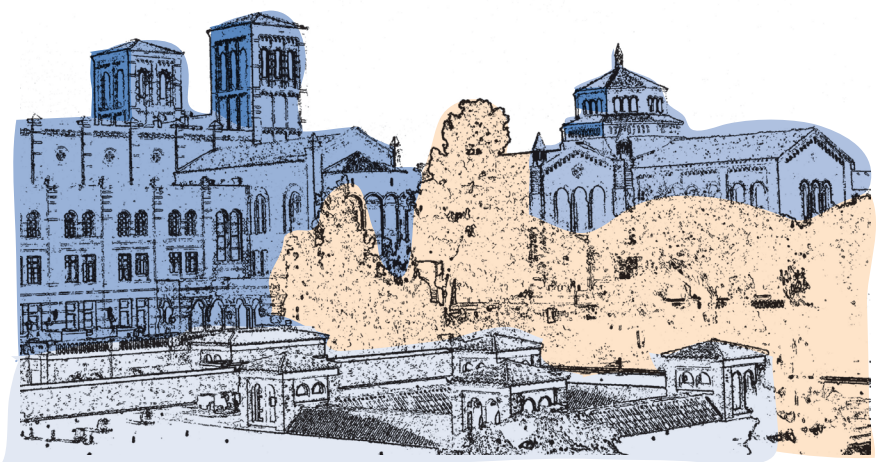
Systems Entrepreneurship

My 50-Year Journey at UCLA

Lee G. Cooper



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Dedication

To my grandchildren: Rosalía, Adso, Soren, and Güel Cooper-Ortega. Mostly, I write about the part of me you don't experience: my intellectual history, how my academic agenda evolved, and the unusual path I've taken to and through UCLA over 50 years. Given that the recurrent themes are systems thinking and entrepreneurship, this is material for a graduate course. You don't talk to your grandkids about such stuff. By the time grandchildren are old enough to be curious and intellectually prepared for these stories, most grandparents are gone. I never knew my grandfathers and wish they had written me. I wish my dad had left something for his grandkids who never knew him. I leave this for you. This is a family legacy that I hope continues.

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Prologue

"Life can only be understood backwards;
but it must be lived forwards."

— Søren Kierkegaard

Motivation

The University of California, Los Angeles turns 100 in 2019. I turn 75 and mark 50 years on the UCLA faculty. That's an excuse to write anything I want. What I feel compelled to write about is how I would propose that we manage ourselves out of the huge messes we confront by fostering innovation, mitigating climate risks, building the new-energy future, addressing the crisis in the American workforce, redressing social and environmental injustice, and enabling large-scale systems change. I've learned that progress comes from bottom-up projects, for the most part. Work gets done by broad coalitions of sometimes small organizations that are specialized around their core competencies. Coalitions morph over the project life cycle as needs change in a changing world. The entrepreneurs that lead their organizations in these coalitions need to manage across organizational boundaries and to understand the broader networks and systems in which they operate. These are systems entrepreneurs. Do it right and the entrepreneurial reward is your slice of the $47-trillion upside to shifting to the new-energy economy. To steer each firm in a coalition, you need to enable communications-management, project-management, and knowledge-management systems across organizational boundaries. You must be able to learn across projects. The framework I present here is robust, built from my experience as a technology entrepreneur as well as what I've learned from

50 years on a business-school faculty. A lot was driven by my desire to find an organized and scalable role for students to work with partners to advance sustainable solutions and put right what has been left in such bad shape by the generations before. If you want to cut to the chase, I suggest jumping to Chapter 14: Answers and the Questions They Imply. The brief essays present my best arguments for what systems we need to create—the systems behind systems entrepreneurship. I end that chapter with what I think are the key take-aways from the book. If you want to understand where these ideas come from, read on.

The longer story fills in my early systems training and what I learned from student movements in the 1960s. I learned similar lessons directing the UCLA Management in the Arts Program, (e.g., people are motivated to work for things they care about). Understanding that motivation is one key to managing organizational behavior. My academic training was in developing methods for synthesizing meaning from psychological data. In a business school, this morphed into developing models of demand dynamics from the individual to the market level. From there came an interest in tools for managing in information-rich environments and how firms evolve into data-driven enterprises. I worked on this for 20 years before I thought I knew enough to teach product management from the beginning to end. I realized that leading a multidisciplinary team is the most fundamental skill needed by a manager. In the mid-to-late 1990s, Intel encouraged me to think about radically new products and strategic-planning methods in the face of disruptive change. This is product management through the stages of the technology-adoption life cycle (TALC). Again, it's systems thinking that provides frameworks broad enough that there is room inside the box for a myriad of issues, ideas, and relations. There were two main outcomes from this research. The first was my technology startup, Strategic Data Corp (SDC). I told the story and early lessons from that venture in my 2004 book. The idea was to build a multi-segmented recommendation engine that could operate in real time in a wide variety of e-commerce sectors. It was to be the tip of the snake that drove the virtual e-commerce supply chain. A robust demand engine was needed to complete the chain. In the days when it took 36 hours to analyze 24 hours of weblogs, the motto of SDC was "Translating Analysis into Action." That it did until the new CEO pivoted the company into AdTech. The other thrust out of the Intel effort was the development of Bayesian networks for strategic risk analyses and planning for disruptive technologies. This drove the Venture Development Project (VDP), which I redesigned and led when I returned my full focus to UCLA in early 2002. The value came from multidisciplinary teams doing business due diligence on technologies mostly incubated in UCLA labs. Some VDP efforts extended over the quarterly shift in students. That provided valuable lessons in the need for communication systems and project-management systems that accom-

modate changes in personnel and tasks as projects move forward. In the chapter on the VDP, I relate the case that I made in 2003. Now there are three incubators on the UCLA campus. Back then, support was harder to find. I became part of the emeritus faculty and consulted until my startup sold to News Corp. in 2007.

I took some time to travel and thank the people who helped make SDC a success. I began writing this current book in 2009 with the epilogue to my 2004 book[1]. The epilogue appears in Chapter 11. Around the same time that I was trying to synthesize the lessons from my startup, I undertook the groundwork for connecting Conservation International (CI) with teams in the MBA capstone course. This was when CI had pivoted its mission from biodiversity preservation in hotspots to designing and implementing sustainable solutions for people and nature. The MBA teams supplied the business skill sets where conservation biologists were weak, while CI staff formed strong links to understanding the science, local issues, and available resources to make things happen. I was pleasantly stunned by how well the combination worked. Broad coalitions win. The potential of generalizing and scaling this engagement model became obviously important. At UCLA alone, ~1,000,000 student hours per year are spent on capstone projects. If replicated on other campuses, there are no insurmountable barriers to running 100,000 projects or more annually worldwide using this framework for engaging transorganizational efforts and learning from each effort.

Rather than the standard handful of MBA students doing a two-quarter capstone, what if we let the scope of the problems dictate the scope of the efforts? I present, in Chapter 13, the case I developed in 2016 for the Center for Action Research and trace the development of the center design until the summer of 2017. I realized that I needed outside partners to make things happen. That led to the sharing of the design with a broader audience through the recapitulation in Chapter 14: Answers and the Questions They Imply.

Shortcut or not, you arrive at a statement of where things stood in the summer of 2017. I describe a successful system for incubating and nurturing disruptive innovation. I tackle the design of action research, where multidisciplinary teams of students work with coalitions to improve the world. The main advocacy there is to focus on project-based learning, let the scope of the problem determine the scope of the efforts, and build the intelligent information systems that will let this all happen. With Michael Totten's help, I describe the $47-trillion gain from shifting to the new-energy economy. I show the implications of this new-economy shift for redressing the crisis in the American workforce. And I give my response to Walker's evolving framework for addressing large-scale systems change. I end with my keys

1. Cooper, L.G. (2004). *Midlife ~~Crisis~~ Startup: Lessons from Venturing Out of the Ivory Tower*, Santa Monica: New Venture Press.

to systems entrepreneurship. In each of the first four essays, I summarized what I felt needed to be done and asked the question: "Does anyone know of any agent or agency that is trying to build this infrastructure? If not, why not?"

