# Champion, student, practitioner, researcher, teacher: The life work of Jim Thompson in System Dynamics

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#### Abstract

Jim Thompson was a member of and contributor to the System Dynamics community from the 1980s till his death in 2021. This paper presents some of his experiences in, and contributions to, the field. Jim came to System Dynamics as an accountant, and much of his early work was focused on business, but learning was his lifelong passion. For his later work in health care, he went to great lengths to help both clients and collaborators build understanding on their own. He touched many lives and will be sorely missed.

## That's interesting. What can we learn from that?

Jim Thompson, like Jay Forrester, considered himself a student of System Dynamics to the end of his life. Both came to the field after successful careers in other areas. Jay, obviously, to found it, and Jim to help to bring out and share the insights and understanding that the field promises. The above quote was one of his favorites, and he used it to both explain his own journey and as encouragement for others to get started on their own. Jim's story is remarkable, and also inspiring. Learning about System Dynamics has had a profound impact of many of us, while his work, like ours, has contributed to the field. In recounting his experiences, we are paying tribute not only to Jim, but also to the potential of System Dynamics to provide opportunities for determined people to do good work.

## Background

Jim came to System Dynamics after a successful career in accounting at Arthur Andersen and as the Treasurer and Director of Strategic Planning of Kollmorgen. From champion, to student, to practitioner, to teacher, his story demonstrates the special nature of the field of System Dynamics. Jim passed away in August of 2021 and we take this opportunity to highlight some of his work and activities that have contributed to the field in the thirty some years he was active in it.

Jim had a unique voice, funny, ironic, at times acerbic, but always genuine and never belittling except to those in power. To capture that we have organized our recounting around first person accounts of his collaborators, teachers, students, mentors, and mentees. Where the work resulted in publications, citations are included, but not everything Jim was involved in was published, or necessarily even came to fruition. While this recounting is incomplete, we hope it provides the reader with an opportunity to get to know Jim a little bit the way we did, and to understand his contribution to the field.

## Opening

In the Early 1980s Jay Forrester was leading an effort to understand the economy through the use of the National Model (Forrester1984). To support this work, Jay sought sponsorship from different corporations and Kollmorgen, a producer of printed circuit boards was, based on Jay's connection to its CEO Bob Swiggett, one of the sponsoring organizations. At the time, Jim was the Treasurer at Kollmorgen and decided to find out why they were paying MIT money for this research not clearly connected to their business needs.

Jim began attending the semi-annual sponsor's meetings and quickly pivoted from skeptic to supporter. Thus begins our journey.

# The Champion (1982-1990)

As a sponsor of the National Model work at MIT Jim was in a position to directly support the work being done. He was also, after overcoming his natural skepticism, enthusiastic in his praise of the field. But what engaged Jim more than seeing the results of good work, was the process by which the work was done. As he became more engaged in the results of the National Model work – insights into the working of economies from a non-economics perspective – he also developed a real desire o learn how to do it. And, while this may be true for many champions, few are willing to give up their day jobs, but Jim eventually was. Or, perhaps more precisely, he was willing to change his day job.

# The Special Student (1990-1992)

Having been exposed to people at MIT though his time as a sponsor, Jim turned to it for the beginnings of his formal education. He completed the available courses offered at MIT by commuting during the days class met from Farmington Connecticut to Cambridge Massachusetts. At the end of it, he recognized that his knowledge was only enough to get started, and wanted to apply his learning and thereby continue his education.

## The Storyteller (1990-1994) – Jim Hines

From his experience as a sponsor of Jay Forrester's work, and his MIT coursework, Jim began considering becoming a true System Dynamicist himself. Not aspired, decided. For some reason Jim took aim at me as someone to learn from. He quickly joined my firm Leaptec, immediately doubling its size.

In short order, Jim revealed himself to be unusually astute as a businessman. In fact, he had practically been a child prodigy, achieving success and senior status at a surprisingly young age. By the time I met him he'd already had a very successful business career. Thus I discovered there were two mentors and two mentees at LeapTec. – making the firm seem even bigger.

Jim told stories, drawn from his own experiences, with which he could convey lessons. Jim occupied a senior position at Kollmorgen, the circuit board printer, from an early age. His position became important to one story when, later on, Kollmorgen almost went out of business. In the ensuing shakeup, all of the senior leaders were 'let go', including Jim.

Jim and his colleagues of course had been aware that revenues and the number of customers were declining. And they had been thinking as fast as anyone could about why that was happening. When the cause remained mysterious, they brought in a consultant. Working with the company, the consultant built a version of Jay Forrester's famous "Market Growth as Influenced by Capital Investment" model. In fact, delivery delays appeared to be lengthening somewhat – a result that the market growth model also produces. Through connections like this and by the charm of System Dynamics (and the consultant), Kollmorgen's leaders gained confidence in the model. Naturally, they took the action such models often suggest: They brought on new capacity and built up inventories, in expectations that sales and customers would rebound. Unfortunately, the opposite happened: Sales dropped faster, and Kollmorgen found itself with very low revenues and warehouses bursting with inventory that no one seemed able to sell. Jim and the other senior managers were forced to leave.

