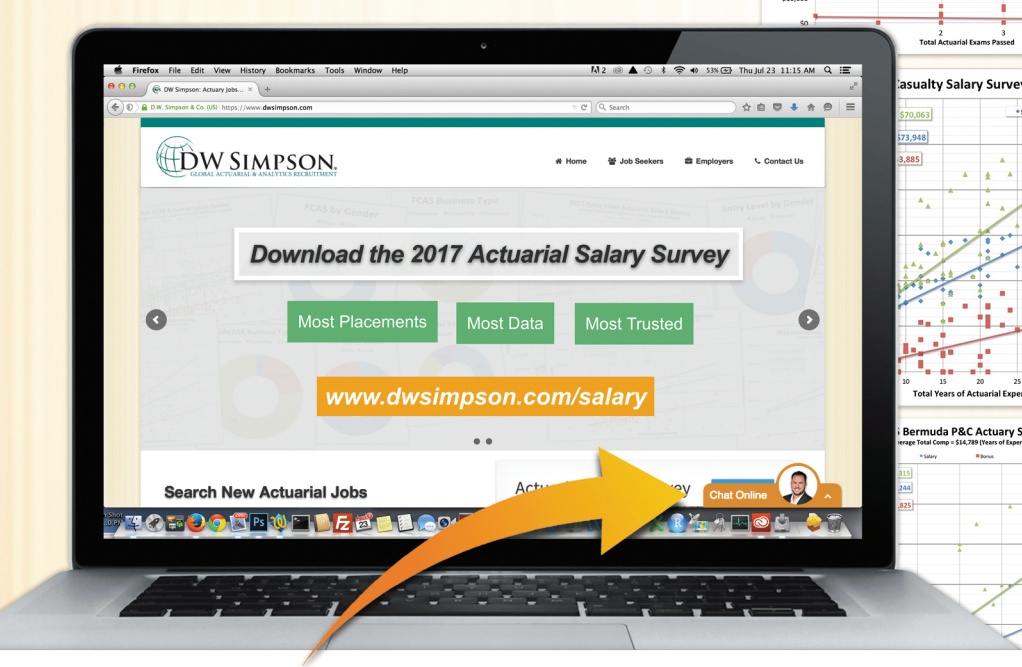

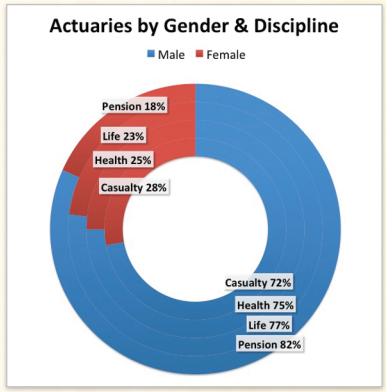

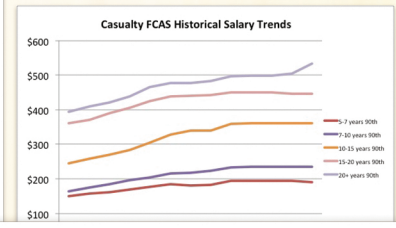

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November/December 2017

actuarial REVIEW

departments

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on the cover

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actuarialREVIEW
The magazine of the
Casualty Actuarial Society

A Fine Tradition

For this issue, we have assembled a wide variety of stories to get you thinking about the future and reminiscing about the past.

Our cover story, "The Others: Part 2," is a continuation of last issue's cover story featuring CAS members who practice their actuarial skills in areas beyond insurance. These CAS members are engineering software and tracking infectious diseases. They are lending their actuarial expertise to start-ups and firmly established companies, helping them innovate and stay on top. Something tells me that these kinds of stories will not be the last ones you hear about. We are going to learn more and more about the changing roles of actuaries in the marketplace.

Speaking of changes, remember when calculators were first permitted to be used in CAS examinations? For those who do, the article on the Technology-Based Examination initiative may conjure up some memories. If you are currently taking exams and don't recall the advent of calculators in CAS history, the TBE article is a must-read.

If you have wondered whatever happened to our "Big Audacious Goal," the recently announced CAS Strategic Plan should answer your question. The answer is, "It is alive and well." (For more on the Big Audacious Goal, see *AR* August 2003.)

For those of us paying more and more attention to economic capital modeling, you will find AR's Stephen Mildenhall's "Explorations" column very thought-provoking. "In Praise of Value at Risk" tackles this compelling and complex subject.

It's become a custom for *Actuarial Review* to honor our CAS volunteers in our year-end issue. The CAS enjoys the efforts of roughly a third of its members, who volunteer in a diverse variety of functions and capacities. Whether or not you are aware of the many volunteer efforts of CAS members — some highly visible and others not so much — they all contribute to making the Casualty Actuarial Society an unparalleled organization (pun intended).

I hope you enjoy this issue. On behalf of the CAS *AR* staff, I thank the men and women who write, review and edit *AR* articles. This publication is indebted to them.

Actuarial Review always welcomes story ideas from our readers. Please specify which department you intend for your item: Member News, Solve This, Professional Insight, Actuarial Expertise, etc.

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A Year of Change

As I write this, my year as CAS president is coming to a close. There is much for me to do before November, but the time to reflect has arrived. I'd like to share some of the things the CAS has accomplished this year and some of the many things that remain to be done.

Before I began my year as president, people would ask me what I hoped to accomplish. What would my focus be? I had a relatively easy time formulating an answer. It was time to refresh our strategic plan, and this was a major undertaking. Relationships with other organizations have also become a significant focus, given our efforts to build The CAS Institute (iCAS) and contribute to the development of a global syllabus by the International Actuarial Association. The priorities seemed obvious to me: Complete our strategic review and continue to work on enhancing relationships with other organizations, both actuarial and others, while protecting the interests of the CAS.

With the help of staff and many of our volunteers, I'm happy to say that the CAS has been able to make progress on both of these goals — and many more. And I have continued to experience the importance of our core values in the process.

In October we released our refreshed strategic plan. It's a testament to our commitment to our purpose and values that the revised strategic plan stayed very close to the ones last articulated in 2012. We added two new core values, diversity and innovation, but they were implicit all along. This goes to show that even though the world around us has changed significantly, and the ways we do our jobs have changed, the things we believe in have not.

This year we also underwent an education audit conducted by the National Association of Insurance Commissioners (NAIC). The purpose of the audit was to determine whether CAS Fellows and Associates meet the minimum educational standards to be considered "Qualified Actuaries" and therefore are able to sign NAIC P&C Statements of Actuarial Opinion. In September we received the results of that audit. Like many audits, there were suggestions for improvements. But the most significant outcome for us is that it was confirmed that the CAS education syllabus provides what is needed for opinion signers. More work is being done, and some changes may come. But, our syllabus was officially recognized as deep enough and broad enough to qualify P&C opinion signers.

Continuing with education, we are making some strategic changes in this area. Our newest venture, iCAS, is progressing at a nice pace and faster than expected. Earlier this year, iCAS started offering modules 1 and 2 of its first credential, the Certified Specialist in Predictive Analytics (CSPA). The first CSPA exams have been given, experienced practitioners have been awarded the credential, membership is growing and a second credential is now under development.

In addition to the remarkable development of iCAS, we are making some creative changes to basic education, such as introducing more predictive modeling material into the basic syllabus. We are introducing technology-based examination with remote proctoring and are expanding the use of integrated examination questions. These last two changes will ensure that our education system more adequately reflects our members' work environment.

On the research side, we are experimenting with converting committees into working groups. Committees work well when there is a defined task with defined deadlines. Research projects are more fluid and need a structure that allows for creativity. We are also configuring these working groups to disband when the work is done.

That's all pretty positive news. Yet, the work of leadership, volunteers and staff doesn't end. Here are only some of the things that the CAS continues to work on.

As our world becomes more complex, we need to work with partners to achieve our goals. As a result of the strategic plan review, we are now in the process of adopting a framework for identifying and assessing viable strategic partners, and we are updating metrics for measuring progress toward achieving our plan.

Education will continue to change, both in what we believe to be appropriate subject matter and in how we validate knowledge. Our admissions and professional education volunteers continue to explore alternatives.

Our experiments in the research area will need to be evaluated and modified if necessary to keep us in the forefront of P&C actuarial research.

And, just like in life, relationships are complex and constantly changing. A focus on strengthening relationships with other organizations will always remain a priority. ●


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COMINGS AND GOINGS

Cheung Kwan, FCAS, has joined Century Insurance Group in the newly created role of executive vice president, chief operating officer. Kwan has over 25 years of experience with all aspects of insurance company operations and has held senior positions with a number of leading national and international insurance carriers.

Sarah Shine, FCAS, CPCU, was recently appointed senior vice president, commercial products at Erie Insurance. Shine joined Erie in 2000 as an actuarial analyst for personal lines and shifted to commercial lines in 2004. Since 2013 Shine served as vice president of commercial underwriting and, earlier this year, was named regional vice president, underwriting, southeast region.

Greenlight Re announced that **Michael Belfatti, FCAS, MAAA**, will hold the newly created position of chief operating officer. Prior to the position, Belfatti was CEO of M. J. Belfatti & Company. Belfatti has also held the position of executive vice president and chief actuary at both Endurance Holdings, Ltd. and Validus Holdings Ltd.

Amanda Aponte, FCAS, MAAA, has been awarded the International Association of Industrial Accident Boards and Commissions NextGen Award for 2017. The honor is given in recognition of new talent and leadership in the workers' compensation industry. Aponte serves as actuary and director of analytics at SFM Insurance Company.

State Auto Insurance has named **Kim Garland, FCAS**, senior vice president, commercial lines. Garland joined the company as senior vice president, standard lines, in 2015. Prior to joining State Auto, Garland was chief product officer of AIG's consumer division. He previously helped lead the restructuring of United Guaranty, AIG's mortgage insurance company, as its COO and later CEO.

The American Academy of Actuaries has named **Kevin M. Ryan, FCAS, MAAA**, as the organization's new senior property and casualty fellow. Ryan is a past president of the CAS and has over 50 years of regulatory, executive and consulting experience. Ryan's career has included serving as deputy director of the Illinois Department of Insurance and as president of the National Council on Compensation Insurance.

David L. Kaufman, ACAS, MAAA, received The Institutes Griffith Insurance Education Foundation's 2017 Lifetime Achievement Award during a ceremony at the National Association of

ACTUARIAL REVIEW *LETTERS POLICIES*

Letters to the editor may be sent to ar@casact.org or the CAS Office address. Include a telephone number with all letters. Actuarial Review *reserves the right to edit all letters for length and clarity and cannot assure the publication of any letter. Please limit letters to 250 words. Under special circumstances, writers may request anonymity, but no letter will be printed if the author's identity is unknown to the editors. Announcement of events will not be printed.*

Mutual Insurance Companies Annual Convention on September 25 in Denver, Colorado. Kaufman is CEO of Motorists Insurance Group and BrickStreet Mutual Insurance.

Business Insurance has included **Alice Underwood, FCAS, CERA, MAAA**, on its 2017 list of "Women to Watch." The list recognizes women leaders doing outstanding work in risk management and commercial insurance. Earlier this year, Underwood was promoted to the role of global leader-insurance consulting and technology at Willis Towers Watson.

Guy Carpenter & Co has appointed **Claude Yoder, FCAS, MAAA**, as managing director and global chief innovation and product officer. Most recently, Yoder served as head of Marsh Global Analytics. Prior to joining Marsh, Yoder spent nearly 20 years in actuarial, underwriting and innovation roles for several insurance carriers, including The Hartford, where he led research and data.

EMAIL "COMINGS AND GOINGS" ITEMS TO AR@CASACT.ORG.

Want the latest on CAS member activities? We post news real time on our social media channels. Follow us on Twitter, Facebook and LinkedIn to stay in the know!

Year-End CE Policy Compliance Certification Due

All CAS Fellows and Associates need to certify their compliance with the CAS CE Policy's requirements by December 31, 2017. If applicable, members must meet the continuing education requirements established by a recognized national standard. Compliance with the CAS CE Policy allows the member to provide actuarial services in the year immediately following certification of compliance. Note that even members who are not in actuarial roles should review the requirements as CE compliance may still be required. Members not providing actuarial services at all must still attest to this on the website. For more information on certification, visit http://bit.ly/2yuYuvw.