In Chapter 15, I assess the potential of Helena[2] to be one of the agencies that can attack our problems at scale. The key to Helena's ability to tackle the wide array of issues and efforts is the Multivac project. Named after the strong artificial intelligence (AI) computer of Asimov's (1956) short story, it is to be capable of supporting all the functions I've been advocating for an intelligent information system. To reach Asimov's description, Multivac will need to advance far beyond the benchmarks I've set. Pearl and MacKenzie (2018) develop a path forward in AI where the kinds of evidence we can gather from our 100,000-project goal are part of the causal record from which strong AI systems can learn. Enabled by breakthroughs in causal thinking about transportability, my goal of learning across projects has a much more central role now than when I began pushing this collaborative action agenda. I have reasonable apprehension about strong AI. One defense is to build training databases of how to do it right—a record of how partnering toward common goals is a way to heal the world.

I feel good at the end of this 50-year journey. Despite the daunting problems we face in life across the globe, we have bottom-up, scalable tools and resources to make a difference a project at a time.

Santa Monica - June 2018

2. https://helena.co/

Chapter 1

Intellectual History

"No man ever steps in the same river twice,
for it's not the same river and he's not the same man."

— Heraclitus

Indulge me while I relate how my early training in systems thinking and measurement set the stage for later developments. Seeing the whole problem and measuring what you wish to manage are the keys.

By the time I was 10, my dad was working full-time in microwave electronics in the Bay Area and starting college in his very late 30s at San Mateo City College. His Baltimore school records had burned, so he lied and said he'd graduated high school. By the time I entered high school, he had finished a BA in engineering and an MS in engineering psychology at San Jose State. He was a high school dropout. On one of her few visits after we moved to California, my paternal grandmother told me, "Your father fell in with a bad lot." That is too simple an explanation. My grandfather died when my father was around 11. Dad was placed under the strict tutelage of the old men in the orthodox schul his family attended. He chafed under the attempts to make him a nice Jewish boy. A few years later, the first mass administration of the Stanford-Binet in the public schools hit Baltimore and classified him as a genius. Teachers started treating him differently. He didn't like it. Then came the Depression. He dropped out at 16. He and his older sister supported themselves and their widowed mother.

It was not an idle presumption that I would go directly to college. I saw his version of the process all the way through. Beyond the intellect, it took enormous

dedication to do it his way. That I could go straight through, I always thought, was a privilege.

While in grad school at night, Dad's day job was at Stanford Research Institute (SRI) doing man-machine systems design. Those were the days when national conferences were organized when someone had a new approach to the problems of systems operability or maintainability. His membership in the Society for General Systems Research[3] brought the avant-garde thinking of the time into my early-teenage mindset. It stuck.

Sputnik had a major effect on my parents and me in junior high. I remember summer nights in the Redwood City streets with my buddy Steve Mayer[4], looking up as Sputnik carved its solo path across the sky. The feeling throughout the country was that smart kids had an almost patriotic duty to go into science and engineering.

My father bought me two books. The first was Beveridge's (1957) The Art of Scientific Investigation. By around page three, Beveridge had convinced me of his thesis that all prior knowledge was a block to creative scientific thought. At that point, I closed the book and never read on. I still have the unread book. The other work was a two-volume set of Conant's (1957) Harvard Case Histories in Experimental Science. I flipped through the pages of that set at least.

One part of my father's master's degree required a course in psychological testing and measurement. He had to administer a handful of Stanford-Binet exams, the 1950s version of the same exam he got tagged by decades before. Some of my adolescent friends and I were conscripted. I took it in front of his San Jose State class as a demonstration. He would never tell me a score. He did boast when one of my cohorts hit the top category, Superior Adult III, and he convinced Steve's parents he was smart enough for college. I was incredulous that his parents only saw the nerd in Steve and not the brilliance. They learned. I was thinking of studying engineering at the time. Dad told me, "You're smart enough to complete an engineering degree."

The bargain was that, if I get the grades, they would find a way to finance it—a standard deal in the days of $104 in fees per semester at tuition-free Cal. My fa-

3. I knew the society was founded by biologist Ludwig von Bertalanffy, economist Kenneth Boulding, neuro-physiologist Ralph Gerard, and biomathematician Anatol Rapoport. What I didn't know back then was that von Bertalanffy was visiting in the US seeking a better appointment than his marginal academic position in Austria when he heard of the Anschluss in March 1938. After his failed attempts to stay in the US, he returned to Vienna in 1938 and joined the Nazi Party, which led to his professorial appointment at the University of Vienna, a very big promotion. "Following the defeat of Nazism, Bertalanffy found denazification problematic and left Vienna in 1948." (https://en.wikipedia.org/wiki/Ludwig_von_Bertalanffy) He was at USC in the 1955–1958 period when my father was most active in the society. I have no idea who knew about von Bertalanffy's past.

4. Steve Mayer is a life-long friend who appears numerous times in this book. If I ever mention Steve without a last name, it's Steve Mayer.

ther made a very modest salary at SRI. The financial realities hit home when he tried to buy my mother's dream of an Eichler tract house in Palo Alto in 1959. We had already sold our three-bedroom, one-bath home in the western end of the flats of Redwood City—the first house on the block to go for over $17k, when my father was turned down for a home loan due to his low SRI salary[5]. He flew to LA and in short order had a job in the aerospace industry at triple the salary, continuing to design large-scale man-machine systems under government contracts. College for my older brother and me would be paid from Dad's salary, not our nonexistent savings. I worked in the summers so that the money I spent from my pocket felt like, and was, my own.

The John Birch Society came through my high school with a short film and a filmstrip based on the House Un-American Activities Commission (HUAC) demonstrations in San Francisco. The filmstrip was somehow based on the then-forthcoming book None Dare Call It Treason (Stormer 1964) and the John Birch Society Blue Book (Welsh 1958). I had read the Blue Book and given talks to some of my classes on the neo-fascist, anti-communist, anti-Catholic, and anti-Semitic propaganda it promoted. I knew I wanted to go to the place they were damning. I only applied to Cal. Physics was my major my freshman year.

The counselors at suburban South High in Torrance directed most of my classmates to the protected confines of the Occidentals or Pepperdines of the region. To me they said, "Yes, Cal." They never felt I would get lost in the crowd. Nor did I have a need to stand out. I just needed to find my own way. I already doubted that physics was my calling and avoided even applying to Caltech after my buddy Steve and I took the tour together. It didn't offer the breadth of other majors in case I changed my mind. That was my excuse. I think both Steve and I feared the competitive aspect. I was not sure I was prepared to handle it. Maybe Caltech would agree and reject me. I knew I could get into Cal. It was 1962, and a high enough GPA assured entrance, even honors at entrance. I didn't even want to look at East-Coast schools. The East Coast always meant private schools to my narrow understanding at the time. I felt more at home in a public university.

Politics

The first political thinking I remember was again at age 10 in 1954, when my father sat me down if front of a TV broadcast of the Army-McCarthy hearings. He said, "You are watching the demise of a terrible man." Dad had been involved in union organizing and was a delegate to the Progressive Party Convention in 1948.