At this point in the story, I asked, what happened? Why didn't more capacity and higher inventories work?"

Jim said he and his colleagues had been curious about that question, too. And he offered the observation, that they happened to have plenty of time on their hands to think about it

Eventually, the former senior officers came to believe increasing capacity and inventories was no solution at all, and that the model results had very little to do with the cause of their falling sales. Instead, Jim said, the cause of falling sales was: Kollmorgen's customers hated Kollmorgen's product. Jim was always concise.

I said, "Whaaaat?"

Jim continued: Kollmorgen's circuit board printing business originally had grown at a rewarding pace, because the company could turn around a circuit design from a customer fast, faster than anyone else in the industry. R & D, of course, involves a lot of redesign, so R & D departments loved Kollmorgen. True, manufacturing people hated the company's circuit boards, because they proved difficult to work with later in commercialization and production. But the R &D folks got first choice about whose circuit boards to use and they simply ignored the weeping noises coming from the manufacturing division down the hall. Kollmorgen prospered. A brilliant business plan. But, with a flaw. Competitors began to catch up on turn-around speed. So, R & D people began caring less and less about whose circuit boards they chose. Eventually, the choice became unimportant enough to R & D that they just let the manufacturing division decide. And manufacturing decided on Kollmorgen's competitors. Sales dropped; customers left.

I immediately grasped the point of Jim's story: System dynamics can't inoculate you from building the wrong model.

But Jim said it wasn't just building the wrong model. Remember, that the solution to increase capacity made the problem worse.

But, he continued, we actually could have handled over-capacity and increased inventory resulting from following the "model's" solution. No, he said, the crippling damage came when the model gained leadership's confidence, and they stopped looking for other causes.



And for a virtuoso performance:

**Figure 1:** Kollmoren's near death experience. Loop B1 was slower than loop B2, probably because of B3 (B4 is stronger than B3 because competitors are behind Kollmorgen).

## The Promoter (1993-1994)

The emergence of model based interactive learning environments offered a new mechanism to engaging a broader spectrum of people in our work as described in Graham et al (1992). Jim got

involved in this with a product called Aaron, which was a two company competitive game aimed at undergraduate business school students.

#### R&D – Jim Hines

I developed the game (in smalltalk) for a client (who probably used it once or twice). But that's as far as my interest went.

Jim the businessman saw it as a potential revenue generator for LeapTec and went into action, writing the user's guide, getting it printed, and selling it. I always thought the failure of the product was because I made it (look) complicated because I liked that look that you see in airplane cockpits. Turns out complicated looking isn't what people want. And, probably, aircraft cockpits have been simplified as far as the engineers could.

#### Support – Bob Eberlein

The User's guide is actually what I remember most clearly, because at the same time I was trying to develop Vensim<sup>®</sup> Arrow (another product lost to history) and Jim and I used the same printing company, actually run by an acquaintance of his, to make the little booklets. Neither product did noticeably well, and we even talked about packaging the two of them together to see if that would generate interest.

Looking through my bookshelves, I can't even find copies of those booklets, through there may be some in my basement somewhere. Vensim Arrow eventually gave way to Vensim PLE – which did gain more traction. In this vein, Jim later created Two Brother's Pizza and other games that were used at Central Connecticut State University as discussed below.

# The General Consultant (1994-1998) – Bob Eberlein

As many of us know, making one's way as an independent consultant is hard, no matter how wonderful System Dynamics is. In 1994 Jim decided he needed the umbrella of a bigger organization to continue the good work. He interviewed with Gemini Management Consulting, and I can remember at the time he said it was that or the "orange apron." It was Home Depot's loss that Jim did get the job with Gemini and ended up engaging clients in a number of System Dynamics projects (as well as more general business transformation projects which was the bread and butter of Gemini). Three of the System Dynamics based projects are described in Thompson (1999).

The first of these was an engagement to grow the number of clients serviced by an insurance company. Simplifying somewhat, it a pretty classic case of over simplified mental models on the part of management:



Figure 2: Manager's mental model

Whereas a more complete picture of the way the business run shows the important of managing capabilities:



Figure 3: Incorporating balancing feedback in the mental model

Such a balancing loop would, of course, derail any marketing-based activity done in isolation. In the case study there were two components of service capacity – operational and claims processing – that both were important to maintaining customer satisfaction. That insight provided the basis for a stronger market development plan.

