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On the importance of mentorship and great mentors

Glenn R. Bell [a,b,c], David V. Rosowsky [d,e,f,*]

[a] Confidential Reporting on Structural Safety, Reston, VA, USA
[b] Department of Architecture and Civil Engineering, University of Bath, UK
[c] Former CEO, Simpson Gumpertz and Heger Inc., Waltham, MA, USA
[d] University of Vermont, Burlington, VT, USA
[e] Previously, Dean of the School of Engineering, RPI, Troy, NY, USA
[f] Previously, Head of the Zachry Department of Civil Engineering, Texas A&M University, College Station, TX, USA

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ABSTRACT

Little has been written about the value of professional mentorship in the field of civil engineering, yet most would argue its importance. New engineers, new faculty, and new professionals in nearly every field benefit disproportionately from effective, timely, and sustained mentoring. Their careers are launched on a positive trajectory, their careers develop, and they advance more quickly, they often find more professional satisfaction in their careers, and – not surprisingly – they often go on to become mentors in their own right. In this paper, the authors (both civil engineers and leaders, one in professional practice and one in academia) reflect on two important mentors they were fortunate enough to share. We wrote this paper for three purposes: (1) to highlight the importance of great mentors to one's career, (2) to thank two individuals that had profound impacts on us both, and (3) to inspire others so seek out mentors, to commit to being a mentor, and to find as much joy in participating on both sides of the mentor–mentee relationship as we have found in our careers.

1. Introduction

Mentorship is as important to a professional engineering career as it is to an academic career. Too frequently overlooked, and often only an afterthought or add-on to loosely defined career development plans, it is our shared experience that mentorship more than mattered; it defined us as professionals, as leaders, and as individuals that have dedicated their careers to generational continuity.

The careers of the two authors, separate pathways but linked by discipline, have intersected at several times. We are both structural engineers, both completed our undergraduate degree in civil engineering at Tufts University (Boston, MA), and both have worked on topics related to structural design, safety, and resilience. Most recently, we find ourselves serving together as members of the External Assessment Panel (EAP) for the *Center for Risk-Based Community Resilience Planning*, a NIST-Funded *Center of Excellence* based at Colorado State University. We also, it turns out, have both been profoundly influenced by the same two individuals, early and later in our careers.

Separated by a decade but sharing a connection to Tufts, the first author, Glenn Bell, served as ASCE Student Chapter Advisor when the second author, David Rosowsky, was an undergraduate civil engineering student (and eventually ASCE student chapter vice president) at Tufts. As David's academic career progressed, preparing graduates with backgrounds in structural design (in particular of light-frame structures for natural hazards loadings), several of his graduate students from Clemson University and Oregon State University began their careers at Simpson Gumpertz & Heger (SGH), where Glenn had risen to Senior Principal and CEO.

There was another interesting, if not bold, connection David forged with SGH, this one very early in his academic career. In 1993, Frank Heger (then Senior Principal and named founder of SGH), wrote a paper appearing in the ASCE *Journal of Structural Engineering* (JSE) raising concerns about the reliability basis of the load and resistance factors appearing in the 1986 AISC LRFD Specification. In response, and with all of the brash confidence that comes with a junior faculty defending his budding research career (not to mention his doctoral advisor, Bruce Ellingwood, one of the leading contributors and early advocates for LRFD), David wrote a paper in response that was published by JSE in 1994. This then sparked a discussion paper by Frank Heger, and finally a closure by David (both of which appeared early in 1996).

But it was not until the opportunity to serve together decades later on the NIST *Center of Excellence* EAP that David and Glenn came to realize

* Corresponding author at: University of Vermont, Burlington, VT, USA.
E-mail address: David.Rosowsky@uvm.edu (D.V. Rosowsky).

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their intersecting careers were, in fact, far more linked. They both had a deep respect and friendship (post-graduation) with Professor Kentaro Tsutsumi (d. 2003), and they both had been profoundly influenced professionally throughout their respective careers by Dr. Bruce Ellingwood, now one of the founding Co-Directors of the NIST *Center of Excellence*.

2. Professor Kentaro tsutusmi

2.1. Glenn Bell recollections

Professor Kentaro Tsutsumi was a far-from-typical professor. His highest degree was an M.S. from MIT. When I met Professor Tsutsumi in 1972 he had had a long and successful career in engineering consulting and had recently started his second career in teaching at Tufts University, where his goal was to give back to the students his experience in practice. Over 23 years at Tufts, he pursued this goal magnificently; his students became leaders in many of the structural engineering firms in Boston and elsewhere.