5. The built-out versions of that tract house listed for $1.5 million in 2017.

We still have the silent 8 mm film he shot of Paul Robeson singing at the Convention in Philadelphia—the same for Pete Seeger. Dad was too much of a realist to be attracted to communist ideology; he had seen how ideas and associations had been used to destroy people. Even as a child of four, I remember the huge scrawl of slap dash letters painted across the white clapboard sidewall of our working-class Dundalk, MD house. "Communist Nigger Lover," I later learned it said. Business reasons drove our family to San Francisco in 1949, not the not-so-friendly neighbors. I think Dad was happy at the fresh start in more equalitarian surroundings.

Not all the political ties were left behind. I remember a grand party at Vincent Hallinan's estate north of San Francisco as part of his bid as the presidential candidate of the Progressive Party in 1952. My dad's vote ultimately went to Adlai Stevenson.

The summer of 1954, I visited my maternal grandmother and step-grandfather in segregated Dallas. I was struck by the difference in living conditions between my grandmother's luncheon-club friends and the shantytowns of the black community. The few black kids that I knew in my general area were working class and lower-middle class, similar to everyone else in my narrow world. Once we moved from San Francisco to the peninsula, de facto segregation kept my schools all white from third grade through high school. My Dallas visit helped me become aware that racism wasn't just blind prejudice. It was economic injustice. No one would choose to live in the shanty towns I saw through the car window. On the grandest of scales, it was a systems failure.

In the fall of 1962, I was in the Cal dorm, Griffith Hall, as a freshman during the Cuban missile crisis. A Marine reservist living on our floor started marching us up and down the narrow hallway, like the clown that parents hire to lead games at a seven-year-old's birthday party. I marched. Fortunately, the US had leadership that deftly avoided a nuclear clash with the USSR. It all had an unreal feel from so far away, mentally and physically. It didn't become real to me until I received my 1-A draft status the following spring. I stared at it with a mental recording of the World War I pacifist song, "I Didn't Raise My Boy to be a Soldier" going through my head. Less than a year before, right after my 18th birthday, I had gone proudly to sign up for the draft—a rite of passage in the early 1960s. I received a student deferment that was pretty standard and easily obtained in those days.

Freshman year was dominated by playing catch up. Almost from the beginning, I felt behind in math and chemistry. There were no advanced placement (AP) classes in my high school in those days. To get on an advanced math tract in the high school I moved to as a sophomore, you had to start as a freshman. My college freshman grades placed me on academic probation when I would return that fall—one more unit of D (second-semester calculus) than my B+ in English (the highest

grade in the class) could off-balance. My B in chemistry turned to a C after struggling with a final unknown that is still unknown to me.

I not only screwed up my own unknown analysis, I ruined Steve's, too. One Saturday morning I went to the chemistry lab to help him after submitting my stuff. I tried to do a Brown-ring test for nitrates on a subsample of his unknown. I poured the chemical delicately down the test tube side, but in reverse order. Realizing this, but not thinking clearly, I put my thumb over the top and started to flip the test tube over. The 36N sulfuric acid hadn't yet burnt my skin when I realized my mistake. I dropped the test tube in the lab-station sink and turned on the water full blast to rinse it off but selected the handle for the side valve that shot a stream over to the next lab station. The stream shocked the young woman working next to me. She, too, dropped her test tube into the sink. Both she and Steve had to ask for more of the unknown, with the associated grade penalty. I would never be a lab scientist.

My spring semester Cal physics class convinced me that I wasn't cut out to be a physicist either. If the engineers in the class hadn't set the curves so low, I could have been much worse off. I switched to psychology—a much better fit. I tell more of the story when discussing my mentors and their contributions.

My first political action was that summer of 1963, after my freshman year at Cal. The Congress of Racial Equality (CORE) staged a protest at the new Southwood Riviera Royale housing tract in Torrance—an all-American city without a single black family. Against my parents' explicit instructions, I went to the Saturday march. We were marching a circuit on the sidewalk when Marlon Brando and his publicity crew showed up. They moved him to three or four different positions in the line of march for the variety of photo ops. Then, they all left—a lesson in the celebrity approach to protest—sometimes that's the only way to attract the press. A few walking cycles later, a small group began singing folk songs and union songs,



Figure 1. Brando at a CORE rally in Torrance. Associated Press photo.

many of which I'd known so long I thought of as nursery-rhyme songs, such as the pacifist song I mentioned above. I sat down in front of a garage door with the rest of the singers. Some guy from CORE came over with a form and said, "Fill this out so we can represent you when you are arrested." I stood up and rejoined the line of march. I wasn't ready to face jail.

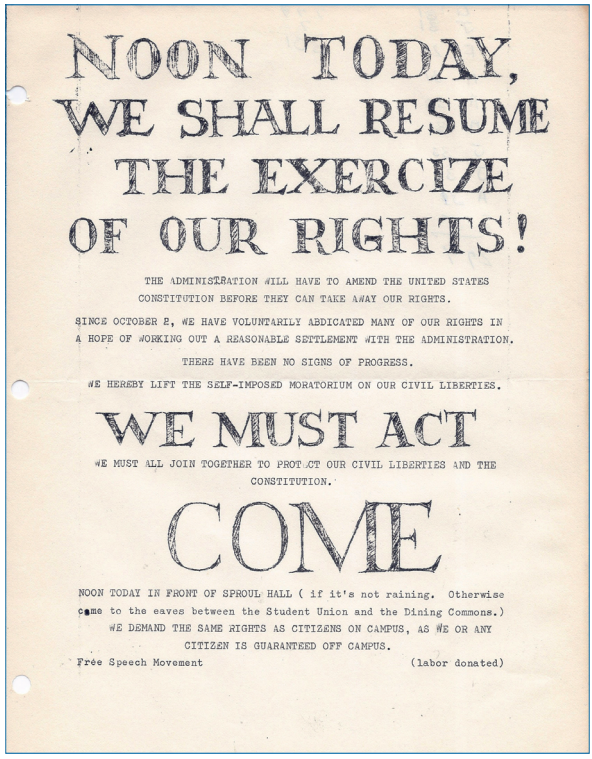
Entering my sophomore year one unit shy of a C average, I was worried, and my dad knew it. He wrote me one of the very few letters I remember receiving from him. His suggested remedy was overlearning. That way, he said, "when they ask you, 'Who is buried in Grant's Tomb?'" you'll just answer without panic. Seeing the whole problem includes seeing the obvious.

Whether right or wrong, I should take personal responsibility for my failures and redouble my efforts. He made it clear that this wasn't advice he would give anybody, but he knew it would work for me. It did.

Truth be told, I never thought I was as smart as my father. He set and met his own high bar. I was smart enough to hold my own in our sometimes-intense discussions and arguments. We did have intellectual fun together. I was content to be among the smartest people I knew. That's sort of the floor for senior faculty at a place like UCLA. Intelligence is a many-faceted ability. All of us have flat sides. Some have facets so sharp they shine like diamonds. Dad had many shiny facets, but his greatest skills were in creative problem solving. Some of my facets aren't as shiny, but I have benefited by inheriting a good dose of those problem-solving skills. I learned to look at the whole problem, not just the glittery parts.

I thought I would be an engineer until I got a better sense of what engineers did. In those days engineer's desks by the hundreds filled hangar-sized rooms in aerospace companies. Each engineer had a slide rule and stacks of graph paper with linear, log-linear, and log-log scales. They seemed like human calculating machines. I thought I would be a chemist until I found out what chemists did. I thought I would be a physicist until my freshman year at Cal convinced me otherwise. I was the very last generation of physics students trained in old mechanical labs. We created standing waves in talc-filled tubes by rubbing rosin rods with sheepskin. Mostly it was a seemingly official pedagogy that you, the student, memorized equations to go through a rigorous set of old hurdles. If you got into graduate school, you were then allowed to think independently.

I mourned the assassination of President Kennedy along with all the Cal community. I somehow heard on the way back from my morning class and spent the next three days gathered with others around the dorm TV. Late night rap sessions filled the time between the station sign-off and the next day's broadcast. The sense of loss was ubiquitous. We felt the future of the world was ours to ponder and decide. At the same time, we felt helpless.