The second case study is actually a successful example of modeling a system. Three companies were trying to collaborate to bring a new technology to market but could not agree on the best way to do it. The lack of agreement was based on uncertainty about the way the technology would be adopted, which made it impossible to decide who should invest what and how the incremental revenues should be recognized and distributed. By creating a model that captured the accounting mechanics – a place where Jim was quite at home – there was a basis for discussion:



Figure 4: Representing income accounting in an understandable way

Combine that with quantifying the uncertainty in a clearly communicable way, the three companies had a basis for actually deciding how to go forward.

Like many consulting stories, this one has an unexpected twist as a competitor entered the market and disrupted the coalition.

The final consulting case discussed was for an international development agency that had evolved from being highly mission oriented to highly budget oriented. That evolution was an artifact for of the simple number of past projects that required completion, and the level and type of scrutiny these projects generated from the countries in which they were executed and the international community. At one point Jim told the head of the organization that he was "flying an airplane in which none of the controls are connected" so heavy was the legacy of measurement and conformance. This was a situation where understanding was helpful, but didn't really resolve the fundamental problem.

#### **Reflections – Jack Homer**

I assisted Jim on two projects in the fall of 1995. In both cases, I was a subcontractor to Ventana Systems. Both projects provided lasting memories.

Jim tells the story of the disability insurance modeling in his 1999 SDR paper. I have nothing substantive to add here, except to note that Jim recognized the value of the term "hurricane diagram", a big unedited causal-loop diagram, a brainstorm picture reflecting the ideas of all client team members. A hurricane diagram has no single clear dynamic hypothesis but suggests many possible hypotheses. It is the CLD version of a laundry list, and just a step on the path toward modeling, not a model in itself.

The insurance company was one of the first tenants of Liberty Place, a landmark high-rise development in Philadelphia completed in 1990, a few short blocks from City Hall. One day we were working with the team at the client's offices, when somebody called out that there was an impressive motorcade passing by on 16th Street in the direction of City Hall. We looked down as President Bill Clinton got out of his black limousine and waved in our direction as he walked. Maybe he was in Philly to confer with Mayor Ed Rendell, who helped with the Clinton reelection campaign in 1996.

The second project I worked on with Jim was for a pharmaceutical company in New Jersey. I was not involved directly with the client but did help Jim with modeling and model testing, working on a very tight deadline. Not only was the final report due, but so was my wife, who gave birth to our daughter Olivia (our third child; now in her 3rd year of medical school), a bit earlier than expected. Jim gave me a one-day extension, the most the unbending client would allow. He thanked me for helping with the stressful crunch and later told me the client was happy with our work. I can't say I was happy with the client, though. Unfortunately, we outside consultants have no way to petition for parental leave.

I had a great time working with Jim. As a fundamentally kind and generous person, he had a real rapport with his clients and directed them toward the goal line with a sure hand.

## The Partner (1996-2000) – Bob Eberlein

Starting in 1996, Jim and I formed Global Prospectus to market a country level data delivery system built off the Threshold 21 model (Barney et al 1995) under license from the Millennium Institute. The goal was to provide organized datasets for a variety of key country level metrics with the ability to look at projected values under different assumptions around both external conditions and internal decision making. The source data were to be drawn from the World Bank and other data providers and the model calibrated to the conditions of each country.

Global Prospectus was incorporated, got a website, and created a program to support delivery and analysis of the raw data. The intended audience for the product (called Presage) was development agencies, investors and countries that wanted to get a better understanding of countries and regions in terms of their current situation and future prospects.

While some progress was made on taking the next step and fully integrating the data with the Threshold 21 model, this task was never completed. Some of the difficulty lay in the technical challenge of integrating the model and providing a coherent delivery system, but most was business related. While Jim and I thought we had a fabulous idea, none of the people we talked with who might actually have paid for it shared our enthusiasm. Even at a price of free for the interim data delivery system, there were only a few takers.

While we had gone beyond floppy disks, and even CDs, to enabled web delivery at this point, the software itself was still desktop based. Technically, the undertaking would have been far simpler today using the modern web-based delivery systems supported by System Dynamics software. Ultimately though, the fundamental mismatch between the ability to deliver insights into future outcomes and the ability of others to consume those insights likely remains. Somewhere around 2015 Jim filed the papers

with the state of Connecticut to formally dissolve the company, though all activity had ceased more than a decade earlier.

## The PhD Student (2002-2009) – Susan Howick

In 2002, Jim contacted myself and Val Belton regarding the possibility of doing a PhD. He was looking for a part-time PhD course and the University of Strathclyde was one of only a small number of universities where he could study at a distance. Jim told us that his key objective for doing a PhD was "to be credentialed to teach at the university level". However, as indicated by the quote at the beginning of this article, Jim loved to learn and I think that his drive to do a PhD was as much about wanting to learn new things.

Jim's passion for learning also formed the basis of his PhD as he focused his work on the way clients learned to resolve problems during System Dynamics engagements. He had seen this happen in practice many times but wanted to understand more about how it happened. Jim's work examined the way individual clients experienced critical learning incidents or, as we referred to them, 'Aha!' moments. He used constructivist learning theory to explain how and when clients' mental models changed during an engagement.