Professor Tsutsumi had an unusual and impactful teaching style. His lectures were as much about professional practice ("You must make your designs foolproof, because in the field anything that can go wrong will go wrong.") and philosophy ("The pursuit of knowledge is the only true happiness.") as they were about technical content. We learned the technical content very thoroughly, but Professor Tsutsumi expected us to take individual ownership for uptake in technical knowledge while his classroom experience was more about the context ("Read the textbook and come and see me if you have any questions.")[1]. His approach had two aims (1) engendering the skill and discipline for a lifetime of self-study and (2) devoting the classroom time to soaking up the invaluable decades of his experience in industry.

The single course that I judge to be the most valuable of my academic experience was taught by Professor Tsutsumi: CE 123, Advanced Structural Analysis. He opened his lecture of the first class with, "You students are now seniors, and many of you will be entering practice next year. It's time you learned to get the right answers to problems yourself and to get them 100% right every time. Partial credit doesn't work in the real world. Missing by a factor of 12 has catastrophic consequences." The course structure was unique. There were no exams. Everything revolved around a massive volume of homework assignments with impossible deadlines – mimicking the real world. Each homework assignment addressed one of the classical methods of structural analysis in the textbook by Norris and Wilber – portal analysis, slope-deflection, moment distribution, virtual work, etc. We were to write out the solutions each problem by hand, and then run the same problem on the mainframe computer software "STRESS". (Computer techniques were in their infancy then; machine capacities and accessibility were limited.) If the answers to the hand solution and computer analysis matched, you would submit the homework assignment. If they didn't match you needn't bother, because the grade was either 100% for a match or zero for a non-match. The volume of the homework was so massive that your course grade was based on the percentage of 100% assignments you submitted over the semester. CE 123 was reputed to be the second-most difficult course at Tufts, following Organic Chemistry. The invaluable lessons learned were (1) how to get the right answer with a high degree of certainty, (2) taking ownership of your work product, and (3) a healthy skepticism of the results from computer analysis.

In my senior year I developed an interest in earthquake engineering, which was a specialty of Professor Tsutsumi. There were no advanced courses in structural dynamics then in the Tufts civil engineering curriculum, but Professor Tsutsumi allowed me to learn structural dynamics with him under a course in Independent Studies[2]. Never a soft touch, Professor Tsutsumi required me to read the entirety of Den Hartog's *Mechanical Vibrations*, and to do every problem in the book and submit to him. He assigned me a desk in the CE graduate student's corral, where he expected to see me frequently. Over the course of two semesters, my learning involved building a laboratory shake table for dynamic testing of structural models, running laboratory sessions in structural dynamics for students, and helping Professor Tsutsumi on several of his consulting projects in dynamics. I helped him diagnose real-world problems with dynamics of a building floor system, a radar antenna, and a power-generation boiler, joining him in the field measurements, conducting the dynamic analyses, and helping him write the reports.

During this period of CE 123 and Independent Studies I spent long hours in Professor Tsutsumi's office. He seemed always to be present, from early in the morning to very late at night. His office was organized clutter – filled bookshelves from floor to ceiling, every horizontal surface, including floors, stacked with books, reports, and notebooks. Just to scan Tsutsumi's scope of interest and activity and fully appreciate the volume of his accomplishments was inspiring. Professor Tsutsumi relished time with his students. Things were never rushed. Our conversations ranged from immediate minutia of projects we were working on together to long-term discussions philosophical discussions about life and professional practice. Professor Tsutsumi always enquired about my girlfriend (who shortly thereafter became my wife, and still is) as he understood she was such a critical source of love and inspiration for me.

While I always intended to attend graduate school, Professor Tsutsumi pushed me to expand my horizons and ambitions beyond the few universities in New England on which I had my eye. Top in his aspirations for me was UC Berkeley, because it was a top-ranked structural program and a powerhouse in earthquake engineering. In retrospect I would have stayed closer to home were it not for his push. Berkeley turned out to be pivotal in my development.