IN MEMORIAM

Harry T. Byrne (FCAS 1959)
1930-2017

CALENDAR OF EVENTS

March 19-21, 2018
Ratemaking, Product and Modeling (RPM) Seminar & Workshops
Fairmont Chicago, Millennial Park
Chicago, IL

May 13-16, 2018
Spring Meeting
Boston Marriott Copley Place
Boston, MA

June 4-5, 2018
Seminar on Reinsurance
New York Marriott at the Brooklyn Bridge
New York, NY

September 5-7, 2018
Casualty Loss Reserve Seminar (CLRS) & Workshops
Anaheim Marriott
Anaheim, CA

November 11-14, 2018
Annual Meeting
Caesars Palace Las Vegas
Las Vegas, NV

June 3-4, 2019
Seminar on Reinsurance
Fairmont Southhampton
Hamilton, Bermuda

IN REMEMBRANCE

In Remembrance is an occasional column featuring short obituaries of CAS members who have recently died. Longer versions of these obituaries are posted on the CAS website at bit.ly/PCASobits.

The Coach

Jordan J. Pitz (FCAS 2001)
1972-2015

Jordan Pitz loved sports. He played them growing up in LaMotte, Iowa, and would later coach his son's Little League baseball team in Madison, Wisconsin.

Pitz taught his young charges good sportsmanship and instilled in them a love of the game. He led by example and saw the good in people and situations. He was ready to offer praise, encouraging even the worst players on a team and finding the positives in the things that they contributed.

His optimism carried over to his own illness. A friend of his said of him, "Even when he wasn't feeling well, he was always positive and he never let his diagnosis get him down."

Born February 3, 1972, the son of Donald and Ella (Kloft) Pitz, he married Jessica Konrardy in June 1997. Pitz graduated from the University of Iowa in 1994. He was an actuary with American Family Insurance for over 17 years.

He died January 5, 2015, at his home in Madison surrounded by family. He is survived by his wife and their three children, his mother, siblings and in-laws. He was preceded in death by his father in 1994.

The Quiet Observer

Haiyan "Heidi" Pan (FCAS 2010)
1973-2015

Haiyan "Heidi" Pan keenly observed her world and the people she held most dear. She held a ceramic science degree and was an early adopter of predictive modeling. She was fascinated with Chinese history and accumulated a large collection of books on the subject over the years.

In 1999 she married Zisu Zhao. The couple moved from Shanghai to Germany and then to the U.S., where Pan pursued an actuarial science degree at Boston University. After a few career moves, the couple settled in Princeton, New Jersey, to be close to Pan's post at Munich Re America.

With the birth of her daughter, Ellen, in 2011, Pan's world changed. She loved being a mother and delighted in observing her young daughter as she grew, especially as the child developed her personality. She wanted her daughter to have the best of everything.

"She really loved the kid," said Zhao. "She wanted her daughter to be happy, to be independent." Zhao said that Pan especially wanted Ellen to understand and learn Chinese. Pan left her daughter all of her books of Chinese history — to be read in Chinese one day.

She is survived by her husband and daughter.

The CAS Volunteer

Frederic J. Hunt Jr. (FCAS 1959)
1923-2014

Frederic J. Hunt Jr., 90, of Coatesville, Pennsylvania, died on December 3, 2014.

He was born in East Providence, Rhode Island in 1923, the son of Josephine (Johnson) and Frederic J. Hunt. Hunt served honorably in the U.S. Navy during World War II and graduated from Brown University. He worked for Insurance Company of North America in Philadelphia from 1955 until his retirement in 1988.

After earning his FCAS, Hunt began volunteering for the CAS in earnest — a commitment spanning two decades. Hunt volunteered for such CAS committees as Examination, Education and Examination, Publicity, and Review of Papers. From 1964-66, Hunt served on the CAS Council, a precursor to the CAS Board.

He wrote and cowrote several *Proceedings* papers and discussions, including a 10-year history of homeowners insurance published in 1962.

Hunt is survived by his wife, Marjorie (nee Whittemore); sons, Peter W. and Jonathan F. (Lisa); two sisters, Elizabeth Schumann and Constance DelGizzi; and two grandsons. He was preceded in death by his sister Ruth Schwacha.

HMO Pioneer

Lloyd F. Mathwick (ACAS 1956)
1926-2015

Lloyd Mathwick, an early innovator in health maintenance organizations, died on February 10, 2015, at the age of 88.

A World War II veteran who served with the U.S. Navy in the South Pacific, Mathwick graduated from the University of Wisconsin-Madison with a degree in economics. He had a long and successful career in the group health insurance industry at Employers Mutual in Wausau, Wisconsin.

In 1974-75 he served as one of 55 liaisons chosen by U.S. President Ford to serve on the Presidential Interchange Executives. The program brought together government officials with key players in the private sector — including IBM GE and Boeing — to share talents and experiences.

Mathwick would later be instrumental in launching Heritage National Healthplan, an HMO subsidiary of Deere & Company in Moline, Illinois.

Mathwick was devoted to his family. He was an avid outdoorsman, animal lover and philanthropist as well as a gardener who cultivated roses.

He was married to Alice Mathwick (nee Schmidt) for 64 years. He is survived by his children Kelly Mathwick, Victoria (Karl) Schneider and Robin (Dale) Cox; siblings, Dona (Allen) Akey and Patricia Bailey; his grandchildren, nieces, nephews and other relatives; and friends.

Most Likely To Succeed

James A. Faber (FCAS 1969)
1935-2016

James A. Faber, 80, died at his residence in Hollidaysburg, Pennsylvania. He was born in Erie, Pennsylvania, the son of the late Robert W. and Florence M. (Lashinske) Faber.

He graduated from Erie's Academy High School in 1953. Ironically nicknamed "Wimp," Faber was voted "Most Likely to Succeed" and described as an "outstanding student; a real brain" in his high school yearbook. The high school superlative would prove to be correct as Faber graduated from the University of Rochester (1958) and served in the U.S. Army counterintelligence unit (1958-61). He married Sharon H. Ricker in 1959.

Faber retired from KPMG LLC in 1994 and filled his time with many community activities. He was an active member of First United Methodist Church in Hollidaysburg, where he ushered and served as financial and endowment chairs. He was an avid golfer and enjoyed reading and stamp collecting.

Faber is survived by his wife; a daughter, Kathryn Katcher and husband, Steven; a son, Jeffrey A. Faber; and three grandsons. He was preceded in death by a brother, Robert W. Jr., in 2014.

The Company Man

Robert L. "Bob" Sanders (FCAS 1985)
1953-2016

Robert L. "Bob" Sanders was a loyal employee and caring mentor who considered his clients his friends. He died on June 22, 2016, at the age of 63.

He was born February 5, 1953, in Dayton, Ohio, the son of Juanita (nee Jenkins) and the late Jack Sanders. He graduated from Vanderbilt University and began his career at Allstate in Northbrook, Illinois. In 1979 Sanders joined Milliman to work in its small casualty practice unit, a three-person office in Milwaukee. He stayed with Milliman for 36 years, working as a principal and consulting actuary and becoming a nationally recognized expert in medical professional liability. He helped Milliman grow into one of the largest U.S. P&C actuarial consulting practices.

Sanders enjoyed hiking in his favorite national parks. Much of his home was furnished with artwork depicting his beloved hiking spots. He loved live music and had an extensive album collection.

When his father died, Sanders purchased his mother a unit in his condo so he could better care for her. He is survived by his brother, his aunts and uncles, other relatives and friends.

TWENTY-FIVE YEARS AGO IN THE *AR* BY ELIZABETH A. SMITH, *AR* MANAGING EDITOR

Karen Clark of Applied Insurance Research, now known as AIR Worldwide, wrote an especially prescient article in the November 1992 Actuarial Review. *Clark, a pioneer in hurricane catastrophe modeling, stops short of calling Hurricane Andrew the "Big One" and hearkens the destruction of Katrina, Sandy, Harvey, Irma and Maria.*

Hurricane Andrew's message to insurers

BY KAREN M. CLARK, PRESIDENT, APPLIED INSURANCE RESEARCH

While this storm will certainly rank as the largest insured loss to date from a single catastrophe, Hurricane Andrew was not the "Big One." Far from it. In fact, it is surprising, and somewhat disturbing, that so many are acting as if Andrew was a rare event — some kind of freak storm.

The damage resulting from Hurricane Andrew should have come as no surprise to insurers. Hurricane Andrew was just about as intense as Hurricane Hugo, which devastated the South Carolina coast in 1989. That is, maximum wind speeds in both storms were nearly identical. On the other hand, Hurricane Andrew struck Dade County, Fla. Dade County alone houses more than half as many people as the entire state of South Carolina. The population in the Miami area is nearly four times the population in Charleston, S.C.

Hurricane Andrew was a Class 4 hurricane, not a Class 5 storm as much of the press (including *Newsweek*) had reported. A Class 4 hurricane could strike Long Island and New England. One did in 1938 — the so-called Great New England Hurricane.

If a severe Class 4 hurricane were to strike Long Island and New England today, the insured losses could well exceed $20 billion. This is getting close to the Big One …

Andrew's message is clear: The U.S. coastal population, particularly in areas vulnerable to hurricanes, has been growing at a rapid rate. While the past 20 or so years have seen relatively few hurricanes, particularly in Florida, these storms do occur with significant frequency.

Property insurers should be prepared to pay multi-billion-dollar hurricane losses every few years on average. Because of random annual variations, insurers should also stand ready to pay out billions in hurricane losses several years in a row.

Hurricane Andrew was not a rare event, unlikely to happen again. Hurricane Andrew was a signal of the size of loss that property insurers will be paying with increasing frequency in the years to come.

Meet David Sauer, Accounting and Operations Assistant

Welcome to the CAS Staff Spotlight, a column featuring members of the CAS staff. For this spotlight, we are proud to introduce you to David Sauer.

David Sauer

- **What do you do at the CAS?**
  I'm the accounting and operations assistant. I work with cash receipts, deposits, accounts payable, checks, invoices, mailings and other general office support.
- **What do you enjoy most about your job?**
  I enjoy working with numbers in the accounting cycle. I like the structure, organization and scheduling in the accounting department. And of course, the CAS has a group of wonderful people I enjoy working with.
- **What's your hometown?**
  Pittsburgh, Pennsylvania.
- **Where'd you go to college and what's your degree?**
  I attended college at Point Park University in Pittsburgh. I received my bachelor's degree in accounting.
- **What was your first job out of college?**
  It was at a publications and printing firm. I was a part of the accounting staff.
- **Describe yourself in three words.**
  Dependable, reliable and hard-working.
- **What's your favorite weekend activity?**
  Washington, D.C. has a wonderful variety of seasons. I like to walk around the lake or on the hiking trail in the spring, summer or autumn. I enjoy being outdoors.
- **What's your favorite travel destination?**
  Ethiopia.
- **Name one interesting or fun fact about you.**
  I am fascinated with the African culture — the traditions, music, art, food and clothing. I have traveled to Africa over a dozen times.

Panorama of Semien mountains and valley around Lalibela, Ethiopia

MEET THE VEEP

Meet CAS Vice President-Admissions Jeanne Crowell

Jeanne Crowell

Our Meet the Veep column introduces our members and candidates to the CAS Vice Presidents who serve on the Executive Council. The EC is the governance arm of the CAS that oversees the operations of the organization, and consists of the president, president-elect, executive director and six vice presidents in charge of different functional areas. In this installment, we are pleased to introduce the new CAS Vice President-Admissions Jeanne Crowell, who begins her term in November 2017.

What is your role as the CAS Vice President-Admissions?

My role is to manage the process for admitting new members, including oversight of the examination process and the Syllabus and Examination Committee. I also oversee the Candidate Liaison Committee and ensure that the CAS has two-way communications with candidates. It's important to get feedback from candidates and understand their experiences so we can improve upon the process. At the same time, it's also important to get feedback from our employers to ensure that our credentialing process is meeting their needs, and I am looking forward to getting perspectives of the CAS Employers Advisory Council in that regard.

What volunteer work had you done for CAS that led to your appointment as VP?

I began my CAS volunteer work with the Syllabus Committee right after I got my Fellowship. At the time I thought I was acting as a rebel by not starting with the Exam Committee as was customary for new Fellows. I enjoyed helping to develop the syllabus and trying to improve the required readings that candidates used to learn the material. After a few years there, I volunteered for the Education Policy Committee and soon found myself serving as the chair. The Ed Policy Committee focused on things like analyzing travel time and evaluating requests for exam waivers based on exams from other actuarial associations around the world. I also got involved in a number of admissions-related task forces that looked into specific questions or issues that had arisen.

I served on some committees other than Admissions committees too, such as the Committee on Volunteer Resources, the CAS Trust Scholarship Committee and the University Relations Committee.

In 2010 I was elected to the CAS Board of Directors where I focused on providing strategic direction to the organization. This was a very rewarding experience because I learned about many other facets of our organization that I hadn't been directly involved in before, and I was fortunate to be able to work alongside many talented leaders. These were exciting years as the CAS found itself unexpectedly facing a competitive environment for the first time.