Jim was a great storyteller and recounted many interesting descriptions of the System Dynamics work he had carried out with various clients. Some of these recollections informed his PhD work, but a key source of his data came from interviewing other experienced system dynamics modelers and, most importantly, their clients. Jim analyzed this data to examine how and under what conditions clients' learning occurred.

The results showed a difference in timings of critical learning incidents associated with whether a predictive or policy focused model was used, the phases of the modelling process where these incidents occurred and the role of different methods during these phases. Jim's work demonstrated how system dynamics provided a framework and means for a client to make sense of an experience. After completing his PhD, Jim was keen to publish his work and found an appropriate outlet in a Behavioral Operational Research Special Issue in the European Journal of Operational Research (Thompson et al 2016).

Learning was a key theme of Jim's PhD work and underpinned much of what he did with system dynamics. I believe that every day is a learning day, and this was never truer than when I spent time with Jim.

# The Expert (2000-2007)

In 2000, Jim secured a position at Cigna Healthcare by showing how simple epidemiological models could be used to understand the effects of pandemics and other public health issues on payor exposure. While many in the US seem to believe health outcomes can be improved by managing the private insurance industry, what Jim showed with his work at Cigna, is that understanding the insurance business requires understanding the health care system.

This work started with actuarial questions at the forefront. Jim was working with the managed care division of Cigna Healthcare to help them gain insights into some important uncertainties. If there were another flu pandemic, what exposure would they face? If people are encouraged toward nurse-practitioner treatments, how much might be saved. In isolation, such questions lend themselves well to actuarial analysis, but answering them all in a coherent way is quite confounding.

Jim started this work with relatively simple epidemiological and patient flow models that could be used to tell stories about why different outcomes would occur. The ability to gain insights into the business based on what was happening to patients and providers was novel and got the attention of others in the organization. In doing the pieces, Jim recognized that a more coherent view of healthcare system could be a valuable vehicle for understanding and improving things going forward.

By bringing together a number of relatively simple models around patient, provider and payor behavior Jim, was able to tell a coherent story about the evolution of cost of care. The integrated model, called the Health Care System model is described in Thompson (2006). A causal overview of the model is shown below.



Figure 5: An overview of the Health Care Systems Model

This model was used to forecast short term health spending outcomes, and it also formed the basis for Jim's health care course described below.

The first of Jim's bottom line conclusions from this work is that "The health care system is structured to increase costs. Technologies are a crucial part of a positive feedback loop that connects consumer purchasing with technology research and funding that generates still more consumption." The model was developed for the US, but that conclusion, and many others, apply to different degrees worldwide.

## The Health Care Consultant (2007-2010) – Greg Szwartz

After the work with Cigna, Jim continued consulting in the area of healthcare dynamics. He collaborated substantially with Ventana Systems, and Health Market Sciences (HMS [now LexisNexis Risk Solutions]) in delivering consulting work that could only be done by someone deep in both technical and functional/content expertise. For many at HMS, he was the role model for how one could have a successful career doing both the technical work you love (System Dynamics) while focusing on a single industry and domain. It should also be noted that even as an expert in both the methodology and subject matter, he was great to brainstorm and work with – always open to new ideas, and also always quick to deliver a big smile and hearty laugh.

In his consulting support for HMS, as an expert in healthcare, Jim knew where we needed to go with many of our models, but he did not bulldoze or push folks to get there. Instead, he knew how to draw them there by asking the right questions (or using a well-timed facial expression). When models calibrated well to population health data, we'd all have a big smile about what we accomplished, but in retrospect part of Jim's smile was probably appreciating the success of teaching a team of young modelers at a startup "how to fish". Jim understood that consultants need to build a team with ability to continue to deliver when he's no longer engaged on the project. This is hard for many of us to do, because consultants are paid to bring outside expertise, and so we feel pressure to move quickly and justify the spending on our time, but long term success requires Jim's approach of teaching and building capacity in the internal teams along the way.

When we think about a success story of someone who went really deep in a technology or methodology, AND subject-matter expertise, Jim comes to mind. And when you couple this with Jim's passion for teaching and his approach to coaching vs. telling, it made for a great system dynamics consultant. Jim was always a step ahead in healthcare dynamics conversations. He could have been many steps ahead, but he chose to work in a way that let us stay close enough to learn.

## The Volunteer (2006-2018)

#### Society Operations - Roberta Spencer

In an August 2012 email exchange. John Richardson asked "Suppose one were to commit themselves to a daily <u>practice</u> of system dynamics modeling of – say – 90 minutes, five out of seven days each week. What would that practice entail? What would the "Czerny Book of Exercises" for system dynamics modelers look like?