Near the end of my senior year as I had my sights set on graduate school, I had one of those long visits to Professor Tsutsumi's office, where the discussion was wide ranging. Out of the blue he asked "So, Glenn, what are you going to do this summer?" "Oh, I said, "I'll probably go back to work as a drafter at that small sanitary engineering firm I worked at last summer. I'm not excited about the opportunity, but there's a recession on, and I doubt I can find anything else." "You can and should do better", he said. I know a firm that I think would be perfect for you – Simpson Gumpertz & Heger (SGH). Frank Heger is a good friend of mine. I'll call him and see if I can arrange an interview." My interview with Heger went well. I was inspired by him and loved the profile of the firm. To my astonishment, Heger offered me a job for a summer internship about a week later, even though jobs were scarce at the time. I have no doubt that Tsutsumi expended some goodwill with Heger to land me the job. Following my Berkeley acceptance, joining SGH turned out to be the second pivotal event in my career. I spent 45 amazing years there, 22 of them as CEO, before retiring in 2020.

On my return to Boston after graduate school, I continued to visit Professor Tsutsumi periodically. This continued from 1975 until just before his death in 2003. He made it clear that he expected my visit. When I entered his office his face would brighten, and I knew it would be a long but worthwhile visit. If I hadn't been to see him sufficiently recently, he would flip back through months on his calendar and say "Let's see. I haven't seen you since XXXX. You must need something from me. What can I do for you today?" Tsutsumi continued to mentor me through my progress from entry-level engineer through advancement to CEO of SGH.

[1] Interestingly, this teaching approach was similar to that of another great practitioner-turned-professor, T.Y. Lin, who Bell had the good fortune to study under in graduate school at UC Berkeley.

[2] In the Independent Studies program, a student could learn by self-study under an arrangement agreed between the professor and the student, so long as the student demonstrated to the professor's satisfaction the requisite uptake in knowledge.

2.2. David Rosowsky recollections

Professor Tsutsumi, an institution at Tufts and someone universally respected if not universally liked, was an old-school engineering professor who pushed and didn't coddle, spoke plainly and directly, challenged us to think divergently and often far beyond the engineering topic of the day's lecture, and very rarely offered affirmation. He was a philosopher as well as an engineer. (How many other structural engineering classes required the reading of the Code of Hammurabi?) He was extremely well read and well versed. But he was a man of few words. So when he spoke, we listened. He was not universally well liked by students or faculty colleagues. But he was respected and treated as the senior eminence that he was. And those who did like him, were loyal and effusive about it. There were always a small number of civil engineering students he was close with, and who stayed in close contact with him after graduation. We were two of those very fortunate students.

When Professor Tsutsumi was transitioning to his well-earned retirement, I was hired by the department to help him pack up and move boxes to storage at the university or at his home, in preparation for vacating his very large office suite on the top floor of Anderson Hall to a smaller hallway-facing office downstairs. Little did he realize the privilege that was to unfold in those months, hearing stories about every phase of Professor Tsutsumi's career and parts of his personal life he never shared previously.

As a doctoral student at Johns Hopkins University (where I studied under Bruce Ellingwood, then a young professor), David would return home to his family in Boston several times a year and made a point of visiting Emeritus Professor Tsutsumi at his office at Tufts often. During those visits, Professor Tsutsumi would open up a desk drawer, pull out a heavily redlined manuscript, and proceed to offer a critique of my most recent ASCE paper, almost as if it was not a peer-reviewed and published paper, but rather a working draft. These, too, were cherished times. This dance played out many times over several years. It was my way of thanking him for all that he did for me, and it was his way of saying he was proud of me. Those exact words never needed to be spoken. We knew well what the dance meant to us both. He would always be my teacher and I always his pupil. We also, as it happens, shared a birthday. I didn't learn this until reading his obituary while writing this paper.

Professor Tsutsumi pushed me to attend graduate school, to go on for a doctoral degree, and to pursue an academic career. I am not entirely sure why, as I was far from the top student in our small graduating class. But he saw something in me, or perhaps something not yet in me that should be, and he pushed me to push myself. Perhaps he pushed everyone. And those who couldn't be pushed in that way came to resent him, while those who were open to it – who were able to receive it and respond to it – *resonated* with it.

If I succeeded as an academic, as a professor and researcher, it was because of Professor Tsutsumi's early and relentless nudging to become that person, and his confidence that I could do so. He alone was responsible for my pursuit of a PhD and an academic career. Not the top student he had taught, but someone possessing the right combination of talents, motivation, and mindset.