NOON TODAY,
WE SHALL RESUME
THE EXERCIZE
OF OUR RIGHTS!

THE ADMINISTRATION WILL HAVE TO AMEND THE UNITED STATES CONSTITUTION BEFORE THEY CAN TAKE AWAY OUR RIGHTS.

SINCE OCTOBER 2, WE HAVE VOLUNTARILY ABDICATED MANY OF OUR RIGHTS IN A HOPE OF WORKING OUT A REASONABLE SETTLEMENT WITH THE ADMINISTRATION.

THERE HAVE BEEN NO SIGNS OF PROGRESS.

WE HEREBY LIFT THE SELF-IMPOSED MORATORIUM ON OUR CIVIL LIBERTIES.

WE MUST ACT

WE MUST ALL JOIN TOGETHER TO PROTECT OUR CIVIL LIBERTIES AND THE CONSTITUTION.

COME

NOON TODAY IN FRONT OF SPROUL HALL (if it's not raining. Otherwise come to the eaves between the Student Union and the Dining Commons.)

WE DEMAND THE SAME RIGHTS AS CITIZENS ON CAMPUS, AS WE OR ANY CITIZEN IS GUARANTEED OFF CAMPUS.

Free Speech Movement (labor donated)

Figure 2. A flyer I created for the FSM.

My first two years at Cal, I chose to focus on my books rather than the civil-rights efforts in Cadillac Row and the Sheridan Hotel in San Francisco. I thought there would be time after I was more secure in class. Who knows how long I would have deferred activism on civil rights if the overwhelming threat to all activism hadn't greeted me on my return for my junior year. There was no way I could duck involvement in the Free Speech Movement (FSM). Lose that battle and the war would have been over. To me, it was the battle for the soul of the university.

Like so many other FSM veterans, I listened to Mario Savio speak, accepted both his logic of the university as a knowledge factory and his compelling emotion, and indicated "to the people who run it, to the people who own it—that unless you're free the machine will be prevented from working at all!" And so, we stopped the machine. And for a while we were free.

The fall of 1964 was my junior year. I was one revolution short of finally getting out of the Unit II dorm. The only advantage of Unit II was a little duplicating room stuck deep in its bowels. I had a key. When Plans A and B for printing FSM flyers were either at capacity or incapacitated, I'd be contacted as Plan C or D or however far down the bench they had to reach to get the job done. The room had a ditto

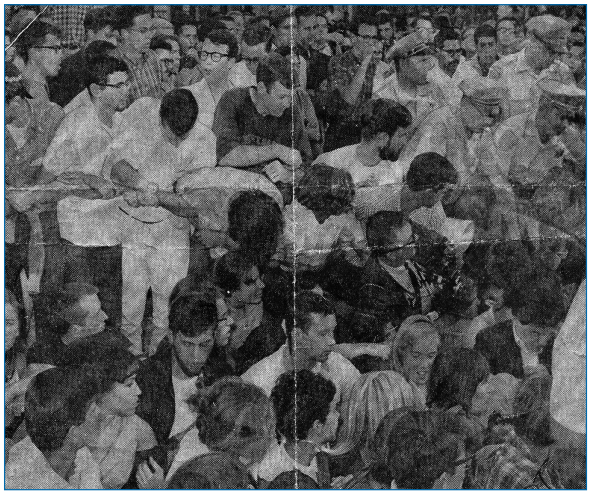


Figure 3. I'm the second from the left in the row of locked arms as the police bust through our lines, October 1, 1964.

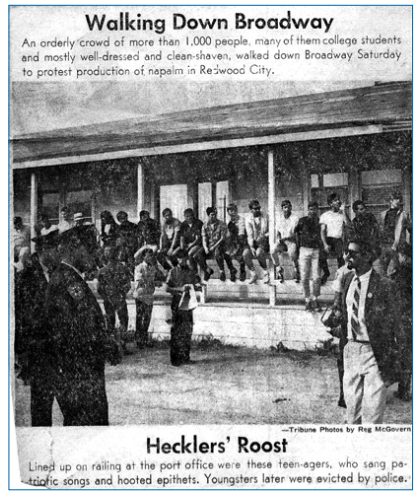
and a mimeograph machine, but the Gestetner was the prize. I found one example printed from a stencil I cut for that Gestetner mimeo. The paper was just scrounged from what I could find in the room, which was usually pretty well stocked. I believe the original of this flyer was on light green paper, but others were plain white.

What impressed me about this side of the FSM was that it felt like a self-organizing system before I knew much about such things. From the spirit of volunteerism in the early meetings through the informal network of people with resources to get things done to the organization in FSM central, it all had a sense of coming together, rather than being built.

Then, a next generation of administrators came in and rolled back our gains one by one. We never had the chance within the university to build the organizational structures that would empower and sustain our freedom. Will we ever get another chance to build it right?

We were a diverse group of people who came together for a common cause. Our style movement had its roots in labor organizing and the civil-rights movement and went on to influence the anti-war movement, and other mass actions through Occupy Wall Street. While I was a junior, during the events that fall, five years after the FSM, I joined the UCLA faculty. I've been an observer of student movements ever since. Nothing since the end of the Vietnam War has had the collective pull we experienced in the FSM, until 2018. Later campus-based movements were narrowly focused, temporal, and small scale[6]. We are in the early days of the high-school-student movement for sen-

6. Forty years after encircling the police car in a locked-arm barricade, I returned to Cal to take my younger son to the Mario Savio Memorial Lecture. I arrived in Berkeley in time to see Daniel in the Cal Straw Hat Band in a noontime rally in Sproul Plaza in anticipation of the Cal-USC game that weekend. The line of political tables that were the nominal cause celebre 40 years earlier was routinely ignored. The FSM table with T-shirts, posters,


Walking Down Broadway

An orderly crowd of more than 1,000 people, many of them college students and mostly well-dressed and clean-shaven, walked down Broadway Saturday to protest production of napalm in Redwood City.

—Tribune Photos by Reg McGovern

Hecklers' Roost

Lined up on railing at the port office were these teen-agers, who sang patriotic songs and hooted epithets. Youngsters later were evicted by police.

Figure 4. That's me in the sports coat and tie helping film a napalm rally. I'm wearing an "I am a Nervous Nelly" button to help date the event.

sible gun regulation. Every new school shooting adds fuel to the campaign. Along with #MeToo, #TimesUp, #Resist, #BlackLivesMatter, and others, organized and sustained protests seem to be gaining momentum, even in the absence of some of the systems infrastructure I think is needed for scalability. What would students do if they had the infrastructure for coalition formation and protest organization and management, and the ability to learn systematically from events? I will return to this topic much later.