Jim replied with a question "**It is an interesting question—what to practice?** The difficulty is that there is little in the way of muscle memory involved in learning system dynamics so simply dragging a stock and flow into a diagram is not helpful. In music practice, the feedback is immediate...you can hear what you're doing. But in SD conceptualising and formulating, you don't know what you've done until you've completed the piece, so feedback is much slower. Then there's the issue of "what song you're playing". You can make a horrid hypothesis simulate well or take a perfectly good hypothesis and make a horrid model. So ... what to do?

Copying the masters is a reasonable alternative, but even there you need someone to help you understand why the formulation is a certain way. The absolute best of that is Jay's body of three major works: industrial, urban and world dynamics. If the learner reads deeply, s/he will understand the nature of system dynamics methodology – something that has been lost since almost the beginning. JT"

It was a fantastic bonus for me that, many times, I was included in interesting idea exchanges.

Jim served as a volunteer for many years on the now defunct Administrative Committee of the System Dynamics Society. The committee makeup was semipermanent and vital to Society operations. I sought advice from this essential group of trusted advisers throughout my career as Executive Director. The Administrative Committee was presented with large, extremely important issues as well as some day-today-but-not-ordinary matters.

I could depend on Jim for thoughtful replies, better yet in a timely manner. He initiated productive conversations to move ahead, or not, on an issue. Jim was involved in the decision for the Society to take on the new role of selling Jay Forrester's books, previously sold by Pegasus Communication, and Dennis Meadow's *Fish Banks* game. Jim felt that it would support the SD learning community.

Jim's presence on the Administrative Committee was critical for many of the policy issues faced by the Society. Here are just a few examples.

Many years ago, we needed to find the right home for the Society's investments. Until this point, funds had been building up in the checking account. The Society had grown to a point that we needed to invest! Jim was essential to this move.

In February 2015, Jim led a team of consultants, graduate students, and staff to create the *Policy Council Guidebook*. Jim is quoted in an email message "This is a valuable project that will help us now and future officers and members of the Administrative Committee and Policy Council." This project took almost two years, and about 100 email messages later, it was presented at the 2016 Delft Conference. It was a huge project spearheaded by Jim. What I remember during this project is Jim's ability to listen and learn, then create.

In February 2017, the Administrative Committee was tasked to make a final recommendation to move the home office of the SDS, after over a year of planning. It was a really big decision and Jim, after throughout consideration, simply replied "OK" leading the way for others to place their votes.

Many times, under the radar, Jim stepped up to help spread the word about System Dynamics and community building. He helped comb through the System Dynamics Bibliography to compose some bibliography highlights, gently reminding readers of the wealth of topics and research contained in the Society's bibliography. The bibliography highlight paragraphs included topics on Sustainability, Recycling and the Throwaway Economy; The effects of aging on system behavior; High-quality application of System Dynamics in health-related research; Fossil fuel research begs for system dynamics models; and Right wing, left wing? Democracy has been an effective and successful political system from the 5th century BC to today.

Our personal and professional lives intertwined. One of my favorite times is when Jim helped facilitate an annual Beer Game events at Brown University. At the time my son, an undergraduate at Brown University, introduced one of his professors to me. We organized playing the beer game for his class, for five years and Jim participated in running the Beer Game (2005-09). Jim appreciated the opportunity to share, educate, and welcome anyone interested in learning about System Dynamics.

Through the years, before we got down to SDS business we always had an important exchange of family and life stories. Topics of conversation included his grandkids and "granddog," UConn women's basketball, pool parties and usually a recap of health issues. In 2014 Jim and I both had some health challenges. Jim's were related to his heart and lungs, and I had a bicycle accident in Delft during the conference. By August we were exchanging health and healing stories. He thought it might be interesting to develop a "healing" model. "I'm envisioning a game/microworld in which patients assess their short-term decisions and feelings (giving up due to red tape, I don't wanna, it hurts, why do I hafta....) and the longer-term implications for their conditions--full recovery in x months, remission, limited range of motion in x months, weight loss/gain...." Then, as time went on, he posed one of his questions to me, "**So what does "full recovery" mean?**"

I was truly lucky to have Jim as a colleague and my friend.

#### Conference Thread Chair – Mark Heffernan

Jim was a co-chair, a mentor, a scholar, we had a shared experience of near fatal illness, but most of all he was a great friend.

Over the course of several years of Co-chairing the Business Thread of ISDC, Jim gently schooled me in the art of turning harsh criticism into guiding and constructive feedback. His encyclopedic knowledge of all things SD related gave us a sound academic basis for some of my more gut feel reactions". I really miss our email chats over the joy of living one more day.

## The Researcher (2010-2013) – Bob Eberlein

In 2010 Jim joined the research faculty at the Duke-NUS Medical School in Singapore, and I followed about a year later. The goal of the research was to understand the evolution of health care in Singapore, with a focus on the implications of aging (of course spelled ageing in Singapore).