But it was Bruce Ellingwood, David's PhD advisor, who would instill in him the passion for learning and discovery, and for guiding others in those pursuits. Bruce was the perfect complement to Professor Tsutsumi, picking up where he left off. The right advisor at the right time, nurturing simultaneously David's curiosity, commitment to research, writing skills, and advanced engineering knowledge over an intense and extraordinary three years at Johns Hopkins University (Baltimore, MD).

3. Dr. Bruce Ellingwood

3.1. David Rosowsky recollections

Like Professor Tsutsumi[3], Bruce Ellingwood was not an effusive advisor. He could be gruff, quick to judge, and at times dismissive of what might have felt to his students like something of significance. But he was also a fabulous teacher, a gifted writer, and a (then emerging) distinguished researcher. Bruce was in his early 40′s when David was his PhD student in the late 1980′s. Not his first, but one of his earliest doctoral students, certainly one of the first to go on to an academic career. He was new to Johns Hopkins University, and academia, and brought a stellar reputation, academic pedigree (all three of his degrees were from the University of Illinois at Urbana-Champaign), and body of work with him from the National Bureau of Standards (now NIST). He, too, was a challenging advisor in that he set high expectations for his student in terms of academic performance and workload. Weekly one-on-one meetings with Dr. Ellingwood were legendary. You had to be alert and very much on your game to absorb what would come at you during those meetings. In the best case, you came away energized and with a clear picture of what was to be accomplished by next week's meeting. In the worst case, you came away deflated and unsure if there would even be a meeting next week. While it didn't happen often (fortunately), what I remember most in those cases was a sense that I had let Bruce down. This usually had the effect of making me work even harder that week to re-establish my standing and re-earn his confidence. Bruce had little patience for delays, and even less for excuses. You wanted to show Bruce your best work, maybe *better* than your best. You came to take a lack of criticism as high praise. And you came, over time, to take his high expectations as exactly what you needed.

In the preface for this special issue of the journal *Structural Safety* to honor Bruce Ellingwood's career and 20-year service as the journal's Editor, speaking to his mentorship as a doctoral advisor, I spoke to many of the same themes:

> "Bruce has also been a consummate teacher, mentor, and advisor to many of us. To me and many others, Dr. Ellingwood was a patient and caring doctoral advisor, became a great colleague and career mentor, and has always been a friend. Those who worked with Bruce as a colleague will recognize many of the same attributes we knew as his students: He is tough, challenging, and sets high expectations. He expects your best and tolerates nothing less. He is passionate about research and discovery on important topics and has no patience for time wasted on problems of little practical value. He shares his opinions freely, as he does his wisdom and accumulated knowledge.

[3] You will notice by this point that we still refer to Professor Tsustumi by his title. There may be many reasons for this, not the least of which being the role he played and the impact he had during our formative undergraduate years. Despite his diminutive stature, his was an imposing presence that was always preceded by "Professor." But it could also be that he never earned a PhD, something he reminded us of often. He was from a different generation, one in which a master's degree from MIT coupled with extensive real-world experience qualified him to teach engineering at the university level. He professed not to have very high regard for the PhD in civil engineering. Even when pushing David to pursue his PhD, his internal conflict was evident. But he realized times had changed and the PhD was necessary to pursue an academic career at a top university.

He is caring and considerate. He is genuine. He is extremely intelligent. And he is kind."

Many of his students and colleagues, many of whom contributed to this special issue, would readily agree to these sentiments. But it is really only upon reflection later in our careers that we are able to fully recognize (and appreciate) Bruce's impact on our careers and the gifts he has given us. Again from the preface of this special issue:

"Those of us that were privileged to have studied under Dr. Ellingwood are also better teachers and better mentors for having done so. Many of the gifts he gave us only become evident later in our careers, as we reflect on our own careers and those of our students and are able to so clearly attribute this evidence of generational success to this one very important individual. Indeed, Bruce has impacted the lives of countless numbers of undergraduate and graduate students, post-doctoral researchers, and faculty members – across generations and around the world."

Indeed, one of my greatest prides is to share a professional family tree with Bruce Ellingwood. Bruce has always remained close with his doctoral advisor, Professor Al Ang. I have always remained close with Bruce, as our relationship grew from advisor, to colleague, to dear friend – always mentor/mentee. And it brings me great joy that so many of my own doctoral students (and even some of their doctoral students) have remained in contact with me. This generational pride is often a feature of a truly great mentor relationship, one that extends across generations and one in which the family tree is cited with enormous pride.