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sign-in sheets, and Michael Rossman hyping his FSM CD drew just occasional greybeards. The small crowd was much more focused on the band. It felt great just to listen, enjoy, and feel the good energy of college spirit. It was easy and natural. The juxtaposition of 40 years ago and my 2004 visit made me feel a little like my youth was cut short. The world had to be saved, starting then, starting there, starting with the absolute right to question. Steve Mayer, Dan's godfather, joined us later for the lecture. Zellerbach Auditorium was perhaps 80% full, a big crowd for the first time the lecture had been placed outside the Student Union. Mario's widow thanked everyone and recounted the history of the Memorial Lecture and announced the winner of the Young Activist Award—a 27-year old with a 21-year history of activism, who was then the Green Party mayor of a town in the Hudson Valley. He spoke about what most of even this progressive crowd didn't want to listen to—if the major parties don't give you what you want, spoil their elections until they learn. Mario's widow returned to introduce the then-new Cal chancellor, Robert J. Birgeneau. He was greeted with applause except for one loud voice yelling, "You're selling out the university!" Instead of ignoring it and speaking on, Birgeneau waited, kind of waived to the guy to say more. Only when nothing was forthcoming did he launch into his welcome speech. Good sign. He did the normal, "I'm proud to be …" but seemed to be authentic. He introduced a short video on Mario that included excerpts from the Dec. 2 talk, a few other clips of fall 1964, as well as Savio interviews on the 20th and 30th anniversaries. This was followed by Molly Ivins, the Texas journalist who just published Bushwacked. She was very lively, ridiculed Bush and other Texas politicians, and left us with the message that we should communicate to the coming generation of activists how much fun we had. Yes, it was fun, but more than fun was the intensity of life when you feel you are deciding the fate of the world. While Birgeneau lost my support later when he brought the police onto campus, his beginning was encouraging. Having Dan there so I could whisper in his ear, dish dirt on the politicos of the time, and just add context, was great for me. Once out of the house, Dan seems much happier listening or even being with me. I was much happier, too. (I wrote this before Daniel passed away in 2010 from complications due to Type I diabetes. We had too few years together after I first wrote that. The last year was his and our happiest since his diagnosis at 13.)

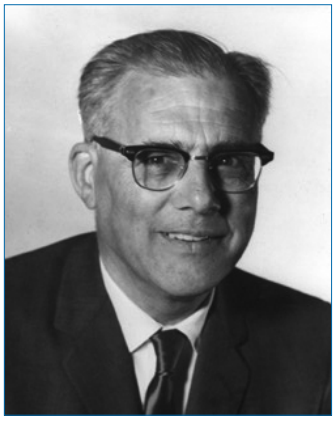


Figure 5. Edwin Ernest Ghiselli, 1907–1980. Professor of Psychology, UC Berkeley.

Photograph courtesy of the Department of Psychology, UC Berkeley.

Mentors

Before the end of the spring semester in 1963, I went over to the Psych. Dept. to inquire about switching majors. The office secretary gave me three professors' names to try. The "A–E" last names went to whichever one of the three they could find. On my second try, Edwin Ghiselli welcomed me in. I had no idea that he was a famous industrial psychologist or that mental measurement was one of his main interests. We just started talking. Things that Dad and I discussed—mainly engineering psychology and living- systems design—found their way in—Ghiselli's sweet spot. He was forthcoming and helpful. My quantitative, scientific way of looking at the world served up questions that he answered with ease. I had, since Sputnik, thought of myself as a scientist to be. I was the guy who, in the freshman-processing rigors of the old Harmon Gym, when asked for a degree objective, put down "PhD."

Psychology fit me better than physics. Students were encouraged to speculate and design research to figure things out—puzzles, not the shut-up-and-do-your-work attitude I sensed in lower-division physics. My first psych-stat class was an eye opener. The professor, Wayne Lee, recently arrived from Johns Hopkins, would turn his back to the class and start deriving equations on the blackboard—just as I'd experienced in chemistry, physics, and math lectures. As soon as the coeds up front would get lost, they would start to titter, then giggle, then laugh among themselves. The laughter would build until it was loud enough to startle him. He would swing around with a bewildered look and try to find out what was happening. He'd earnestly ask for questions. Silence. Then he'd turn back to the board and repeat. The women in the front seemed much more willing to admit when they were lost than the men huddled silently in the back rows. To me, he seemed concrete compared to the level of abstraction in my second-semester freshman calculus. That was the source of my 4-unit D. The question I certainly failed on the math final was all symbolic, but I later speculated I was supposed to calculate the hyper-volume

subscribed by a doughnut (torus) rotating along its major and minor axes in four-dimensional space time. I remembered this when my older son, after his freshman year at Johns Hopkins, decided to stop taking math courses, saying, "All they talk about is air."

Compared to my prior experience in physics, the quantitative stuff in psychology was much more down to earth, even when discussing high-dimensional information spaces. Bill Meredith taught my second psych-stat course—primarily linear-statistical models. He encouraged me to take his multivariate-analysis course. In it, Bill introduced me to basic-structure analysis. The results of surveys, questionnaires, or experiments would end up in tables of numbers (i.e., matrices). There would be *N* people (rows) and *p* measures (columns). The sense was that there was some deeper meaning underlying these surface measures. You start with *p* points in *N*-dimensional space and/or *N* points in *p*-space and see if some other perspective makes it easier to understand what it all means. If you understood what mathematical operations you could perform that would not distort the underlying meaning, there were powerful tools to help find that *meaning*. The key was reducing the dimensionality of the information space and looking for a point of view that made the meaning clearer. I was hooked. Later, in my senior year, Bill invited me to take his doctoral seminar in psychological measurement. When my turn to present came, Bill suggested I hitchhike on an upcoming talk by Roderick MacDonald and speak on MacDonald's orthogonal-polynomial solution to Lazarsfeld's general latent-class model. I started early in training for my later GSMmy Award.[7] [8]

I was eager to take Ghiselli's course in reliability and validity. I stopped by his office a number of times, and he had been a good mentor and kind to me. I also understood that reliability and validity of measures were the most fundamental properties in any search for meaning. I took Reed Tuddenham's course on personality assessment. In one session on projective techniques, he held up one subject's results from the Mosaic Tile Test—small geometric tiles used to make a pattern. In this case, the subject had laid some tiles on top of others in an evocative, 3D, geometric pattern. He said, "Obviously schizophrenic!" By this time, I had enough confidence in my understanding that I challenged him. I launched into a diatribe on how a creative response to the task was not an obvious sign of schizophrenia. In my mind, I stormed out of class. The reality is that I don't remember clearly.

7. The GSMmy Award came from a 1970s student roast called Cabaret that honored me for "Best Translation of an English-Language Course into a Foreign Language."

8. In my first year in grad school, Tucker, my doctoral advisor, invited Lazarsfeld to speak. I was excited and pulled an all-nighter going back over my notes and figuring out what I wanted to ask. Lazarsfeld's talk was at the end of a long day, in a warm, packed, 80-person lecture hall. He gave the kind of broad introduction I should have expected. I was asleep in five minutes, waking as soon as the applause started—one of my more embarrassing moments in grad school. Decades later, Lazarsfeld visited the UCLA business school for two quarters, and I did get the chance to talk at depth. He was a remarkable scholar with major contributions to quantitative sociology, psychology, and political science.

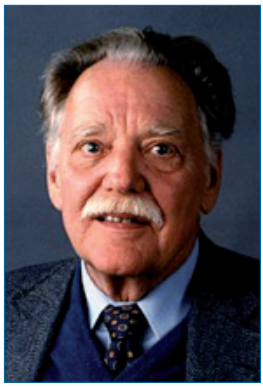


Figure 6. William M. Meredith, Professor of Psychology, UC Berkeley (1929–2006).

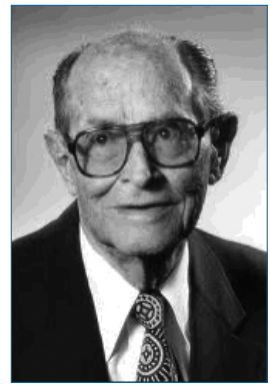


Figure 7. Ledyard R. Tucker, Professor of Psychology, University of Illinois (1910–2004).

I ventured over into sociology to take a class on research methods from Shirley Star (1918–1976), visiting from the University of Chicago. During World War II, she worked on the social-science all-star team studying *The American Soldier* and was a co-author of the seminal volume on measurement and prediction (Stouffer *et al.* 1949). She was a senior study director for the National Opinion Research Center (1947–1960). While the class was elementary, I did get to talk with her about her fights with the FBI during the McCarthy Era. She found a way not to go to jail and still protect the identities of respondents in controversial political-opinion research: turn over the questionnaires, as demanded, and burn the key linking the numbers to the names. It worked only once, but once was enough for her. Nowadays, we need to put much more forethought into protecting privacy when privacy is promised.