Since my years on the board, I have served on the Nominating Committee and the Leadership Development Committee, both of which I have thoroughly enjoyed. Now I've come full-circle back to Admissions.

What are your goals as VP-Admissions?

One of the main objectives is to ensure that we produce a syllabus that covers the right material to educate our future members. Another important objective is to deliver high-quality exams that allow candidates to show what they have learned and that appropriately distinguish between candidates who have met the minimum standards and those who haven't.

To that end, the Admissions Committees are in the midst of several enhancements to our exams that I will support and oversee:

- First, we are in the process of incorporating integrative questions on our Fellowship exams. These

I spent my junior year studying abroad at Oxford University, where I was astonished to discover that the first-year students caught up with all of my mathematical studies in their first trimester.

larger questions allow candidates to synthesize their understanding of material across learning objectives in response to a scenario, thus more closely mirroring real-life actuarial work.

- Second, we are updating our exams that cover statistics and actuarial models, replacing the Exam 4 requirement and Exam S with two exams called Modern Actuarial Statistics I and II. These exams will be rolled out in 2018 and will better prepare our future members for future modeling work.
- Third, we are changing the way we administer written-answer exams by moving from a paper and pencil test to an Excel-based examination, which we are calling Technology-Based Examination. This will be administered first with Exam 5 next spring. I am very excited about this initiative because it opens up a wide range of opportunities in the future to create more real-world actuarial problems to be solved using Excel rather than a calculator. (See page 21 for more on CAS Technology-Based Examination.)

Could you share an interesting fact about yourself?

I grew up in Wisconsin and attended the University of Wisconsin, majoring in mathematics and eventually going on to get my master's degree in actuarial science. I spent my junior year studying abroad at Oxford University, where I was astonished to discover that the first-year students caught up with all of my mathematical studies in their first trimester. I spent the rest of the year digging deeper into math topics alongside the first-year students. This was a challenging and invigorating year; I was immersed in a culture that I hadn't realized is so much different from what I was familiar with. The friendships I developed with some of the English students continue today.

In my free time, I enjoy singing with my friends. I am a member of a local ladies' barbershop chorus that sings a cappella music in four-part harmony. I also enjoy singing in a barbershop quartet, which allows more freedom for the four members to select and interpret music the way they desire. My first quartet, Synchronicity, won the international championship in 2004, and my most recent quartet, Moonstruck, won in 2014. If interested, you can find a YouTube video of Moonstruck if you search for "Moonstruck Loch Lomond." (Crowell is the subject of a "Nonactuarial Pursuits" column in the August 2007 issue of *Actuarial Review*.)

When you meet new Associates/Fellows at the Spring and Annual Meetings, what information or advice do you try to impart to them?

I understand that the exams are a difficult and long process, but the career is worth it. Don't give up.

Once you finish your exams, look for ways to get involved in the CAS. Your volunteer work can be highly rewarding, and the friendships you make are highly valuable. The Syllabus and Exam Committee is a great place to get started; you can meet other actuaries from around the country and the world and give back to the organization by helping to make the exams even better.

DOWNTIME BY LAURIE MCCLELLAN

Meant to Bee

Taylor Kresbach's first experiment with raising her own food didn't go smoothly.

Kresbach, a consultant and reserving specialist with FTI Consulting in Winston-Salem, had bought 10 fluffy yellow chicks to join the six ducks in her backyard barn. There was just one problem with her plan: It's impossible to tell if a baby chicken will turn into a hen or a rooster. She took a trip a few months later, but unbeknownst to her, the animals were about to hit chicken puberty. "I came home from vacation," Kresbach says, "and I had three roosters crowing. I had to text my neighbors and say, 'I'm so sorry.'" She quickly traded the roosters for hens using Craigslist, and her neighbors got to sleep undisturbed again.

The mishap didn't stop Kresbach from adding a completely new animal to her yard this year: bees.

Kresbach got hooked on bees when she was a little girl. Her aunt, a long-time beekeeper, introduced her to the insects. "She would always teach me about their behavior, and how they know how to do certain things. I just thought it was really fascinating," says Kresbach.

It wasn't until Kresbach moved south, from Massachusetts to North Carolina, that she had both the warm weather and the big backyard that she wanted. So in January, she and her boyfriend, Cody Davis, took the next step together, enrolling in a class offered by the Forsyth County Beekeepers Association. "Whenever I would tell people I was going to bee school," Kresbach says, "they'd say, 'oh, you're going to business school?' And I was like, no, *bee* school!" At the end of the course, Kresbach passed a written and practical test to become a certified beekeeper.

In April she and Davis each purchased a hive nucleus, a small bee colony equipped with a queen bee, from a beekeeping neighbor. Their colonies contain Russian bees, a strain of honeybee (*Apis mellifera*) imported from the Pacific coast of Russia by the USDA in 1997. Unlike many other honeybee strains, Russian bees are nearly immune to the mites that have driven massive die-offs in bees in recent years. "They'll actually eat mites off each other," says Kresbach.

Taylor Kresbach tends her hive.

Twice a month, Kresbach puts on a special outfit — khaki pants, gloves and a white hooded sweatshirt with a built-in screen that protects her face. Then she uses pine shavings to light a fire in a handheld smoker, a beekeeper's tool that gives off a continuous stream of cool smoke. When bees smell the smoke, they instinctively react as if a forest fire is nearby that might destroy their hive. They move deep into the hive and begin eating their supply of honey, in case they have to abandon it. While the bees are busy eating, Kresbach can carry out the routine task of inspecting her hive.

One by one, Kresbach pulls out each frame, or individual box, in the hive. She checks on how the hive is growing and how much honey the bees have stored. She also looks closely at how many eggs the queen bee has laid. Since worker bee eggs take 21 days to hatch, moving through three visibly different stages — egg, larva and pupa — Kresbach can judge how many new bees are about to join the hive.

"Say you have two frames full of pupae," she explains. "You're going to have an explosion of bees, and you need to support them. If the beekeeper fails to enlarge the hive by adding more frames," Kresbach says, "the bees run out of room, and will swarm. When that happens, the queen bee, along with 60 percent of the worker bees, flies off to find a new home, leaving the beekeeper with a much smaller hive."

Although beekeepers only formally inspect their hives twice a month, Kresbach frequently drops by her colony just to watch her bees going about their business. "My boyfriend will put a lawn chair next to the hive and watch them for like, an hour," she says, "because it's pretty entertaining."

Even though her hive and her

boyfriend's hive sit just a few feet apart, it's strictly a "his" and "hers" arrangement, with no cooperation between the hives. "My bees will not go into his hive, and his bees will not go into my hive. They know where they live, and they will return there, which is really fascinating." Designated bees guard the entrance to each hive to keep intruders out.

When Kresbach bought her bees, she was afraid of getting stung. Ironically, she lost that fear after a bee clocked her, right on the forehead. At the time, Kresbach wasn't wearing her protective gear or carrying her smoker, a key safety tool in case of a sting.

"Bees are very, very smell driven," Kresbach says. "And when they sting you, they release a pheromone, which says, 'this is a bad person, they're invading our space.' And so all the bees around there will smell that, and they'll attack you. The smoker will make that signal fade really quickly." Since she didn't have a smoker, Kresbach just ran into her house at top speed. In hindsight, "it really wasn't that bad," she says, "and it got that fear to go away."

As a first-year beekeeper, Kresbach won't be reaping the usual reward from her hive in the form of honey. Bees stockpile honey so they have something to eat during the winter months. "You have to leave a certain amount of honey in the hive, so they have enough food to last the winter," says Kresbach. "So I don't think we'll be taking from our hives this year, just because we don't want them to die. We're new at this."

She may not have beeswax or glowing jars of honey to show for her work this year, but Kresbach feels she's already received other rewards. She likes knowing she's helping the environment. The bees also pollinate the plants in her extensive garden, where she grows everything from onions to watermelons to herbs. Before she went to bee school, Kresbach says, "I didn't realize that one onion plant had to be visited a handful of times to produce an onion. *One* onion. So we need bees!"

Kresbach also has her eyes on the future. "Next year we'll have enough [honey] to sell," she says. "That's the plan. It would be cool to have a place at the farmers' market with our honey and eggs."

Kresbach wants to encourage more people to take up beekeeping. It costs about $300 to $500 to purchase equipment and bees, but after that, she says, "it's a low-maintenance hobby. Everyone I talk to about it thinks it's so fascinating. I tell them, 'You can do it, too! It's really easy.'" ●

Laurie McClellan is a freelance writer and photographer living in Arlington, Virginia. She is on the faculty of Johns Hopkins University, where she teaches in the M.A. in Science Writing program.

Buzzwords

Have you ever heard of a "corporate drone" or a "worker bee?" Here's the real science behind the workplace metaphors.

Worker bee: It's true that worker bees are remarkably industrious. The cause of death for the average worker bee? Wearing out its wings on the job. Bees beat their wings 190 times every second, which creates their distinctive buzzing sound. All worker bees are female, and the average hive has 10,000 to 50,000 of them. The lifetime output of a worker bee is 1/12 of a teaspoon of honey.

Drone: According to *Webster's Dictionary*, a drone is someone who does "very hard or dull work." Not so in the beehive! Real drones live a relatively cushy life. The only job of these male bees is to mate with a new queen when needed. However, many drones never get the chance to fulfill their biological destiny; instead, they simply hang around the hive and eat.

Queen bee: A single leader is sometimes called a "queen bee," which is an accurate reflection of what goes on in the hive. Each beehive can have only one queen. If several queens hatch when the hive is getting established, the queens will fight to the death, until only the winner is left. Her Royal Highness is responsible for laying all the eggs that will hatch into future bees.

Honeycomb: Like the office cubicle, the honeycomb that bees construct is a way to fit more workers into less space. Each cell of a honeycomb, which is used to store larvae as well as honey and pollen, has six sides. In 1999 mathematician Thomas Hales proved the honeycomb conjecture, which holds that this shape — the hexagon — is the most efficient way to pack a space.

The CAS Adopts New Strategic Plan

The Casualty Actuarial Society Board of Directors has adopted a revised version of the CAS Strategic Plan, which sets the direction for the CAS's continued growth and success over the next five years. Building on the momentum generated by the plan implemented in 2012, the revised plan continues to support the organization's strong commitment to education and professionalism, while also recognizing the Society's expanding focus into new areas.

The foundation of the Strategic Plan is the set of seven core values that define the essential and enduring CAS principles that will guide the organization into 2020 and beyond. The values of collaboration, community, continual improvement, professionalism, and practicality carry over from the prior iteration of the plan. The 2017 plan has added the values of diversity and innovation.

The Strategic Plan articulates the scope of casualty actuarial practice and the work of the 8,000 members of the CAS who are valued worldwide for their advice and insight in solving risk-related challenges. The scope also has seen an expansion from the prior plan, with a new recognition that CAS members will be called upon to embrace innovation and adapt and evolve their practice as new sources of risk and uncertainty emerge in the future.

While the CAS Strategic Plan has expanded its focus in a number of ways, the organization's core purpose remains the same: to advance and promote the practice and application of casualty actuarial science. This is achieved by:

- continually expanding the body of actuarial knowledge as it applies to casualty actuarial problems.
- expanding the practice into wider areas of application.
- establishing qualification standards.
- delivering basic and continuing education programs.
- sustaining high standards of conduct and competence.
- creating a dynamic community for casualty actuaries and related practitioners.

Fulfillment of the core values and purpose of the CAS will be accomplished by achieving the action-oriented goals outlined in the plan. The goals — and their supporting objectives — are organized around six specific areas in the CAS: basic education, continuing education, influence and outreach, research, professionalism, and member community.

"Our Strategic Plan continues to envision the CAS as the premier organization advancing the practice and application of casualty actuarial science and educating professionals in P&C practice," said CAS President Nancy Braithwaite, FCAS. "Our enduring values, along with a new focus on diversity and innovation, will move us towards the realization of our vision. With this plan, we reconfirm to our stakeholders our intention to lead the worldwide casualty actuarial profession into the future."

The complete CAS Strategic Plan and an infographic depicting the key elements of the plan are available for download.

To provide feedback on the plan to the CAS Board, please send an email to office@casact.org.

ENVISIONED FUTURE

The CAS will be recognized globally as the premier organization advancing the practice and application of casualty actuarial science and educating professionals in casualty actuarial practice.