Jim began this work looking at the progression of dementia in the population. The approach was something almost second nature to most of us in the field, but got a warm reception from those in the health policy community:



Figure 6: Simple aging chain representing cognitive impairment

This very simple aging chain articulates the way in which disease progression occurs, because of the values of the flows, and the resulting burden of disease, as a consequence of the values of the stocks.

Those insights are highlighted in Thompson, Riley and Eberlein (2013), and the work progressed to higher levels of articulation and precision such as Thompson et al (2014).

Achieving precision and, more importantly, accuracy, requires recognition of the details of computational techniques – something Jim and I collaborated on in Eberlein and Thompson (2013). Simply put, using age cohorts, even as small as 1 year, can lead to substantively different results than a precise (effectively FIFO) representation of aging. Consider the structure in Figurer 7, which uses 1 year cohorts (ages 0 to 100Plus by year).



Figure 7: Blended cohort representation of aging

Contrast this with the structure shown in Figure 8.



Figure 8: No blending (FIFO) cohort representation of aging

Figures 7 and 8 are identical except that the stock has been replaced by a conveyor which means each group stays resident for precisely one year before aging out, and into the next group. Figure 9 shows a comparison of the results of these two formulations projecting the number of people over 90 in Japan.



Figure 9 Behavior comparison of blended and not-blended aging

In Figure 9 both the timing and magnitude of the peak in elderly population are different because of the mixing going on even with very tight (1 year) cohorts (DT was  $1/16^{th}$  of a year). Japan was chosen because of the very pronounced decrease in fertility during the second world war followed by a postwar baby boom echoing so strongly three generations later.

Somewhat more ambitiously, Jim and I were engaged in research to arrive at improved representations of burden of disease based on demographic and other factors. This work was somewhat reminiscent of our Global Prospectus ambitions, though focused on health and not economics. Like that work, it did not come to fruition, though we did make some interesting technical progress as discussed in Eberlein et al (2015).

For all the great work Jim and I did while at Duke-NUS, it is the food, especially the Laksa, that stands out most vividly from our time in Singapore.

#### The Mentor (2010-2013) – John Ansah

I first met Jim when I interviewed, via Skype, for a Research Fellow position at Duke-NUS Medical School, Singapore. The interview went well, and I was eventually hired to work with Jim. Our working relationship lasted 3 years from 2010 to 2013. Jim and his wife Nancy helped my family in many ways to settle into life in Singapore. Jim was a wonderful person and I remember the animated conversations over lunch, trying to learn how to properly use chopsticks.

#### Projects

I worked with Jim on several projects including a nursing workforce planning project for the Ministry of Health and a cognitive impairment research project looking at prevention, health, and social care needs for people with dementia. The ability of Jim to engage stakeholders from diverse backgrounds and explain the basics of System Dynamics Methodology was wonderful to see throughout these projects. Jim was very passionate about System Dynamics and that was obvious in all his research engagements.

The most important published paper I worked on with Jim focused on developing a system dynamics model to compare a steady state distribution of Singapore's population to the current population (Ansah et al 2015). The model was then used to explore different disequilibrium migration policies and their impact on the dependency ratio (the number of children and retired people relative to the working age population). The paper was well received and the research department at the Singapore Prime Ministers' office requested a copy of it. We also coauthored a conference paper (Thompson et al 2012), focused on the strategic implications of workplace policies on nursing capacity planning. This paper reports some of the insights from a nursing manpower planning project with the Ministry of Health in Singapore.

#### Advice

Jim's important modeling skills advice to me was to ensure that all insights models are initially put into equilibrium before any experiments are performed to ensure that observed behavior changes can be attributed to the experiment. I remember attending a presentation by Prof. Khalid Saeed in Singapore on the topic: farmers, bandit, and soldiers: a generic system for addressing peace agendas. Khalid presented the causal loop diagram and showed the model in equilibrium before introducing the experiments. Jim looked across to where I was sitting and pointed at the presentation just to reinforce his advice to me. He cared deeply about passing on his knowledge to people he worked with for which I am very grateful.

Jim was very particular about model documentation. I remember his clear instructions about what needs to be in the model documentation write-up to ensure that users of the document can understand the model development process and the experiments conducted with the model. He made sure that I understand what is expected of me by going over with me as many times as possible. Jim's ability to provide useful and constructive feedback was something I valued a lot. My favorite advice from Jim was always to start by building small models, test, and only add if the model structure is not adequate to explain the dynamic hypothesis. This has been a guiding principle in my modeling journey.

I witnessed many discussions between Jim and other faculty at Duke-NUS Medical School about the use of system dynamics to inform health policy. Jim was very strong and passionate about putting his point of view across on the appropriate use of system dynamics to inform health policy.