Bill Meredith took me under his wing in getting into graduate school. Ghiselli wrote for me, too. Bill urged me to enter the Educational Testing Service (ETS) Fellowship competition for Princeton's doctoral program. I was a finalist. Correcting what were ultimately my screw-ups, he got me admitted to the University of North Carolina's, LL Thurstone Psychometric Lab. It took Bill only an extended weekend to wangle an acceptance.[9] When Ledyard Tucker wrote and asked me to be his RA at Illinois, Bill took it for granted that I would accept, and I did. Tucker had been Thurstone's head research assistant (RA) at the University of Chicago during the era of *Primary Mental Abilities* and the other large-scale measurement studies of that generation. Thurstone had been an assistant to Thomas Edison with a master's degree in engineering (1912) before studying for his PhD in psychology (1917) from the University of Chicago. Thurstone claimed to be a methodological behaviorist, but wrote about *Vectors of the Mind*, adapted from his presidential ad-

9. I never directly discussed my activism with Bill at the time. He never discussed his with me. It turns out he was very active helping the NAACP with race-related projects. His expertise in understanding systematic individual and group differences was in high demand. I attended the Festschrift in honor of his retirement. He then confessed his surprise that I had not returned to jail and deep pleasure that he had helped me move on in grad school and UCLA.

dress to the APA.[10] Tucker, the disciple, became the master of the search for structure underlying psychological data. He made many contributions to both the art and science of factor analysis. He extended factor analysis to multi-mode (*N*-Way) data and showed how to use factor analysis to estimate the parameters of functional relations. He wrote about hyperplane finding and fitting before anyone had heard of support vector machines (SVMs). He made many of the essential connections between factor analysis and multidimensional scaling (MDS).

Tucker believed that, with the right analytical lenses, we could gain a clear focus on the major factors driving human behavior and a decent focus on the minor, systematic factors and be able to filter out the noise that exists in all social-science data. He developed special tools for understanding the system and structure of differences across individuals. We are ultimately unique while sharing major commonalities with some others. I bought into this framework early and believe it to this day.[11] The academic field has gone to more individual-level modeling, leaving some powerful approaches behind.

Graduate school was a narrowing experience as much as Berkeley was a broadening experience in the 1960s. I took a much deeper dive into a much smaller domain: exploratory multivariate analysis. What passed for breadth came from listening to Tucker help other students and some faculty discuss and solve analytical problems in other areas of psychometrics, mathematical models, and experimental design. Tucker's large office was partitioned into four sections with bookcases and filing cabinets in between. The front half held an often-empty secretary's desk facing the door on the east and my desk facing the north wall. Tucker's desk was behind the bookshelves that separated him from the secretary's desk. The final quadrant held a conference table, where Tucker held court as the understated master helping others with their problems. Filing cabinets separated my desk from the conference table. I couldn't see what he was writing on those yellow-lined pads but came to visualize the math as he spoke. Matrix algebra is a highly visual, mathematical language that Bill Meredith introduced me to years before. I felt I was fluent until my first graduate-level math class in matrix algebra. I got a D on the first midterm. In the Math Dept., everything was a theorem-proof class—not my strong point. A D would be a double fail in my program. I would automatically be put into a terminal master's program. This was about the time of my draft test,[12] and the prospect of Vietnam focused the mind. I solved every homework problem in the book and got extra feedback on that from the instructor. I ended up with an A, which surprised the hell out of me. My father's

10. Thurstone, L.L. (1934). "Vectors of Mind," Address of the president before the American Psychological Association, Chicago meeting, September 1933. First published in *Psychological Review*, *41*, 1-32.

11. An interview by his last doctoral student captures the man (https://www.ets.org/Media/Research/pdf/TUCKER.pdf).

12. The *Draft Test* was given only one year in the Korean War and one year in the Vietnam War. Pass and you received a student deferment. Fail and you were likely to be drafted. It was a very biased test: engineers and scientists had a much easier time than humanities and letters. I passed.

admonition in my sophomore year to redouble my efforts when facing possible failure still held in that first year in grad school. Once past that hurdle, I had great intellectual fun in grad school, regardless of the turmoil in my personal life.

I walked into grad school quite unsure if I would be ready for a university job in only four years. The final acts of a doomed first marriage pushed me to seek a job in LA after only three years. My assistantship at Illinois only paid $2,200 per year. So, I spent my summers making money in industry with my dad designing large-scale, man-machine systems for Litton's military contracts. I knew Litton would hire me if I came back to LA. I assumed I could work half time and finish my dissertation in a year. That, of course, was before I had a dissertation topic or had even taken my major-field exams. I had met a UCLA business-school faculty member who was visiting Illinois. Some of the B-school students were taking the same advanced multivariate-analysis classes as I did. They gave much fancier parties than the "three quarts for $1" Drewry's Draft beer that was the staple of grad-student parties in the Psych. Depart. The visiting professor was an eccentric social psychologist, named Hal Kassarjian, who had been one of the first to move from psychology into business schools and create the field of consumer behavior. He set up the UCLA interviews and shepherded my appointment down from a nine-course lecturer to a three-course acting assistant professorship Step II, with automatic conversion to the regular ladder, if I completed my dissertation in less than two years. This was a newly created title meant to add to faculty diversity.

I mentioned my mentors: Meredith, Ghiselli, Tucker, and Thurstone through Tucker. They were important pioneers in distilling meaning out of the data we now simply call *big data*. Ghiselli wrote the book on reliability and validity of measurements (Ghiselli 1964) and the adaptions of measurement systems to industrial settings (Ghiselli and Brown 1955). We could not talk of data-driven enterprise without such foundations. Meredith opened my eyes to high-dimensional data systems, how to search for meaning in high-dimensional data, and the language of such a search (i.e., matrix algebra). Tucker was the unrivaled master of developing tools for finding meaning not only in high-dimensional data but also in high-dimensional data cubes and hypercubes. Tucker had been the head statistician for the ETS that developed the Scholastic Aptitude Test (SAT) before leaving for the faculty at the University of Illinois. And Thurstone was the grandfather of us all in psychometrics and mathematical psychology. The needs in those days were for exploration, and these scholars crafted the foundations of exploratory multivariate analysis.[13] I'll credit my father for my consistent return to systems thinking. It was my interest from adolescence in what my father was doing that sparked

13. Prof. Donald A. "Al" Riley, wasn't really my mentor. He taught my first large-lecture Psych 1A class. I thought for years he tricked us on a multiple-choice test item. The question was something like, "Which has the stronger impact on real-life forgetting: proactive interference or retroactive interference?" We'd read all these pieces on the stronger experimental interference coming retroactively. When he scored proactive as correct, many of us felt conned. It took me decades of accumulating individually weak *proactive* interferences to realize he was right.

my discovery of systems design. Put these histories together with the new academic environment, a graduate business school, rounding up from the late 1960s to the 1970s, and interesting things were bound to happen.