STRATEGIC PLAN GOALS

#1: Basic Education

#2: Continuing Education

#3: Influence and Outreach

#4: Research

#5: Professionalism

#6: Membership Community

DIVERSITY

Expertise. Insight. Solutions.®

casact.org

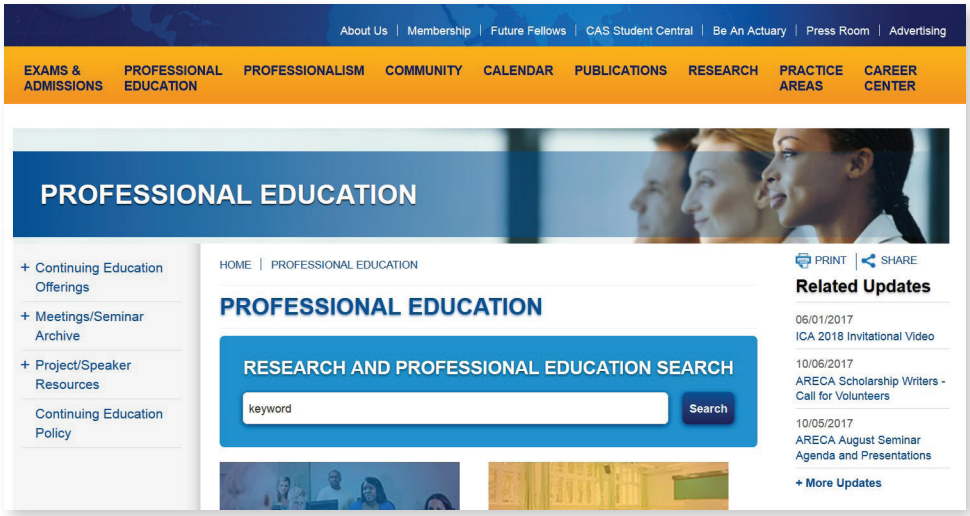
At the Casualty Actuarial Society, we know that a diversity of perspectives and life experiences will help build an actuarial profession that grows and evolves to meet the needs of tomorrow. Learn more about our commitment to this multidimensional picture at casact.org/diversity.

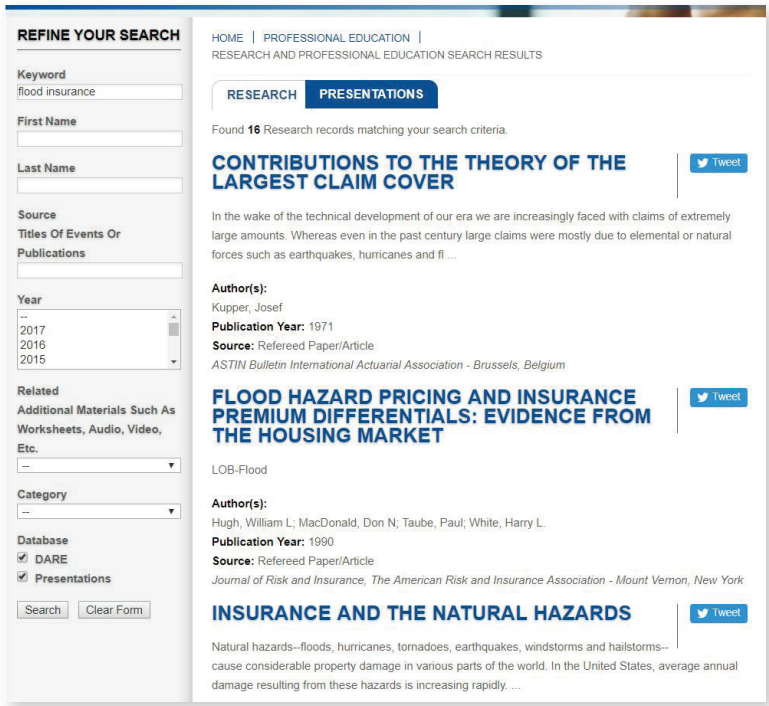
The CAS Website Incorporates New Research and Professional Education Search Tool

BY JODY ALLEN, CAS PROFESSIONAL EDUCATION AND RESEARCH COORDINATOR

With the launch of a new search tool, CAS website users can now find any and all CAS professional education and research content in one place. This new tool searches content that includes past CAS articles, presentations and research papers. The enhanced search function is ideal for those conducting research on current and past projects, those wanting a refresher on a topic from a previous meeting and those wishing to earn additional CE credits.

The search tool accesses a database with material dating back to 2000 for professional education content and 1914 for research content. With a vast catalog at users' fingertips, the Research and Professional Education Search is anticipated to become the one-stop resource for all actuarial content.





The CAS Initiates Technology-Based Examination

BY MIKE BOA, CAS CHIEF COMMUNICATIONS OFFICER

The CAS is transitioning its exams to a computer-based environment called Technology-Based Examination (TBE). Beginning with Exam 5 in spring 2018, candidates will use Excel to take their exams on personal computers that will be overseen by remote proctors. With this transformation of examinations, the CAS continues to evolve its basic education system. TBE will more closely imitate on-the-job assignments in which actuaries use computers for work, thus making CAS exams more relevant to real-life actuarial practice.

"Implementing TBE shows our continued commitment to adapting the CAS examination system in innovative ways to meet the needs of candidates, employers and other stakeholders," said CAS President Nancy Braithwaite. "The CAS credentials are already proven assets and highly valued worldwide," said Braithwaite. "TBE reinforces the position of the CAS's education system as the most robust and comprehensive framework for training property-casualty actuaries in the world."

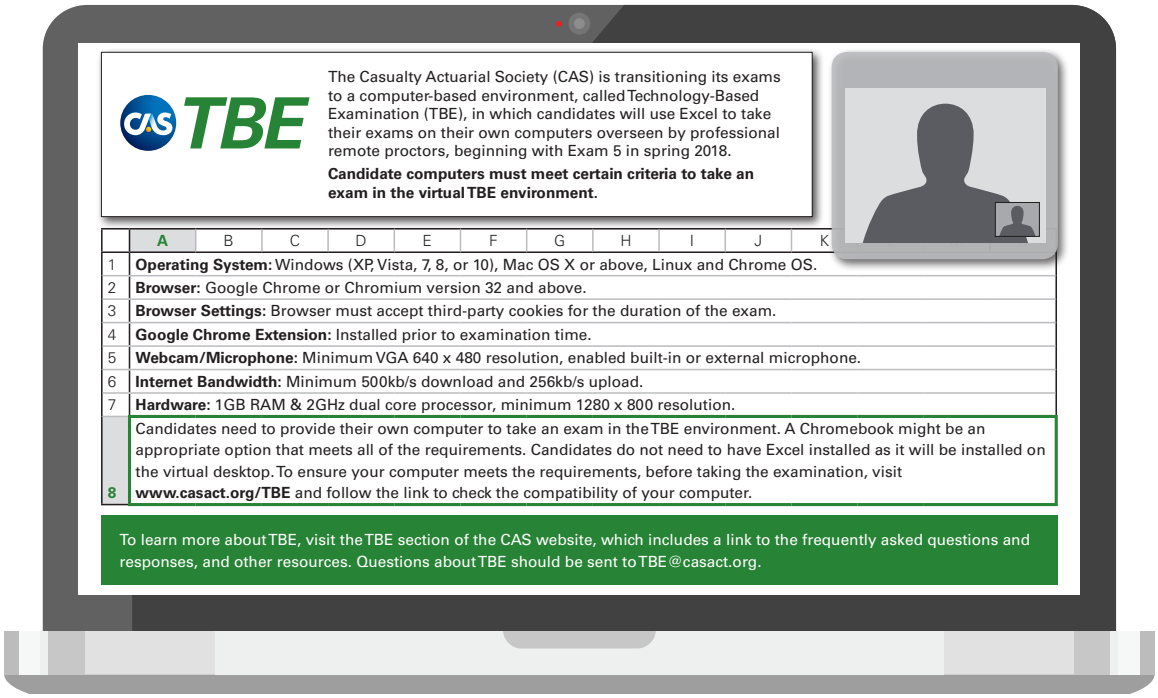
Candidates will sit for exams in the TBE environment using Excel software on their own computers, and at the location and time of their choosing, within certain parameters. Professional remote proctors administering the exams will monitor candidates through a webcam and microphone throughout the exam sitting.

"TBE will provide a variety of benefits to candidates sitting for exams, as well as to the volunteers and staff who administer our exams," said Steve Armstrong, CAS Vice President-Admissions. "Following our initial offering of Exam 5 through the TBE platform in the spring, we're aiming to implement TBE for additional exams in fall 2018 and beyond."

The CAS has partnered with two technology firms to administer TBE: TrueAbility will be providing the online, Excel-based testing environment, and PSI will provide the professionally-trained remote proctors.

To learn more about TBE, visit the TBE section of the CAS website, which includes a link to the frequently asked questions and responses, TBE computer requirements, and other resources. In addition, a complimentary webinar about TBE with leaders from the Admissions area is scheduled for November 28 at noon EST, and registration is now open.

For questions about TBE, write to TBE@casact.org.



The CAS in Asia

Malaysia

The CAS was a major sponsor in the Actuarial Society of Malaysia's 7th General Insurance & Takaful Actuarial Seminar in Kuala Lumpur. Held July 24-25, 2017, the event focused on predictive analytics and emerging risks. Ming-Yi Wong, ACAS, manager from Ernst & Young, presented on robotics; and Wee Keat (Kenny) Tan, FCAS, chief actuary of AmGeneral Insurance Berhad, discussed international actuarial insurance operations. Attendees also visited the CAS booth for information on the local CAS Regional Affiliate, Asia Region Casualty Actuaries (ARECA), and The CAS Institute's Certified Specialist in Predictive Analytics (CSPA) credential.

Republic of China

In July 2017, Chuan-Wei (Susan) Wu, FCAS, and CAS International Relations Manager Michael Chou met with faculty and students at two Taiwanese universities with well-regarded actuarial departments. Their mission was to further the CAS's efforts to promote the profession internationally and to educate students about developing their careers as P&C actuaries.

Wu returned to her homeland to visit Taipei's Soochow University, where she met with and presented to professors from the financial engineering and actuarial mathematics department and university students. Currently based in the U.S., Wu spoke about different areas of actuarial work, the CAS basic education system and the Society's role in the property-casualty market. She shared her experiences working in the U.S. and Japanese insurance markets, outlining differences in the two country's jurisdictions and regulations as well touching on global trends affecting the profession.

Chou's audience at Taichung's Feng Chia University included students from emerging markets in Vietnam and Cambodia as well as professors from the financial engineering and actuarial degree program. Chou talked about the CAS exams and general insurance opportunities, and he told of ways to get involved with the CAS and activities in the region.

Wu and Chou's visits generated much interest among the students and faculty. For more on the CAS's international efforts, please contact CAS International Relations Manager Michael Chou at mchou@casact.org.

People's Republic of China

The CAS participated in the 8th China Forum for Risk Management and Actuarial Science in Beijing last July. The forum was also an opportunity to showcase the benefits of CAS Academic Central and CAS Student Central.

Organized by the University of International Business and Economics (UIBE) and the Insurance Society of China, the event welcomed hundreds of students, academics, and industry practitioners from actuarial science, finance and insurance, and risk management.

X. Sherwin Li, FCAS, appointed actuary, China Re P&C and chair of the Asia Regional Committee, discussed some of the latest development in the P&C industry. Eric Huang, FCAS, deputy general manager and chief actuary, Long Insurance Company of China, presented some of the opportunities and challenges for actuaries in the artificial intelligence era. CAS staffer Michael Chou was on hand giving a general overview of the CAS and some of its current initiatives.

1. *Kenny Tan shares his experience running insurance operations.*
2. *Actuarial students at the CAS information booth.*
3. *Susan Wu speaks with Soochow University students in Taipei on July 14.*
4. *Susan Wu (right) with Professor Chung-Gee Lin at Soochow University in Taipei.*
5. *The audience of the morning general session at the 8th China Forum for Risk Management and Actuarial Science.*
6. *A Forum panel at the 8th China Forum in Beijing.*
7. *Michael Chou (left) with Professor Chi-Kai Chang at Feng Chia University in Taiching, Republic of China.*

In Celebration of Volunteers:

THE CAS 2017 VOLUNTEER HONOR ROLL

We are an association of people, professionals and friends.

Since the founding of the Casualty Actuarial Society in 1914, volunteers have been the main life force sustaining the Society through its various dimensions of growth — in the examination process and in the variety of continuing education activities, as well as in supporting the sheer growth in membership. An effort of this scale generates a continuous need for volunteers, with generally one in three CAS members volunteering each year. These positions include the entire range of CAS activities: the examination committees and exam proctors, research and development activities, liaison representatives, and various program committees and speakers, who serve as faculty for these programs. We recognize that none of these activities can take place without the active participation of the many CAS volunteers, and, for this, the CAS thanks you.