3.2. Glenn Bell recollections

My relationship with Bruce Ellingwood was different than David's. I was never Bruce's student, and he was not a classical mentor to me, yet he has been a source of great advice, knowledge, and inspiration. I first met Bruce in the late 1970 s at a world conference on probabilistic mechanics in structural reliability. While I knew of Bruce beforehand, he stood out in person for his intellect, precision, curiosity, and exceptional lecturing. While only six years older than me, it was clear he was on a completely different career trajectory. I had the opportunity in that conference to chat with him on breaks, which I considered an extreme privilege.

A few years later Bruce invited me to join the ASCE Committee on Safety of Buildings, which he chaired. Probabilistic methods of structural reliability, including Load and Resistance Factor Design, were making their way into codified practice, and I was to be one of a small group of practitioners amongst an intimidating cadre of academics. Apparently, I had made an impression on Bruce at that conference.

My overriding impression of Bruce in this experience was his uncompromising dedication to intellectual rigor and honesty. There was commercial interest amongst structural material organization to favor certain points of view in reliability standards, but Bruce would have none of it. But at the same time Bruce was realistic about the practical considerations bringing theory to practice. He was very solicitous of my opinions and the other practitioners on our committee. Bruce's approach engendered in me a life-long interest in and dedication to partnerships between academia and industry in progress and innovation.

In the years since the Committee on Safety of Buildings, I would always consult with Bruce on matters of probabilistic concepts of structural reliability. He was always generous with his time and advice, and absolutely rigorous in his work. One of my last projects at SGH was to evaluate the effects of alkali-silica reaction (ASR) in the concrete of the Seabrook Nuclear Power Plant in New Hampshire. I and my colleagues retained Bruce as a peer reviewer of our work with respect to safety and reliability. Bruce testified with our SGH team on our findings before the U.S. NRC Advisory Committee on Reactor Safety. It was humbling to see that although my work had withstood intense scrutiny in these hearings, it was Bruce's blessing of it that carried the day.

In 2016 Bruce invited me to join the External Assessment Panel of the NIST community resilience *Center of Excellence*, mentioned above. In truth I was too busy at the time to take on this new commitment, but it was my indebtedness to Bruce that caused me to say yes and find the time. This is the group through which David and I reconnected since our days at Tufts University. The principal dialog that David and I are having with Bruce is the same as I had had with Bruce decades before on the Committee on Safety of Buildings: How to move ground-breaking, innovative research concepts into practice.

4. Summary and conclusions: Reflections on mentorship

Great mentor–mentee relationships are built on deep commitment. Both Tsutsumi and Ellingwood were generous with their time and invested themselves in us. This went well beyond our time in meetings together, extending to reflective thinking and action between meetings as well. But such relationships are two-way streets. The mentee must reciprocate by ensuring the mentor's investment of themselves pays dividends through the mentee's action, follow-through, and, ultimately, progress and success.

Absolute candor and honesty by both are critical. Meaningful impact is not possible without trust. This can be challenging in situations, for example, if the mentee senses the mentor's advice is influenced by personal gain. In our case, for example, although Tsutsumi would have been happy to have both of us as his graduate students, he understood we needed to move on to other institutions, and he not only advised us but helped us to. Following this model, Bell had many situations in his career at SGH, where he advised mentee employees to move on from SGH.

Mentors must resist the temptation to live vicariously through their mentees. They don't tell you what to do; they listen more than they talk. They offer perspectives you don't have and teach you how to make decisions yourself.

Exceptional mentors, like Tsutsumi and Ellingwood, are very demanding. They have high expectations for you. They understand your capabilities and ambition and push you to achieve far more than you would expect of yourself.

And if you are very fortunate, as we were in our relationships with Tsutsumi and Ellingwood, your mentor actively advocates for you. Were it not for Tsutsumi's proactive involvement in Bell's attendance at UC Berkeley and employment at Simpson Gumpertz & Heger his career, no doubt, would have followed a far less exciting path. And was it not for Ellingwood's high standing in the field and personal connections with academics at the top universities, Rosowsky's academic career would not have been as successful. The best mentors remain connected to you for long periods of time, if not your entire professional career. They are sounding boards, advocates, listening ears, and confidence boosters. They offer praise as well as constrictive criticism, unwavering support as well as unvarnished truth, and in many cases, they know you better than nearly any other professional colleague.