## The Teacher and more (1995-2018)

#### Central Connecticut State University - Steve Cavaleri

I first met Jim in a hallway of a classroom building at MIT 1991. At the time, he was a special student, and I was a Visiting Scholar in the System Dynamics Group. After knowing each other for a while, Jim and I discovered that we both commuted to MIT from Connecticut. After a short time, we mutually decided to carpool together from Connecticut. During those long car trips, I began to learn of Jim's passion for system dynamics, and his respect for Jay. Jim had known Jay for many years through his work at Kollmorgen Corporation. Jim had been selected by Kollmorgen's president to attend several of Jay's executive workshops at MIT.

Over the next thirty years, Jim and I collaborated by teaching summer classes in system dynamics together at Central Connecticut State University (CCSU). Over the coming years, Jim would also teach his own classes in systems dynamics as well as teaching strategic management – a required course for senior undergraduate business majors. Jim became a high sought-after instructor by students. He quickly developed a reputation as being a brilliant, but well-organized, patient, and kind instructor.

From the beginning of our collaboration, Jim was a frequent guest lecturer in my classes and that continued until the end of his career. Jim brought his extensive experience, insightful analysis, and detailed illustrations based on his many years of business and consulting experience to the classroom. These qualities were highly-valued by CCSU's business students – many of whom worked full time at local companies, such as Aetna Insurance, Pratt& Whitney, Stanley Tools, and ESPN. One of our highlights was co-teaching a summer system dynamics class to a group of 15 students from Helmut Schmidt University of Germany. This school is known as being the 'West Point of Germany'. The students were well grounded in basic principles of engineering and economics, as well as being highly motivated. They savored Jim's knowledge and were most appreciative of all he had to offer them about system dynamics.

Over the years, Jim and I also collaborated in designing several microworld simulations, including Two Brothers Pizza, Argot Mountain Bikes, and Well Done! My role in designing these microworlds was a minor one. I provided Jim with a high-level view of the learning goals for each simulation, and the key features necessary to achieve the specific pedagogical lessons I intended. Two Brothers Pizza is still successfully being used today at CCSU in the system dynamics course under the leadership of management professor, Chet Labedz. The simulation has literally been played by thousands of students at CCSU. Another microworld, Argot Mountain Bikes depicted the operations side of a mountain bike manufacturing company. Students were challenged to manage production and inventory levels to meet dynamic sales demand patterns. The final microworld, Well Done! was a knowledge management (KM) simulation designed for the KM course. We used this simulation in the beta-stage of development, however we both got side-tracked with other projects and never completed the software development cycle after its initial use. Throughout all these development projects Jim's wry sense of humor, sharp intellect, and dedication to helping the students at CCSU shone through in his work.

Jim and I were also frequent writing collaborators who worked together on several conference papers, and an article on sustainability (Thompson and Cavaleri 2010). This article was an outgrowth of Jim's doctoral research findings. Jim also co-authored a contributed chapter on systems approaches to strategic planning published in my book Managing in Organizations that Learn (Cavaleri and Fearon 1996).

Through the 1990s, Jim and I also collaborated on a systems thinking management development consulting project at a local manufacturing company, Gerber Scientific. The executives in the company were mostly highly trained engineers and scientists who immediately recognized Jim's amazing system dynamics acumen and would often seek his advice and counsel.

Jim and I would frequently attend Boston Red Sox games together as well as UConn men's and women's basketball games. Jim and his wife, Nancy, were some of the most passionate fans of UConn women's basketball I have ever known. Oddly, whenever we sat together at these many games our conversation would inevitably drift to system dynamics. Jim was one of the finest ambassadors for system dynamics I could ever imagine. I know that his unique blend of business acumen, wit, and kindness not only touched the lives of many students at CCSU, but it also subtly changed how they viewed the process of managing and leading for the better.

Last, but not least, Jim and I would meet at least once a year for lunch at the China Pan restaurant in Farmington, Connecticut. In the latter years, we were usually joined at the China Pan by another frequent collaborator, David Fearon. Professor Emeritus at CCSU. Inevitably, David and I were most attentive during these lunches as Jim would regale us with his stories of his friendship with Jay Forrester and the origins of system dynamics as a professional discipline. For this gift we remain most grateful.

#### WPI – Khalid Saeed

I hired Jim Thompson as an adjunct professor in 2008 to develop and teach a course on healthcare policy that would be included in our graduate offerings on System Dynamics. Jim not only developed and taught this course but was able also to deliver one of our advanced applications courses titled system dynamics insights that was originally developed and taught by Jim Hines.

My personal impression of Jim is that of a mild-mannered scholar who listened to you carefully, but always spoke his mind. And you always learned something new when you talked to him. A very diligent person who enjoyed his work in all domains he traversed. He became aware of his terminal condition many years go, but instead of being dismayed, he decided to run full speed until the very end. I talked to Jim a few times in his last days. I have one regret – not driving out and seeing him in Farmington before he passed. Have a good afterlife Jim.