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Rachel A. Abramovitz
Jason Edward Abril
Shawna S. Ackerman
Eve Ingrid Adamson
Jeffrey R. Adcock
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Christopher J. Burkhalter
Lucas R. Burlingame
Elliot R. Burn
Michael Burnett
James Kelly Burns
William E. Burns
Anthony R. Bustillo
Timothy James Butler
Jarrett Durand Cabell
Andrea W. Cablayan
Christine Cadieux
DuoDuo Cai
Sandra J. Callanan
Steven M. Caluori
Erin C. Campbell
Wesley Campbell
Alp Can
Claudette Cantin
Chuan Cao
Li Cao
Michael Li Cao
Qian Cao
Xiaobin Cao
Yang Angela Cao
Mariel Capco
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Regina Tze Sin Chan
Carl Chang
Chia-Ming Chang
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Frank H. Chang
Hsiu-Mei Chang
Hungchi Andy Chang
James Chang
Lon Chang
Lisa G. Chanzit
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Large Employers with at Least 40% of Members Volunteering

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Allstate Insurance Company
Zurich North America
CNA Insurance Companies
United Services Automobile Association
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VOLUNTEERS

and the Work They Do

BY LAURIE MCCLELLAN

A Portrait of the CAS Microinsurance Working Party

As actuaries know, the numbers often tell the story. This story starts with 12 risk professionals from seven countries spread over four continents. In the course of one year, the team tackled the emerging field of microinsurance, the creation of insurance for low-income people. They came up with a few answers, a lot more questions, and a potential road map for CAS members to follow in future investigations. Along the way, they learned a lot about what makes a working party tick.

Barbara Chabbaga, a member of the CAS Microinsurance Working Party, talks with audience members following the 2017 CAS Spring Meeting session titled, "Current Applications of Microinsurance Innovations."

The CAS Microinsurance Working Party officially kicked off in the fall of 2016. But the seed for the group was planted several years earlier, when Jim Weiss, FCAS, CSPA, director of analytic solutions at ISO (Verisk Analytics) attended a CAS webinar where William Collins, ACAS, spoke. "The presenter really had to build insurance programs from scratch," explains Weiss, "as opposed to just keeping a machine that someone else built running. The fact that you're having a direct impact on people's lives through this work is what made me think that microinsurance is a pretty cool thing."

Weiss started looking for CAS research on the topic, but "I found there wasn't … a lot of literature, or documented thought processes," he said. With the idea of starting a working party, Weiss recruited Scott Swanay, FCAS, whom he'd met at a CAS meeting a year

earlier. Swanay was then working with Blue Marble Microinsurance, launching a drought insurance program for corn farmers in Zimbabwe.

The team now had two people, and CAS staff put out a call for more volunteers by posting a notice on the CAS website. One actuary who was excited to see the invitation was Barbara Chabbaga, lead consultant at AB Consulting in Nairobi, Kenya. "Microinsurance is all we do," she says. "The insurance penetration in Kenya is 2.9 percent. I feel the way that insurance can make a difference is when it's accessible and makes sense. And in the Kenyan context, in the region … it has to be microinsurance. Because that's what people can afford."

Chabbaga has seen firsthand how products can be designed to help the people who, she says, need it most. She notes that in Kenya today, nearly anyone can easily take out a small loan using their mobile phone. But those loans create the need for insurance.

"Say you have a family. They've never had access to credit. They've never had access to insurance. They were just making ends meet with their two cows," she says. "And then they're told, 'you can access a loan through your phone, and we'll take your cows as security.' And then imagine the breadwinner falls ill … and suddenly they have to pay back the loan. [They] go from making ends meet … to the one asset [they] have being taken away."

Chabbaga also points out that in microinsurance, payment and distribution need to be tailored to the customer as well. "You can't expect somebody who's earning a daily wage or a weekly wage to pay an annual premium," she says. "You wouldn't expect the same person to walk into a massive skyscraper to buy their insurance product. They want it close to them, either on their phones, or though people that they trust, like the *agrovets* [store] where they buy their farm [supplies]."

Tom Johansmeyer, assistant vice president at PCS (Verisk), has worked with microinsurance in Turkey and seen its social impact. He joined the group partly to investigate another angle: the potential for growing new business. "We all talk about mature markets being slim for growth, and how difficult it is to … bring more money out of stable markets like property catastrophe. … We are focused on squeezing every last dime out of a mature market, rather than entering the big one," he says. On the other hand, Johansmeyer notes, "You've got four billion people who could benefit from microinsurance. That's a very good start."

Eventually, 12 professionals from all over the world, CAS members and nonmembers alike, joined the Microinsurance Working Party. Arranging conference calls across that many time zones, the members admit, was a Herculean task. But soon Syed Danish Ali from Pakistan was on the line with Keith Lau, ACAS, from Hong Kong. Inma Peña, a member of the Spanish Actuarial Association, called in from Madrid, where she was writing her doctoral thesis on pricing in microinsurance. Charles Cervinka, FCAS, FCIA, spoke from his office in Bermuda, while fellow Canadian Eric Cheung, FCAS, joined the conversation from Toronto. In the U.S., Su Wash called in from New York, and Mike Mendel, FCAS, from Chicago.

After some brainstorming, the group decided to focus on social impact, product design and development, microinsurance in mature markets (e.g., insuretech) and data. Then they dove into the research.

April Li, ACAS, an associate actuary at Traveler's in St. Paul, Minnesota, found the research process "eye-opening." She helped interview several people working in the field, including World Bank employees, about their experiences. "I honestly haven't done many interviews as a way to gather information," she says. "But we did a lot of that. … It was a surprise how welcoming people are. … Many people were so willing to help, to share their knowledge and experience."

After gathering information, the group compared notes and came up with new ideas. "We had so many perspectives coming together," says Tom Johansmeyer. "The thinking [the group] provided was game-changing." After that, he says, "The writing was easy." To raise awareness about microinsurance, the group wrote nine different articles for industry publications. Several of the stories were collaborations between two, three, or even four authors. Four stories have been published so far, in outlets that are as international as the working party itself. They include the British-based *Insurance Post*, *Reinsurance News* and *Intelligent Insurer*; *The Actuary*, published in England by the Institute and Faculty of Actuaries; and *Asia Insurance Review*. Three articles are currently being submitted to publications, and two will be submitted later.

How did the group get so much accomplished in one year? According to Scott Swanay, "It wasn't just an academic exercise. You think, here are people's lives potentially at stake, because of having this insurance or not having it. … I think that's really what carried us through. The passion from knowing what the impact [of microinsurance] has been in some cases."

Jim Weiss credits setting clear goals. "We were very stra-

tegic about creating a plan we could follow and stick to," Weiss says. "We didn't try to conquer the world. We felt if we could just take a few baby steps to get our profession closer to being relevant in the microinsurance arena … then we would have made industrious use of our volunteer time." Halfway through the group's work, Weiss had the idea to post a second notice calling for volunteers. "We got some folks who joined midway through, who were new members of the CAS … and who were able to do some great writing and some great thinking, and that helped us to get even more done," Weiss says.

To many in the group, researching and writing nine articles was just a small start. "If the articles are able to inspire people to look more into microinsurance, or even to practice microinsurance, or get their organizations involved … that will be the big win here," says Weiss.

Tom Johansmeyer thinks that insurance professionals still have a lot to learn about the field. "I've always had an appreciation for the fact that microinsurance is hard to do," he says. "Now I feel I have a better sense of why. Microinsurance is the sort of thing that will take a coordinated, industry-wide effort."

But for many of the working party members, the rewards of volunteering went beyond a feeling of accomplishment. April Li discovered that she "looked forward to working with other professionals, beyond the people I interact with at work." Johansmeyer agreed, stating, "The distribution group was absolutely incredible. I didn't know anybody on the group prior to this project, and now I stay in touch with them."

Joining the working party was Li's first experience with volunteering for CAS. Her advice for others thinking about volunteering? "Be curious and keep an open mind, and don't be afraid to try. I'm still taking the exams, so time is always a concern. It's not a huge time commitment, and it can be managed."

Weiss encourages others to not just get involved, but to help CAS target worthwhile issues. "If there's a topic you're interested in," Weiss says, "whether or not you have a ton of expertise in that topic … and you don't feel the CAS, or anyone else for that matter, is really giving that topic the attention it deserves … that's a really great opportunity to point out that need and create a collaboration opportunity to produce a body of knowledge where it might be lacking. Don't let fear of your own inadequacies stop you from going out and trying to solve a problem, because it will be very rewarding."

Feeling inspired to learn more about microinsurance? You can read four of the nine articles produced by the working party online. See page 40 for a listing of the papers.

Members of the CAS Microinsurance Working Party

Syed Danish Ali

Charles Cervinka

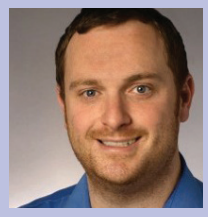
Eric Cheung

Dave Core, CAS Staff Liaison

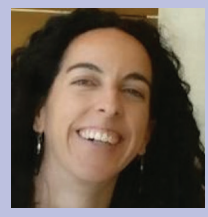
Tom Johansmeyer

Keith Lau

April Li



Mike Mendel



Inma Peña

Scott Swanay

Su Wash

Jim Weiss, Chairperson

Laurie McClellan is a freelance writer and photographer living in Arlington, Virginia. She is on the faculty of Johns Hopkins University, where she teaches in the M.A. in Science Writing program.

The CAS Microinsurance Working Party Papers

Paper	Author(s)	The CAS Microinsurance Working Party Papers Take-Aways	Target Audience	Publication
"Why and How Cross-Selling Works for Microinsurance"	Tom Johansmeyer and Keith Lau with contributions Scott Swanay and April Li	* Methods and rationale for cross-selling insurance products with non-insurance products (e.g., mobile service), including examples from around the world. * Ancillary considerations with bundling (e.g., method of indemnification).	Executive, Technology	Published on *Insurance Post* http://bit.ly/2iqa33T.
"Microinsurance Challenges Related to Distribution and Regulation"	Swanay, Li, Lau and Johansmeyer	* Pros and cons of "collaborative innovation," illustrated using challenges in microinsurance distribution. * Considerations and best practices to ensure partnerships function effectively.	Product Management, R&D	Published on *Reinsurance News* http://bit.ly/2irLDao and *The Actuary* http://bit.ly/2hxQzKu.
"Microinsurance: What's the Right Channel for Effective Distribution?"	Swanay, Li, Lau and Johansmeyer	* Pros and cons of different channels of microinsurance distribution (financial institutions, retail etc.). * Considerations for aligning distribution channel with target market.	Executive, Product Management	Published in August 2017 *Asia Insurance Review*.
"Measuring Microinsurance Success"	Jim Weiss	* Common metrics to examine social and financial success of microinsurance, with examples of their use. * Techniques to overcome measurement challenges (e.g., A-B testing).	Actuarial/ Technical, Corporate Social Responsibility (CSR)	Published on PC360 http://bit.ly/2x79X4u.
"Potential Sources of Data for Micro-Insurance Pricing"	Inma Peña	* Reasons why insurance premium/loss data is not always available in great supply when serving new and underserved markets. * Benefits of innovative sources of information to price new products, with relevant examples from microinsurance.	Data Management, Technology, Actuarial	Pending publication.
"What Every Insurer Needs to Know About Impact Investing"	Syed Danish Ali	* Social context surrounding impact investing (including economic and demographic factors). * Financial risks and opportunities associated with impact investing, in general and specifically to P&C insurance companies.	Investment, CSR	Pending publication.
"Microinsurance for Mature Markets — Addressing Long-standing and Emerging Challenges"	Su Wash and Eric Cheung	* Characteristics of underserved segments in mature markets for insurance. * Similarities between microinsurance and several global insurtech initiatives in delivering products to these segments.	Executive, Technology	Pending publication.
"Microinsurance Market Selection — Factors to Consider"	Swanay, Li and Johansmeyer	* Factors that can influence the success of a program in a new market (e.g., infrastructural and demographic). * Examples of questions insurers should consider asking when looking at new markets.	Executive, Producers	Pending publication.
"Microinsurance Product Design: A Brief Introduction for Actuaries"	Charles Cervinka	* Key differences between microinsurance products and more traditional products. * Considerations in designing a microinsurance product.	General Interest	Pending publication.