While many people have vast experience that should make them great mentors, not all are, indeed, great mentors. Great mentors are self-aware, have reflected deeply on their own experiences, and can translate their experiences into lessons learned to be passed on to the mentee.

Great mentors are role models, personally and professionally. They don't strive to mold you in their own image but inspire you to be like them. A mentor's actions are more important than their words. They reinforce important core values. They care about the whole person.

No two individual relationships are necessarily candidates for great mentor–mentee relationships. There must be a match that extends to personal chemistry. Tsutsumi and Ellingwood, themselves very different people, were great for us but not good matches for everyone. They were tough, intellectually rigorous, and very demanding. They were quick to show their disappointment in us when we fell short. Where others might have disengaged, Tsutsumi and Ellingwood inspired us to try harder.

Bell and Rosowsky took very different career paths, one leading to leadership in consulting and the other to leadership in academia. Tsutsumi and Ellingwood offered very different experiences, one very practice-oriented and the other at the highest levels of education and research. Why did both mentors of such different background so profoundly influence each of our different career trajectories? The answer is, in part, in their common characteristics as mentors and their approach to mentoring as summarized above, but they also complemented each other in ways that are particularly relevant to civil engineering. Civil engineering needs university teachers and leaders who understand practice and can convey practice perspectives to their students, and it needs practitioners who great teachers and can work at the cutting edge of technology. In short, we all must blend education, research, and practice. Tsutsumi and Ellingwood allowed and inspired us to embrace that blend.

Presently we hear much concern from students and young professionals about a decline in commitment to mentoring. This is of great concern to us, as we have personally experienced what a defining experience great mentoring can be. Our indebtedness to mentoring must be paid forward, just as Bruce Ellingwood did with his mentor Al Ang and his mentee David Rosowsky, and Rosowsky has done with his students (and their students). While hard to quantify for purposes of promotion and reward, mentoring is nonetheless a key element of a successful professional career, and responsibility of a successful professional. Senior colleagues do not choose to mentor their younger colleagues for recognition, nor are they likely to be effective as mentors if it were to be mandated. Rather, like so much in our professions, mentoring is a calling to duty, to service, and to ensuring generational continuity. In rare cases, one is part of a long line of dedicated mentors, creating a professional family tree that is both successful and often close. The Ellingwood professional family tree is one of those exceptional examples.

Following his inspiration from Tsutsumi and Ellingwood, Bell has felt a strong duty to mentor throughout his career – for students, supervisees, aspiring leaders and other colleagues inside and outside of SGH. When he stepped down after 22 years as CEO of SGH, the employees presented him with a book they wrote with innumerable individual expressions of gratitude for his mentoring. Now near the end of his career, that book is more meaningful to him than any of the public awards and recognitions listed on his resume. When asked about what he is most proud of in his leadership career in academia, Rosowsky says it's the levels of success achieved by those he mentored early in their leadership careers, many of whom went on to senior leadership positions at other universities.

Great mentor–mentee relationships like the ones we shared with Kentaro Tsutsumi and Bruce Ellingwood are hard to institutionalize. They derive from deep personal commitments that are two-way streets. At their best they are career defining, and the process self-perpetuates as the mentee shows their indebtedness by mentoring a new generation of mentees.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The following was taken from D. Rosowsky's remarks at a ceremony honoring Professor Tsutsumi held the year following his death.

"More than any other person, Professor Tsutsumi influenced my decision to pursue a graduate degree and ultimately an academic career. His influence continues to this day. Many decisions I make I find myself asking 'What would KT suggest?' He saw something in me even when I struggled in CE 22 or CE 123. He nurtured me, he pushed me, and then he pushed me a little further."

The following acknowledgments appeared in the paper *Defining Resilience* by D. Rosowsky (*Sustainable and Resilient Infrastructure*, Taylor & Francis, 2019). The authors agree they feel appropriate here as well.

"The author is grateful to current and former colleagues who helped to shape the thoughts shared in this article. In particular, the author acknowledges Kentaro Tsutusmi (undergraduate advisor at Tufts University) who first introduced him to the Code of Hammurabi; Colin Brown (mentor and guide through countless discussions on the dimensions of engineering decision and risk); and Bruce Ellingwood (doctoral advisor at Johns Hopkins University, professional colleague, and lifelong mentor) who has done more than anyone to shape his career over the last 30 years. Engineering and philosophy are not such disparate fields."