#### From a Student – Sarah Boyar

I met Jim in his Health Care System Dynamics course in which he methodically worked us through aspects of the US Health Care system. Jim's passion for health and public health was clear and unequivocal. His first lecture was titled – Why do we go to the doctor? I remember engaging in long philosophical debates about this idea. He always wrote back, questioning insights and becoming animated by the new ideas I brought from different perspectives. For example, we discussed Ivan Illich's Limits to Medicine at length. Our discussions rambled across many philosophies and cultural differences in providing health care. His interest in modelling for health clearly extended beyond the US health system.

I do believe that working overseas lead Jim to a different outlook on health system dynamics. In particular, through his work in Singapore, Indonesia and then Bangladesh, he saw new ways that modeling could improve population health and delivery of public services. He wrote (about an outcome of this work) that, "this may be bullshit, but the managers in Bangladesh were intrigued and enthusiastic to give it a try. They estimated they'd save about a third of their ad budget."

When Covid hit the UK I was paralyzed, terrified as a modeler for the public health service. I simply couldn't put pen to paper or begin on a model. I rang Jim up and, even though we hadn't communicated much in a few years, we instantly were back into modelling discussions. I think we spoke for about 6 hours straight before he admitted that his family was waiting on him to watch a movie, and, again, softly reminded me of the importance of family. But when I work up the next morning, there was a Covid model in my inbox. He couldn't resist.



Figure 10. The essential elements of a simple COVID model.

The model was a brilliant and parsimonious representation of the feedback between risk, risk perception, isolation, hospitalization, severe illness, and projected deaths. It is the only model of Covid I have seen to date which has feedback between perception and reality at its heart. It was simple and non-arrayed, just a handful of stocks. And deeply insightful: "SD deals best with bigger picture. Leave details to economists." We agreed that the little model he did in which people comply with distancing and isolation when they perceive mortality rates are increasing and relax when rates decline simulates real world behavior.

Jim knew it was the endogenous dynamics of risk perception which most required modelling. He understood the dynamics. He also understood the political and modelling environment, and so shrewdly put a calculation of R-nought into the model – *as an output*. At the time I was hugely frustrated by the lack of feedback in many of the public health models, where uncertainty seemed to be multiplied into the future, rather than becoming bounded by the endogeneity and limits of the system. Jim comforted me, "...usual stupid mistake is to project infections from R-nought \* #sick. It's totally wrong." We laughed, and I quoted him back to himself:

"Don't replicate a bad model. Just show where the logic is wrong." -JT

I worked alongside a behavioral science team attempting to represent 'adherence to restrictions' when looking at the spread of COVID. The work was with the police, health services, communities, schools, and many different organizations. The behavioral scientists became caught up in analyzing the details of specific events such as St. Patrick's day or a music concert. I wanted to pull them back to a bigger picture. Jim said simply, "Just explain it's non-monotonic."

#### "Huh?" I was confused.

Jim replied: "Nonmonotonic thinking means taking endogeneity out of the modelling in the sense that additional structures (and subsequently ranges for parameters) are continually expected. Monotonic structures produce increasing (or decreasing) results that never reverse. Balancing feedback can be non-monotonic. If you perturb a system in equilibrium, its behavior is likely to be non-monotonic. But some balancing feedback systems degenerate to 0."

#### Jim Thompson: Science!

I have never loved that word so much as I did when Jim used it in this context.

#### The Health System Designer (2013-)

After finishing leaving Singapore, Jim continued work on health care consulting, though at a lower level of intensity.

In 2014, Indonesia was rolling out a new single payor healthcare system as described in Augustina et al (2019). Jim worked with a group in the health ministry to help understand the consequence of the upcoming changes. Though never published, the work was well received and, seemingly, of some use in the ongoing planning.

### Bangladesh – Susan Howick

Building on that, in 2016 Jim worked remotely with the Ministry of Health and the International Centre for Diarrhoeal Disease Research in Bangladesh, alongside colleagues at University of Strathclyde, to explore the sustainability of community health based insurance schemes in Bangladesh.

Jim's modelling provided insights into how microbanking could be used to add to the financial sustainability of a community based health insurance scheme and the importance of balancing marketing to potential members and ensuring that a sustainable level of coverage is provided in light of local capacity constraints. The work was not published, but inspired researchers in Bangladesh to explore the use of system dynamics to investigate this area further.

## Conclusions

From skeptic to accomplished practitioner, researcher, and teacher, Jim Thompson accomplished a great deal over the course of his second career. He was also a remarkable friend – kind, generous, and always with a joke up his sleeve. To those who did not have the honor of knowing him, we hope this article will give you a feel for what that was like. At the same time, it also serves to remind us that with System Dynamics, the possibilities are grand.

A final quote from a 1999 emal: "I can tell you that I don't like working alone. I do enjoy working with people to achieve a common goal." Indeed as did we.

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