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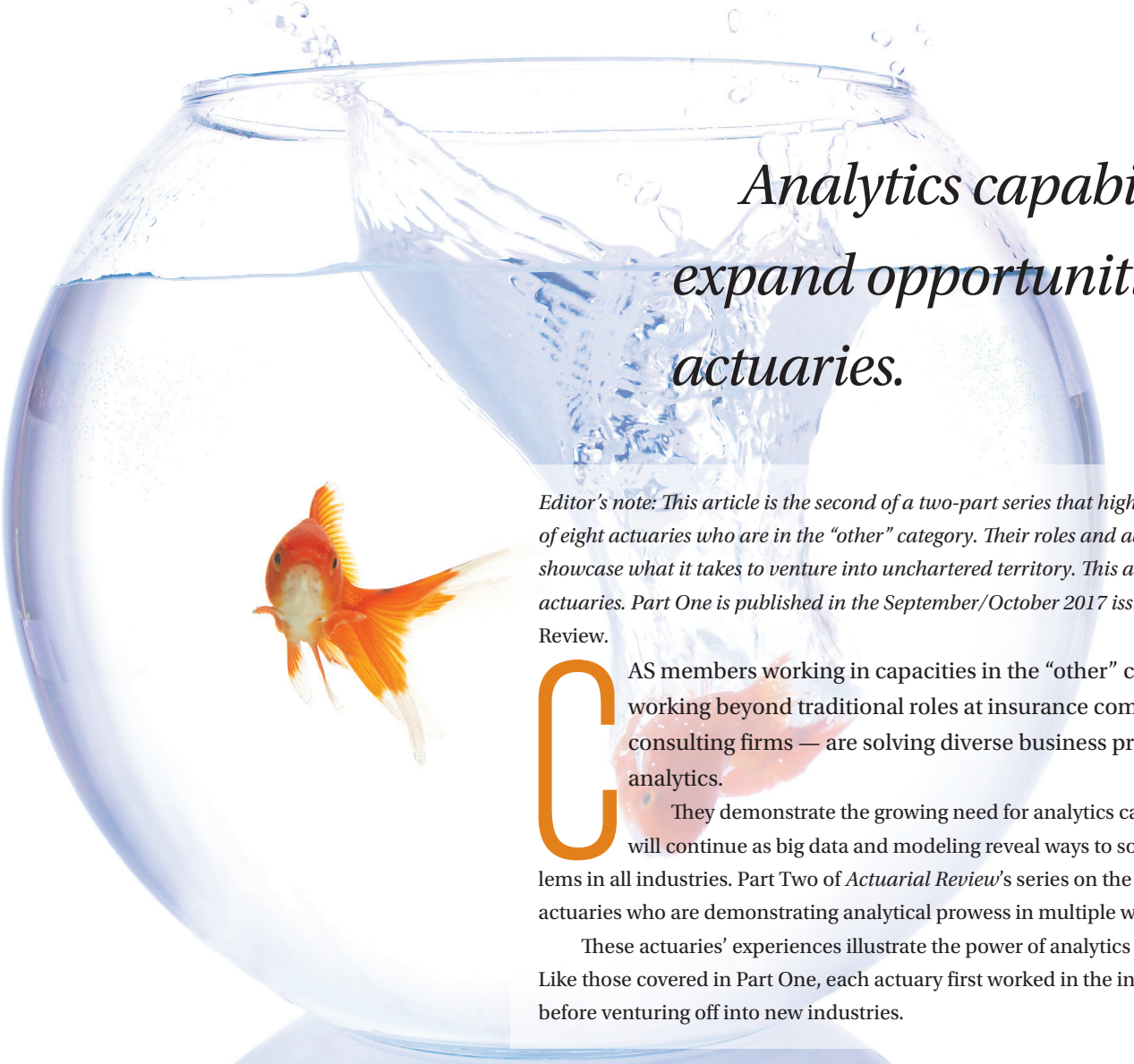
THE OTHERS *Part 2*

By ANNMARIE GEDDES BARIBEAU

Analytics capabilities expand opportunities for actuaries.



Editor's note: This article is the second of a two-part series that highlights the careers of eight actuaries who are in the "other" category. Their roles and advice for success showcase what it takes to venture into unchartered territory. This article features four actuaries. Part One is published in the September/October 2017 issue of Actuarial Review.

CAS members working in capacities in the "other" category — those working beyond traditional roles at insurance companies or consulting firms — are solving diverse business problems through analytics.

They demonstrate the growing need for analytics capabilities, which will continue as big data and modeling reveal ways to solve business problems in all industries. Part Two of *Actuarial Review*'s series on the "others" features actuaries who are demonstrating analytical prowess in multiple ways.

These actuaries' experiences illustrate the power of analytics in their careers. Like those covered in Part One, each actuary first worked in the insurance space before venturing off into new industries.

Deploying Predictive Analytics for Diverse Business Applications

Kevin Kuo, Software Engineer, RStudio, Inc.

After applying predictive analytics to enhance internet of things (IoT) related products at Honeywell International, Inc., Kevin Kuo recently joined RStudio, Inc. as a software engineer.

His goal: Enhance R's open-source ecosystem to offer big data and deep learning capabilities to R users. "Initially I am focusing on sparklyr, which provides an R interface to Apache Spark, a distributed computing framework," he says. "But I also plan to contribute to the R packages for TensorFlow and Keras, which are libraries for deep learning." The idea is to enable professionals familiar with R to leverage the latest technologies and hardware without having to explore other programming languages, he explains.

Before joining RStudio in August 2017, he spent six months as a principal data scientist at Honeywell. There, he led the team that built predictive models using data from sensors and telematics devices as well as external topographical and climate data to improve predictive maintenance of automobile parts such as turbochargers. Instead of basing maintenance on just miles or time, the models consider other factors such as driving behavior and altitude changes. "A vehicle that goes up and down hills a lot in hot weather will have a different maintenance profile than one that just cruises on level roads in a mild climate," he explains.

In addition to IoT applications, his team also built prescriptive models for the company's accounts receivable departments to prioritize collections resources and to inform collections strategies. "The idea here was to use machine learning to identify which customers would be more likely to pay sooner if you reached out to them and how you should go about contacting them, for example via phone or in-person visits," he explains.

While at Honeywell, he also had the opportunity to contribute to model deployment infrastructures. "After you have some R code to build a model," he explains, "you have to turn the model into a service that can respond to real-time prediction requests from your end users." Achieving this means scaling service to handle a high volume of requests and refreshing the model dynamically if needed. "This isn't a topic data scientists are traditionally familiar with, but I'm seeing them adapt in order to be more effective in cross-functional teams," he adds.

A Diverse Career Path

The predictive analytics expert could not have predicted that his career would lead to software engineering. Originally, Kuo pursued a career in finance. After earning a bachelor's degree in applied mathematics, he started his career as an options trader at a market-making firm. Shortly after the financial crisis in 2009, he lost his position and played poker online for a while before returning to school to earn a master's degree in applied mathematics.

"Don't get too fixated on insurance knowledge … but leverage the fact that you have experience working with quantitative problems in a business context."
—Kevin Kuo

Kuo began his actuarial career in life insurance at KPMG, LLP. "I discovered that some of my financial mathematics knowledge was transferable to valuation of embedded options in variable annuities, so I decided to start there," he says. However, he quickly pivoted to working on predictive modeling

engagements due to project needs, which led him to transfer to the consulting firm's P&C practice and to start taking CAS exams.

After a couple of years, he joined Citibank to lead the direct mail acquisitions strategy for the Home Depot credit card portfolio. "That was a marketing analytics type of gig," he recalls, where he built customer response models and designed A/B testing experiments to evaluate different designs of mailers and offers. He returned to KPMG for a year and obtained his ACAS before joining Honeywell. "I just picked up more and more technical expertise around software engineering as I progressed in data science, mostly out of necessity," he explains.

Kuo offers the following advice to actuaries considering opportunities in other industries: "Don't get too fixated on insurance knowledge … but leverage the fact that you have experience working with quantitative problems in a business context," he says. "If you're interested in data science, you'll also have to roll up your sleeves and start coding, especially if you're in the early stages of your career." While many people can talk the talk about bridging technology and the business, few can actually get solutions built, and those who can are the most in demand.

Optimizing Travel Insurance

Aaron Fezatte, Strategy Manager, Expedia, Inc.

Aaron Fezatte applies business intelligence to boost online sales of optional travel coverage.

Before joining Expedia three years ago, Fezatte was a senior actuarial analyst for Liberty Mutual Insurance Company, where he worked on pricing and analytics for both personal and commercial lines. At Expedia, he applies his skills from a different angle: as a member of the strategy team. His job is to secure coverage options for various exposures related to traveling. "My role," he explains, "involves working with insurers to develop travel insurance products to meet the needs of our customers around the world."

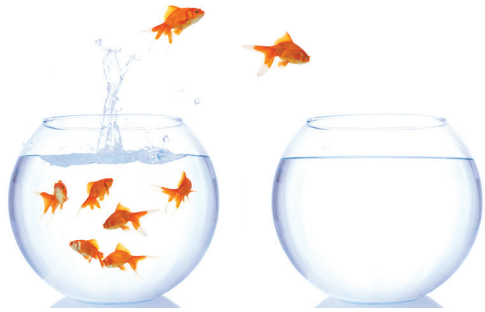
Several goals are involved with applying business analytics to the demand for travel insurance. One goal is that his team tries to ensure coverage is "as attractive and affordable as possible," he explains. By slicing and dicing data, he can make recommendations to insurance companies and can encourage them to consider other approaches to coverage. "It is helpful to understand the insurance perspective and provide supporting data, ultimately enhancing the relationships with our partner insurance companies and giving better value to customers," he says.

There are several variables that can affect offering the right product. Fezatte analyzes data ranging from type of travel, trip cost and destination to length of stay and travel purpose (business or leisure). Such data can also reveal ideas about new benefits to recommend to insurance companies that yield more useful products for travelers.

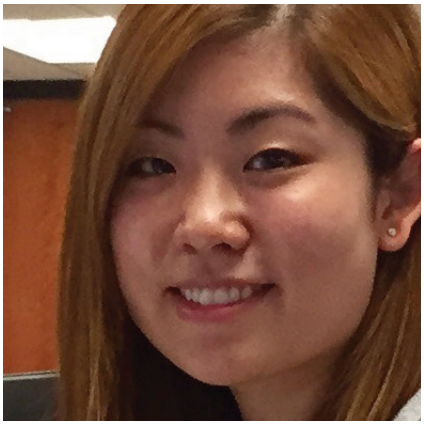
Over the course of time, his team has helped make travel insurance more transparent and easier to understand for travelers.

Changing Roles

Fezatte initially was unaware of jobs outside of the insurance industry. Like others, he found his job through a recruiter. When he learned of the position, he was attracted by the opportunity to establish new processes and procedures from the ground up while having the leeway to innovate new solutions. "Don't be afraid of titles that do not say actuary," he advises other actuaries. "There are plenty of interesting roles out there that are directly related to risk."



Reducing Risk from Infectious Disease



Cathine Lam, Data Scientist, Economics & Actuarial Team, Metabiota

Cathine Lam's passion to minimize the social and economic consequences of widespread infectious diseases explains why she joined Metabiota more than a year ago.

Seeing the Severe Acute Respiratory Syndrome (SARS) virus halt business operations and travel in Hong Kong and other parts of Asia about 15 years ago left a lasting impression on Lam. To prevent future outbreaks, she says, countries with severe outbreak history still scan entrants for fever or flu-like symptoms.

Lam worked for Milliman as an actuarial consultant for eight years. She hopes to "relieve the financial burden of recovery" in her work as part of Metabiota's economics and actuarial team. Metabiota supports and develops products and services that help track and anticipate the social and economic repercussions of pathogenic microbial agents. The company's clients include government agencies, businesses, reinsurers and insurers.

As the company's sole property-casualty actuary, one of her primary responsibilities involves developing and enhancing the infectious disease stochastic catalog. The catalog offers millions of hypothetical, scientifically plausible simulations to fill in the gaps from historical outbreak data.

For disease research in academia, infectious disease spread models have developed significantly, Lam explains, but there is still work to be done on economic cost impact. "My role in the team is producing realistic modeled loss cost outcomes, which ultimately produces metrics that could be used by our clients to develop coverage or policy planning," she says.

Hundreds of biological, socioeconomic, political and environmental data sources are fed into the models, including pathogen characteristics, country preparedness and global travel patterns. Historical outbreak data and Metabiota's infectious disease stochastic catalog are accessible for clients through a multifunctional dashboard.

Historical data includes active tracking of diseases including influenza, Zika, measles, Middle East Respiratory Syndrome (MERS) and cholera by location and pattern. The stochastic catalog simulates risk impacts and interventions by population or policy exposure.

Seeing the SARS virus halt business operations and travel in Hong Kong and other parts of Asia … left a lasting impression on Lam.