Early UCLA Days

I was hired into a business school with a starting salary of $11,200 for the academic year with never having had a business course in my life. I had no business examples for the early quantitative courses I was scheduled to teach. I had held a succession of summer or part-time jobs that built from the ordinary to something more special. I had worked as a cook and counterman at A & W. If you look, you get a retail understanding of small production teams, upsides and downsides. I was hired with some of my buddies to paint the inside of a neighbor's small factory. The factory mostly assembled components shipped to Cape Canaveral for the early missile and space program. The most boring task in the whole company was proofing the transistor boards in a clean room. They put four columns of 50 transistors on each board. Someone had to make sure the 200 numbers were row-wise sequential. The couple of times I got dragged in there, I made them give me a quota and then sped read the column sequences. I never spent more than 90 minutes doing a day's quota. Mistakes were rare, but I caught enough that they didn't question my accuracy. Nothing blew up to my knowledge. This kind of line-work teaches about supply chains and networks at a shop level. If these resister boards don't show up in Cape Canaveral when needed, the mission is delayed or aborted. I spent another summer apprenticed to a master carpenter. Projects get completed by semi-autonomous work groups interacting over time. Your progress is a function of your team and the partnering teams. Planning and communications were the keys to smoother sailing. The summer after my freshman year I gouged little metal burrs out of little metal slots in the appliance division of Minneapolis Honeywell. I only got that job by swearing I'd dropped out of Cal. When, at the end of summer, I told them of my change of heart and decision to return to Cal, I got a long pitch on my future as a machinist. I learned you need to maintain discipline even in mundane tasks. Motivation has to come from other sources. I spent one summer in direct sales of an encyclopedia. That was quite an education for a future business-school professor. In my entire teaching career, I never used the "Blind Carpenter Close." It's not a dirty joke. It's the sales pitch that ends "… and he spends his dying days having his daughter read to him out of our encyclopedia." The real education was the home-office culture that could have been the inspiration for *Glengarry Glen Ross*. Although I earned good money that summer, I learned sales would never be my niche. One summer

I worked on a crew repairing new houses in a subdivision that had gone into bankruptcy. I did whatever was needed to get the houses ready for market: moving walls, installing garbage disposals, diagnosing wiring, or whatever. Again, it's an interaction over time of semi-autonomous, yet interdependent work groups. Without more formal project-management and communication systems, a lot of time was wasted. Finally, I spent two summers designing personnel subsystems on naval contracts. Much of that time I was in the same group with my dad. It was great to see the respect with which he was treated. The further away from our core group I got, the respect turned toward deference. The orthodoxy of the time was a Department of Defense (DOD) specification called "Design-Work-Study." My dad taught me that you solve the problem however it works for you and then reconstruct it to the DOD specification—logic in use recapitulated as reconstructed logic. See the problem for what it is. These were all systems of personnel, equipment, and other assets performing tasks that shifted over time. By the end of those summers, I understood systems design. Despite my lack of business courses and lack of examples relevant to my teaching, I had no fear of entering a business school as faculty.

The first faculty guide showed me as follows:

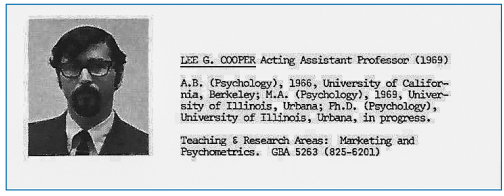


Figure 8. From the 1969 faculty guide.

The first Internet node became operational at UCLA in the summer of 1969 when I was first hired.

Angela Davis and I were hired under the same *acting-assistant-professor* title. It came out of a report on the causes of the Watts riots. In May of 1968, the UC president created the Urban Crisis Program and positions for acting assistant professors ("ABD," all but dissertation) were part of the program. I knew none of this at the time. In the business school, two other faculty were hired under the *acting* title: Thaddeus Spratlen and Robert Singleton.

Thaddeus Spratlen: With a BS (1956), MA (1957), and PhD (1962) from Ohio State, Thaddeus was appointed acting associate professor the same year I was appointed acting assistant professor. The University of Washington recruited him away in 1972. In our short time together, I gained an enormous respect for Thad



Figure 9. Front panel of the first Internet node.



Figure 10. The first Internet node on display for the 30th anniversary 1999.

and his wife Lois. Thad was like the adult in the room. He understood scholarship, family, and community engagement. Lois was his equal and co-conspirator. They had a lovely home in Inglewood. I think they had already decided to leave and were explaining to me the benefits of raising a family in Seattle over staying here. I knew they would have a positive effect on wherever they called home.[14]



Figure 11. Angela Davis ~1970

14. A quick search showed a video of Thaddeus and Lois on their 60th anniversary a few years before Lois passed away and a University of Washington ceremony honoring their legacy. They were a great couple. I also learned that Thad was earlier blocked from a career in the State Department due to his race. One of their daughters was confirmed in 2014 as the US Ambassador to Kyrgyzstan.

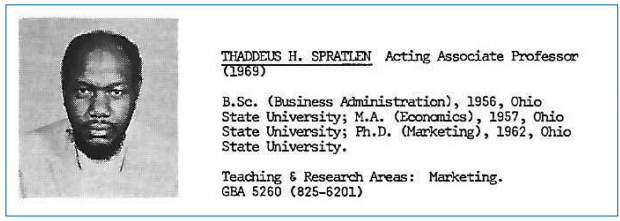


Figure 12. Spratlen, 1969 faculty guide.

Robert Singleton was a UCLA-bred (BA 1960, MA 1962, and PhD 1983) civil-rights activist. He organized the 13 UCLA Freedom Riders in 1961. He and the eight that traveled by train with him from New Orleans were arrested upon arrival in Jackson, Mississippi, quickly tried and convicted of breach of the peace, and moved to Death Row at the infamous Mississippi State Penitentiary in Parchman on the very day that Barack Obama was born. He was the founding director of the African American Study Center at UCLA, named after UCLA Olympian and Nobel laureate Ralph Bunche.

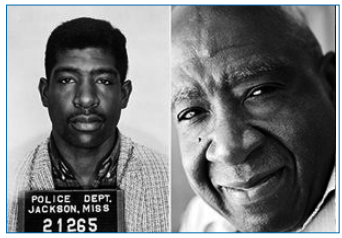


Figure 13. Robert Singleton. Courtesy of the Singletons.

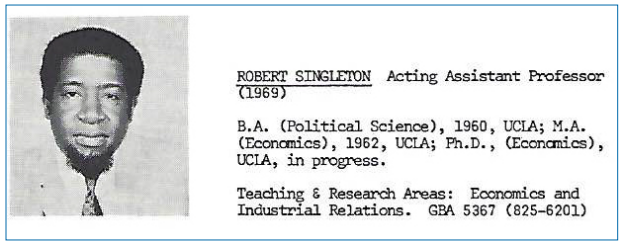


Figure 14. Singleton, 1969 faculty guide.

I went to Angela Davis's first lecture, which was moved to the 1,800-seat Royce Hall to accommodate the crowd. The course was on European intellectual history. I remember it as a brilliant overview and synthesis. If I were a student, I would have loved her as my teacher. I said as much to a local TV reporter who shoved a mic in my face as I exited the hall.

The next day, I taught my own first class on multidimensional scaling (MDS), to seven doctoral students. The contrast in scale was not lost on me. I knew my classes would never be center stage. An introductory statistics class was required in every social science. Interest greatly narrowed after that. Even psychometricians in psychology departments play from the periphery. As the first to venture straight from psychometric doctoral studies into a business school, I always expected to be a stranger in a strange land. I was equipped for exploration.