Besides helping government agencies prepare to minimize the spread and risk of potentially life-threatening pathogens, Metabiota offers reinsurers and insurers assistance as well. The company's dashboard provides modeled loss outcome by pathogens and event types as well as the thresholds for parametric triggers by location and disease type for insurers that want to provide coverage for their portfolio. Lam also works on product development. One current project is developing coverage for business interruption due to disease.

The Actuarial Advantage

Applying her actuarial mindset and the Actuarial Standards of Practice (ASOPs) benefits Lam's efforts. Effective communication, data quality evalutation when data is sparse and the appropriate treatment of catastrophe losses are just some of the ASOP applications that contribute to more reliable results, she says. Her actuarial background also provides a unique perspective for creating actionable and actuarially sound metrics

to estimate infectious disease risk.

Because she has also held internships at noninsurance entities, such as IBM, Lam is comfortable applying her actuarial skills in her current role. She says that when serving in a new industry, it is important for actuaries to "have an open mindset because there will be a lot to learn." Lam recognizes that getting outside the zone of traditional actuarial positions could be uncomfortable, but she encourages actuaries to do it anyway. "It will be rewarding when you use your cross-industry analytical and actuarial skills to help solve problems," she says.

As for working on a multidisciplinary data science team, Lam says it is important to "understand that professionals from other industries can offer different insights." Actuaries should also embrace big data and technology, she advises. "Think of them as tools that can help you along the way."

Accessing Risk and Safety With Granular Intensity

Frank Chang, Director of Insurance and Safety Analytics, Uber Technologies Inc.

When Frank Chang joined Uber Technologies Inc. as its lead actuary three years ago, he faced a tricky proposition: how to ensure peer-to-peer drivers have coverage beyond the limits and exclusions of their personal auto policies.

The company was already contracting with insurers willing to provide coverage by the mile, but it needed to better understand the right price for this coverage. Since jurisdictions differ on requirements and personal auto insurance policies vary by limits and language, his task was to estimate the cost of insurance at every stage of a trip — from going to pick up clients, transporting them and returning home.

That was quite a challenge when purchasing auto insurance by the mile was as new as the introduction of Uber's peer-to-peer transportation services. For state insurance and transportation regulators, this was new territory as well.

Before Uber ventured into peer-to-peer driving services, the company provided livery and "black car" services covered by commercial auto insurance. When the company chose to advance into peer-to-peer transportation, its drivers, who generally work part time on an as-available basis, found commercial auto insurance cost-prohibitive.

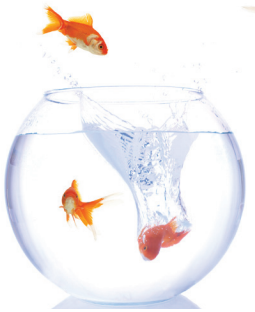
To monitor the cost per mile, Chang's team collects detailed information through the Uber app, which includes GPS, accelerometer and gyroscope information to glean insight on velocity, location, time of day, hard brakes and accelerations.

Uber's peer-to-peer drivers do not buy commercial insurance coverage. Instead, the company purchases commercial coverage from insurers and retains part of the losses. Since Uber keeps some loss, Chang's department applies analytics to manage risk and to assure appropriate reserving in the United States and worldwide.

"The core of what we do is reserving at a very granular accurate level," he says. Due to the amount of exposure and the potential costs of miscalculation, "the need for accuracy at Uber is very high."

The Route to Uber

Chang's path to actuarial work began after he finished his Ph.D. in mathematics. At that time, he was a stay-at-home dad



changing diapers and looking for flexible part-time work. He found it by being an equities analyst for The Motley Fool and teaching piano. His evaluation of insurance stocks introduced him to the idea of becoming an actuary.

He began taking two actuarial exams at a time while still being a stay-at-home dad. When his second son reached 9 months old, Esurance Car Insurance hired him as an actuarial analyst. He finished the exam process while serving as an actuarial analyst for Firemen's Fund Insurance. For four years, his actuarial work ran the gamut of nearly every line the insurer offers — from reserving to reinsurance to commercial admitted and non-admitted insurance.

"That is what allowed me to be ready for my time at Google," he recalls. At the time, Google was seeking an in-house actuary to save on consulting fees and to complete other projects. The company had three goals for Chang: first, to calculate reserves for the company's captive and to estimate costs for a few dozen lines of retained loss; second, to price warranties in 2012 when Google was entering the consumer electronics market; and third, to help establish a Google credit risk model for the company's AdWord customers.

"I finished most of my responsibilities in the first few months and my manager needed to find more work for me," he recalls. After pursuing other projects, such as enterprise risk models and fraud, he was ready for a new challenge. So he contacted one of his former Google colleagues, the first chief financial officer for Uber, and became an in-house actuary there in 2014.

While solving the tricky proposition of producing very granular and per-mile loss estimates, he built a 22-employee team of actuaries, data scientists and modelers. Currently, he is expanding his department to include more actuaries.

"Our risk covers billions of miles in the U.S. alone each year," he said. "Being able to scale insurance analysis globally has issues galore." Uber operates in dozens of countries internationally, so third-party motor liability, passenger accident, driver accident and other coverages are part of the mix.

"Uber"-granularity

Estimating potential losses as accurately as possible requires going ultra-granular, he says. To monitor the cost per mile, Chang's team collects detailed information through the Uber app, which includes GPS, accelerometer and gyroscope information to glean insight on velocity, location, time of day, hard brakes and accelerations.

This extra data allows more accurate risk assessment. In traditional insurance, a driver could report their residence as Philadelphia when they mostly drive in Manhattan. "Rating on garage and zip code screws up your model because you don't really know what the true exposure is," he observes.

To improve risk management, Chang also manages Uber's safety data science team, which determines how to make the platform safer for everyone. The team uses telematics data, such as driving style, to encourage drivers to reduce harsh braking "because riders complain about hard brakes!" he says. Since Uber drivers are legally independent contractors, they can travel as they wish. However, Uber does provide "nudges," such as app banners, to remind drivers when they are going too fast. The safety research team is also looking at how to mitigate interpersonal conflicts and encourage safety.

Encouraging Actuarial Success

For actuaries who want to move into new roles, he suggests they learn as much as possible about insurance because "you become the insurance expert." He also believes actuaries should broaden their horizons. "We cannot think of ourselves as just actuaries — We need to think of ourselves as broad consultants; we need to be able to handle large datasets and have a data science toolkit. We also need to be able to understand how insurance works, what is in a policy and how is insurance is transacted."

Chang is seeking actuaries who are "intellectually curious" and comfortable with trying new approaches. After interviewing nearly 1,000 actuaries and actuarial analysts, he finds that most want to work within what they know. For example, some applicants want to start with clean data, saying, "I only want to square triangles" or want a very routine role. While that is expected at insurance companies, Chang observes that nontraditional roles require applicants who want to work in a creative environment.

Annmarie Geddes Baribeau has been covering actuarial topics for more than 25 years. Her blog can be found at www.insurance-communicators.com.

EXPLORATIONS BY STEPHEN MILDENHALL

In Praise of Value at Risk

VaR can misbehave,
Hiding dragons in the tail.
Many views reveal.

Propose value at risk (VaR) as a risk measure and you will be the fool in the room. Peers will roll their eyes and will whisper behind your back, "Don't they know… *not* subadditive?" Instinctively we reach for tail value at risk (tVaR) confident in its well-named coherence — would a rose risk measure smell as sweet? Nonactuaries have fewer qualms: VaR is alive and well in capital models from Solvency II, A.M. Best (both original and revised capital adequacy ratio) and Standard and Poor's. The Swiss Solvency Test is an exception, using coherent tVaR.

This Explorations column will begin to explore three questions:

- When does VaR fail to be subadditive in real applications? That is, when is the VaR of a sum greater than the sum of the VaRs?
- How significant is VaR's failure?
- Is tVaR the only good alternative or are there others?

Insurance is based on diversification and subadditivity expresses that a risk measure respects diversification: The risk of a sum is less than the sum of the risk of the parts. "Less risky" can be measured in a number of ways — broadly classified into location, dispersion and tail measures. Insurers are often regulated and internally managed based on tail risk measures, which motivates our interest in VaR.

Our experience with "tame" loss distributions and normal random variables leads us to expect that VaR should be subadditive. Indeed, this is the case for the family of elliptically contoured distributions that greatly generalizes the multivariate normal, but it is not true for all distributions.

How can a portfolio possibly be more risky than the sum of its parts? A well-known risk management text (McNeil, Embrechts and Frey, 2005) lists three cases for which VaR can fail to be subadditive:

- Case 1: When the dependence structure is of a special, highly asymmetric form.
- Case 2: When the marginals have a very skewed distribution.
- Case 3: When the marginals are very heavy-tailed.

Case 1 is a circus trick. Asymmetric dependence is spectacular and alarming, but generally not a dragon. It can be controlled using tVaR, but also as our opening haiku suggests, by using many views, e.g. VaR at several different return periods. It is, however, a very instructive trick to learn and an ever-present possibility to consider.

Case 2 is where the dragons live. Dire consequences can follow if they pass unnoticed and the potential skewness of the marginals is ignored. Again, the risk can be controlled by using tVaR or by using many views.

Case 3 is where the really big dragons live. When the marginals are heavy-tailed, there is a complete breakdown of diversification. In this case, I don't want to pool risk because I want to minimize the number of samples I draw. Glyn Holton offered a great mental picture: You have a choice of drinking from several wells but one of them is poisoned. You clearly won't "diversify" your risk by mixing water from all the wells — you'll try one and if you survive you'll stick with it. For very thick-tailed distributions, tVaR is of no use. The distributions involved do not have a mean and therefore tVaR is not defined. However, many views will still ring alarm bells.

In this issue's column, we will explore Case 1 in more detail. Subsequent articles will consider the other two cases.

Using VaR at a range of return periods ("many views") will slay all dragons, whereas tVaR will fail in the face of particularly ferocious foe. Reporting VaR at a number of return periods has long been standard practice within reinsurance (if your broker or reinsurer isn't showing you a range of return periods it is time for an RFP!) and A. M. Best has recently adopted the idea of assessing tail risk through many views in its stochastic BCAR. It is a theoretically sound approach that works in all circumstances, coherence be damned.

Case 1: Failure of subadditivity driven by dependence structure

Given two nontrivial marginal distributions, X and Y, and a confidence level, α, it is *always possible* to find a particular form of dependence resulting in a failure of subadditivity! This is very surprising,

as it shows that dependence trumps characteristics of the marginal distributions. We shall see that the exact form of the dependence has many unique characteristics.

To be concrete, think of X and Y as samples from the underlying distribution. In cat-model speak they are samples from the yearly loss table. More specifically, suppose that we have samples of 10,000 draws from X and Y and that we are interested in the $\alpha = 0.99$ VaR. From the definition, we can compute $v_X = \text{Var}_{0.99}(X)$ $v_x = \text{Var}_{0.99}(X)$ by sorting the X sample from largest to smallest and by selecting the 100th observation, and similarly for Y. (Generally we would select the $10{,}000 \times (1-\alpha)$ largest observation.)

It is widely appreciated that positive dependence between variables increases the risk of their sum. Therefore, a reasonable first guess for the "worst" possible dependence structure is when X and Y are *comonotonic*. Comonotonic means that we order the samples X and Y separately from highest to lowest and pair off the resulting elements: The largest value of X with the largest value of Y, second largest of X with second largest of Y and so forth. In many senses, this pairing or dependence structure does produce the most risky sum $X + Y$, it has the greatest variance and worst tVaR characteristics, for example. However, it does not result in a failure of VaR subadditivity at any threshold α! In fact, it will result in VaR being exactly additive; the α percentile of the sum is simply the sum of the α percentiles of X and Y.

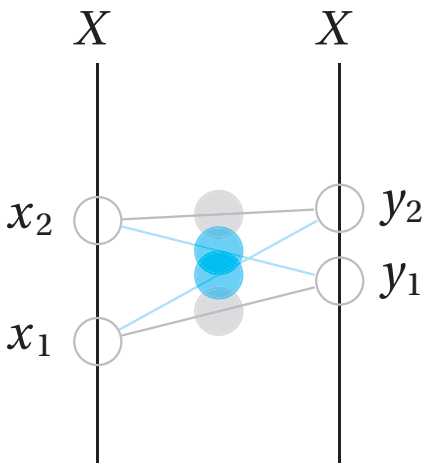
How can a portfolio possibly be more risky than the sum of its parts?

There is no diversification benefit, but there is also no failure of subadditivity. The worst α-VaR pairing of X and Y has a more subtle and surprising form.

To find a failure of subadditivity, let's start by solving a more general problem: How should we combine observations from X and Y so that the αVar of the sum is as large as possible? That is, given our samples x_i, y_i, i=1,2, ... 10,000 we want to form pairs $(x_i, y_{k(i)})$, which will define a bivariate distribution of X and Y, so that the VaR of $X + Y$, which has samples $x_i + y_{k(i)}$, is as large as possible. The function $k(i)$ defines a shuffle of {1, 2, ... , 10,000} as i varies. In other words, we want the 100th largest observation of $X + Y$ to be as big as possible.

The first thing to observe is that we should only pair the 100 largest observations of X with the 100 largest observations from Y. If we have a candidate pairing that does not satisfy this condition, we can make a better candidate by

Figure 1: Crossed (cyan) and uncrossed or comonotonic (gray) combinations of (x1, x2) and (y1, y2). The filled cyan circles represent the aggregate assuming crossed dependence and filled gray assuming uncrossed. The maximum minimum value is the lower cyan circle corresponding to the crossed arrangement.



swapping any pairings using observations outside the "top 100" with unused top 100 entries.

We can now abstract the problem as follows: We have n=100 points X and Y that we want to pair to maximize the minimum pairwise sum. How should we pair these n entries? An obvious contender is the crossed pairing: Pair the largest value of X with the smallest of Y, the second largest of X with the second smallest of Y and so forth, ending with a pairing of the smallest value of X with the largest of Y. (Order tied elements arbitrarily.) The crossed pairing makes sense; it does not "waste" any large values by needlessly pairing them together.

It is easy to see that if we are just trying to pair n=2 values from X and Y, we achieve the right answer (see Figure 1). If the X values are $x_1<x_2$ and the Y values are $y_1 < y_2$, then there are two possible pairings: The uncrossed pairing $x_1 \leftrightarrow y_1$, $x_2 \leftrightarrow y_2$ and the crossed pairing $x_1 \leftrightarrow y_2$, $x_2 \leftrightarrow y_1$. But clearly $x_1 + y_1 \le x_1 + y_2 \le x_2 + y_2$ and $x_1 + y_1 \le x_2 + y_1 \le x_2 + y_2$, so the minimum value for the crossed pairing is greater than or equal to that for the uncrossed pairing. It turns out that the crossed pairing is the optimal answer for any number of points $n \le 2$ (see the Appendix for details).

It is a general theorem, first proved independently by Makarov in 1981 and Ruschendorf in 1982, that an analog of the crossed arrangement gives the maximum VaR for any two distributions X and Y, and not just for equally likely discrete samples. The proof relies on a famous paper by Strassen written in 1965. It is surprising that this result was not known until 1982.

Getting back to our original problem, note that the crossed pairing will violate subadditivity if all the samples from X and Y above their respective α-VaRs are different, because each term in the crossed pairing is greater than the sum of the individual VaRs! There are several important points to note about this failure of subadditivity.

- The dependence structure works for any nontrivial marginal distributions X and Y—it is universal.
- The dependence structure is tailored to a specific value of α and does not work for other values of α. It will actually produce relatively thinner tails for higher values of α than either the comonotonic copula or independence. In this sense it is a peculiar example. It is not hiding dragons; in a way, it creates a phantom dragon at a particular α.
- The implied dependence structure only specifies how the larger values of X and Y are related; for values below the α-VaRs of X and Y, any dependence structure can be used.
- The dependence structure does not have "right tail dependence"; in fact it is the exact opposite.

The crossed dependence is hard to generalize to three or more marginal distributions. Whereas it is easy to create maximal positive dependence for any number of variables (the comonotomic copula), it is much harder to create maximal negative dependence between three or more variables. The reason is that if X and Y are negatively correlated and Y and Z are negatively correlated, then X and Z will tend to be positively correlated. Recently, Embrechts, Puccetti, and Ruschendorf, (2013) have shown that iteratively making each marginal cross with the sum of the other marginal distributions gets close to the optimal solution and provides a usable algorithm to compute the worst VaR dependence structure for n ≤ 3 variables. Their method is called the "rearrangement algorithm," which will be explained in a future column. Future columns will also explore skewness and thick-tailed exceptions to subadditivity.

Editor's Note: An appendix to this Explorations column appears in the AR *online.*

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IN MY OPINION BY GROVER EDIE

And Your Point Is?

We live now in an economy where attention is the scarce commodity. The quicker we cut to the chase, the quicker others catch our meaning.

— Richard A. Lanhan[1]

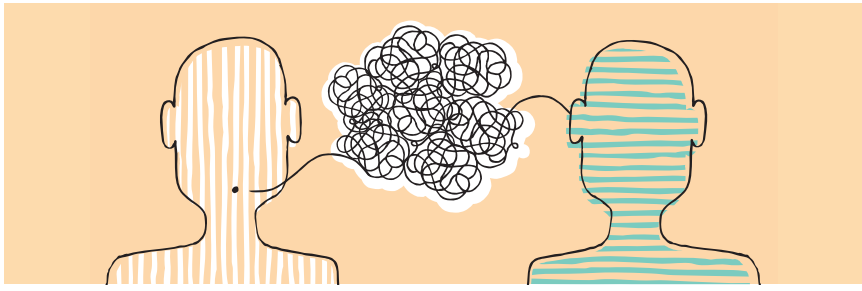
We actuaries have a lot of information to convey to our clients and management. It is difficult to trim down such complex information, but we need to be cognizant of our recipients' "word allotment" — a concept that I've been working on lately.

Word allotment is the number of words that your recipient will tolerate before deciding to continue with your communication, be it phone call, email or even in person. Word allotments vary by who is sending and who is receiving the communication, and whether it is oral or written, in person or otherwise.

For phone calls, my word allotment is about 10. That's just long enough for the caller to say "Hi, I am Joe Blow calling from company xyz and…" before I decide to continue the call. Who delivers the message is a big determining factor of the word allotment. When I hear "Hi, grandpa" over the phone, my word allotment is only those two words, and I will stay on the line. When an unknown caller uses words such as "donate," "vote" or "survey," my word allotment quickly diminishes. You get the idea.

Timing is also an issue. My word allotment is greater when I am rested, lesser when I am tired or hassled. When the words are delivered also matters. If your listener is on the way to an important meeting, you should wait until she or he has a space of time to give you their full attention. When phoning, I always ask if this is a good time to talk for the same reason. I would rather call back than have the listener only give me a brief amount of partial attention. Early morning, just before quitting time and lunch time seem to be poor times to try to get your point across.

The environment is also important. Trying to discuss a confidential matter in a public place will certainly shorten your audience's word allotment.



Word allotment definitely comes into play with some in-person meetings. When I tended a booth at a recent convention, I noticed that some of the people who stopped by had an extremely short word allotment — some had no allotment at all! The trick was for me to find something in common to talk about with a visitor and convey that within one or two sentences. Name badges enabled me to talk about the last time I was in their city or state, or that I wanted to visit and asked for what I should see there. It was challenging, but also a bit fun.

The same applies to emails. You want your readers to decide to continue to read the email within *their* word allotment — often what they can see on their phones or email screens without opening the document. With emails, the subject line can be your friend. Keep the message short enough so that all the important items can be seen in the reading pane. If you are a consultant, you want your signature line and logo to appear there as well, if possible. Longer items should be attachments. The number of emails your recipient gets can also be a factor. I used to get 60 or 70 in a day as a chief actuary and know people who get hundreds a day, and that will shorten your recipient's word allotment considerably.

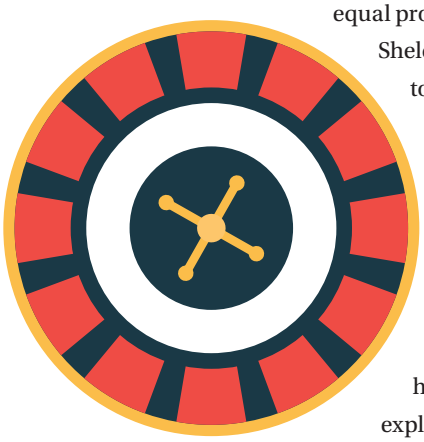
I try to practice my word allotment concept every day. Effective communication conveys the pertinent information to another within their word allotment. The problem is that we may not have any idea what another person's word allotment is, so it is best to underestimate rather than go long and be ignored. If we endeavor to "cut to the chase" so that others can "catch our meaning," we can be more successful communicators.

[1] Paraphrased from The Longman Guide to Revising Prose, Pearson Longman 2006, p. vii.

IT'S A PUZZLEMENT BY JON EVANS

Design a New Casino Game

You work at a casino owned by Sheldon. Sheldon presents you with a roulette-like machine that spins around and randomly stops at a number from 1 to n, where n is fixed, each number having equal probability.



Sheldon asks you to design a new game where the probability of winning is p. Can you do this? If so, explain how. If not, explain why not?

Rockets Into Deep Space

The key to this puzzle is the famous "Rocket Equation" that you can find in Wikipedia and various other references, but is not very hard to derive by applying calculus to Newton's Third Law. The momentum of an object with mass M and velocity V is MV. In a closed system, all changes in momentum must sum to 0 by Newton's Third Law. So when a rocket of total mass M increases its velocity by dV, through burning an infinitesimal amount of rocket fuel dM with exhaust velocity V_e, the equation $M\,dV = -\,V_e\,dM$ holds. If a rocket starts with total mass M_0 and weighs M_t after all its fuel is burned, then the total change in velocity it experiences can be expressed by the integral $\Delta V = \int_{M=M_t}^{M=M_0} dV = \int_{M_0}^{M_t} \left(\frac{-V_e}{M}\right) dM = V_e\, Ln\left(\frac{M_0}{M_t}\right)$ since M is changing and V_e is constant.

Rocket booster mass consists of structural mass M_s and fuel mass M_f. Let the probe mass be M_p. When n boosters are fired in parallel $M_0 = M_p + n(M_s + M_f)$ and $M_t = M_p + n\,M_s$. To simplify calculations, we can choose units of mass so that $M_p = 1$ and units of velocity so that $V_e = 1$. Then from the statement of the puzzle we get two equations: $Ln\left(\frac{1+2(M_s+M_f)}{1+2\,M_s}\right) = 1.14\; Ln\left(\frac{1+(M_s+M_f)}{1+M_s}\right)$ and $Ln\left(\frac{1+3(M_s+M_f)}{1+3\,M_s}\right) = 1.20\; Ln\left(\frac{1+(M_s+M_f)}{1+M_s}\right)$. These equations appear to not yield an algebraic solution, but numerical methods (like Solver in Excel) lead to the solution $M_s = 0.852207$ and $M_f = 11.4909$. The ratio of ΔV from firing n boosters in parallel to ΔV firing just one booster is $Ln\left(\frac{1+n(M_s+M_f)}{1+n\,M_s}\right) / Ln\left(\frac{1+(M_s+M_f)}{1+M_s}\right)$. As $n \to \infty$ this ratio increases and asymptotically approaches a limit of $Ln\left(1+\frac{M_f}{M_s}\right) / Ln\left(1+\frac{1+(M_s+M_f)}{1+M_s}\right) = 1.35369$. So Wernher tells Walter that it is impossible to double the velocity of the probe, or even just to increase it by 36 percent, by adding boosters to be fired in parallel.

Table 1

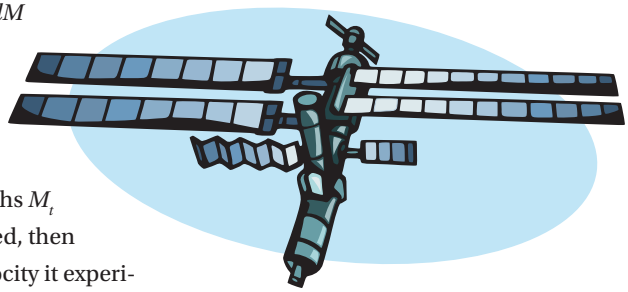
kth Booster*	ΔV	Sum of ΔV	Sum of ΔV / last booster ΔV
1	1.9746	1.9746	1.0000
2	0.5930	2.5677	1.3003
3	0.3598	2.9274	1.4825
4	0.2589	3.1864	1.6137
5	0.2024	3.3887	1.7161
6	0.1662	3.5549	1.8003
7	0.1410	3.6959	1.8717
8	0.1224	3.8183	1.9337
9	0.1082	3.9264	1.9884
10	0.0969	4.0233	2.0375

Reverse firing order.

If a series of boosters is fired in sequence, discarding each after being fired, then ΔV from firing the kth from last booster is $Ln\left(\frac{1+k(M_s+M_f)}{1+k\,M_s+(k-1)M_f}\right)$. See Table 1.

Consequently, Wernher tells Walter that 10 boosters fired in sequence will be needed to double the velocity of firing just one booster.

Solutions were also submitted by Bob Conger, Rob Kahn, Clive Keatinge, Jerry Miccolis and Brad Rosin.



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