Four of these first seven students had never before ventured into a business school. So, I came at a time when the business school was starting to attract interest from the rest of campus, rather than solely the other way around. The marketing group, which is where I was hired, consisted of faculty trained in root disciplines: economics, mathematics, operations management, and psychology. The chairman of the whole business school, Lou Davis, saw the budget ax falling on the UC system and grabbed his best chance at shaping the department in the future. He was the one who saw the acting-assistant-professor title as a way of preparing for the lean years. Over a dozen new faculty were hired the year before me and around the same number in my year—the best athletes regardless of discipline. No one was hired for the two subsequent years, before a trickle of new hires started to come in.[15]

I left for UCLA the morning after passing my preliminary orals for my dissertation. I had a five-page abstract and the core mathematics done and had been bestowed the privilege to call Tucker "Tuck," an honored rite of passage for his successful students. Translating the methods into optimization code, collecting data, and showing that it all made sense were my main goals. My secondary goal was to do it as independently as possible. I listened to Tucker hand-carry some doctoral students through their dissertation problems. I wanted this to be mine as a tribute to him as well as showing my independence. All through college, when I would want to tackle a too-large problem, my dad would advise me to do something doable, "It's not your dissertation, after all." When my cohort hit dissertation stage, I would hear all these comments about coming up with a *doable dissertation*. I took on the topic I wanted regardless of the 'doability' and have been pleased with that choice ever since. Tuck and I met only once after preliminary orals, at the annual meeting of our professional society at

15. I found out later that Lou knew my dad through the Society for General Systems Research. Lou and my dad were two of the few non-PhDs to have prominent roles in that organization.

Stanford in March 1970. In between talks, I listened to the NCAA tournament for the first UCLA championship after Lew Alcindor.[16]

I did put one desperate call in to Tuck in early June. I was beginning my final sprint to finish, and I saw a pattern in a matrix output that just wasn't right. I had written all the code in FØRTRAN IV. The matrix packages of the day did not allow for things such as the Fletcher-Powell functional iteration. Those were the days when you had to do the math to get analytical derivatives for optimization routines. Without seeing the computer output, Tucker walked me through a Q and A that led me to see the *where* and *why* of the problems, just as I had heard him do so many times at his conference table. He would draw you out on the limb of your error, gently start sawing away, always hoping you'd figured it out before you fell.

My final sprint was six weeks of 18- to 22-hour days. My final orals were set for the first week in August, and I'd convinced myself missing this would cause a year's delay. Tucker was leaving Illinois for a year at Stanford's Center for Advanced Study in Behavioral Science. On the Monday of my self-imposed deadline, I had been up for 36 hours. I was trying to shuffle the edited pages into the seven copies I needed to send off. My fingers weren't working right. Jim Bettman, a colleague from my cohort, who arrived with dissertation well in hand, helped me finish the task. Thank you, Jim.

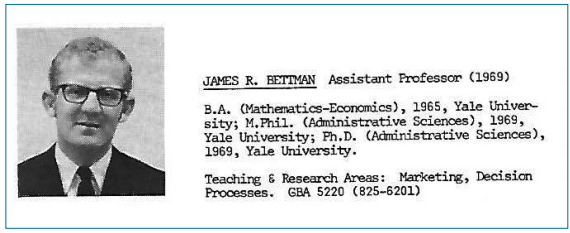


Figure 15. Bettman, 1969 faculty guide.

By 4 pm, I was finally leaving the building and in serious need of sleep. My normal exit was right through the Franklin Murphy Sculpture Garden. Right ahead of me was former Chancellor Franklin Murphy explaining a sculpture to a small group of what I immediately assumed were high-end donors. First, I

16. First, maybe this showed that my interest in pure psychometrics was waning. More likely, UCLA was my first really winning sports franchise. I arrived atCal after the best sports years. Students used to point to football coach Marv Levy's masters in history as evidence of the de-emphasis of sports at Cal. I went to Illinois expecting better. On my first drive to grad school, in the middle of Texas, in the middle of the night, I heard the radio story of the two, well-kept sets of books discovered in the Illinois athletic department—one detailing all the illegal payments to athletes. By the time I got to Urbana, everyone was fired.



Figure 16. Murphy spoke of "The organs of creation."



Figure 17. "Why" Richard Hunt.[14]

thought that I'd never have enough money to be invited into that group. Second, I decided to just join in and follow along. Sleep could wait. I really did get the feeling he handpicked each of the sculptures and each of the donors to give it. His passion for sculpture came through in every description. To explain an enigmatic sculpture that then adorned the southwest entry to the old building, he reached his partially closed right hand to the sky and uttered "Why," the title of the piece, echoing an artist's cry against the injustice in the world. To describe an erotic piece on a side path, he spoke of "the organs of creation." I remember one spring morning walking into the garden from Parking Lot 3 to find all the torsos and busts adorned in dresses, scarves, and hats as part of an MFA project. Simple drapes made the sculptures spring to life in a way that still pleases me five decades later. Until the new building opened in 1995, I always considered the walk from the parking lot into the old business-school building a special privilege.

Post Dissertation

By early November 1970, my divorce was final, and I had a PhD behind my name. My mom bought me the desktop nameplate pictured below. Dad was already proud. I had to decide if I wanted to go back into the psychology faculty market. USC had left the door open for me to revisit once my dissertation was

17. The plaque says, "Richard Hunt, 1974." Now it's relocated to a less prominent place, but it was outside the old building in 1970.

done. Despite an excellent psychometrics group, I just couldn't bring myself to do it. It felt as if I would be starting over. The teenager in me couldn't swap the Blue & Gold for the Cardinal & Gold. Los Angeles is a town split by gang colors. I knew where I belonged. My allegiance and deep affinity were to a public-university system.

Besides, I already had my 1970–1971 teaching schedule set. Winter quarter, I was to teach my first, non-quantitative class: Consumer Behavior. The first class was January 11. The day after my compulsively detailed introduction to the structure and goals of the course was the premier episode of "All in the Family." On Wednesday, I went into class and added mandatory viewing and time on each Wednesday to discuss what we thought. I knew I'd seen something new that was both impactful and entertaining. It was a new kind of comedy that transformed the family dynamic into the societal portrait. I got to tell that story a few years ago to Norman Lear, who was then 91 and still going strong.[18]



Figure 18. Gift from my mother.

I also refrained from the psych job market because I had just met a fascinating colleague—the first who had *marketing* as his root discipline. Masao Nakanishi was a UCLA PhD, who had just spent a post-doc year at Rochester, partly to get separation between his grad-student days and his future as faculty. In the old model, when it worked best, he had learned economics and econometrics from the Econ Dept., statistics from the Math Dept.,[19] etc. He was better at each topic than his teachers. We published together for 25 years. At the end of our active research engagement, he paid me the ultimate compliment that he just felt more creative when we worked together. He was awarded "The Order of the Sacred Treasure, Gold Rays with Neck Ribbon" by the emperor of Japan in 2016, which comes with a special award (Figure 20) and an extra pension from the emperor. That's the same award as famed

18. Gerry Rossy was a student in that section and will confirm the essential details of this story.

19. At that time, UCLA did not have a statistics department. I served on the committee that designed it decades later. Our lasting contributions were enforcing a focus on data and hiring Jan deLeeuw to head it.

designer Isamu Noguchi received. I accepted Masao's compliment for what it was and still pondered what made it feel so creative to both of us. We shared a common core that ensured communication and had such complimentary other skills that it felt the canvass was almost limitless. Not all collaborations work. When they do, wonderful things can develop.

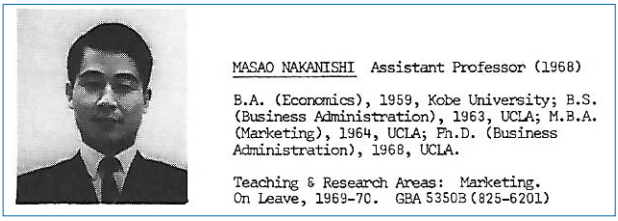


Figure 19. Nakanishi, 1969 faculty guide.



Figure 20. The Order of the Sacred Treasure, Gold Rays with Neck Ribbon.

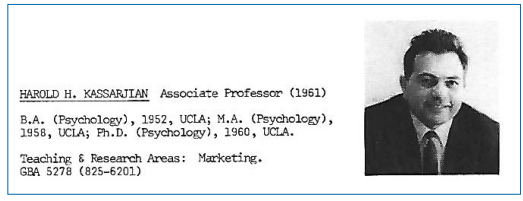


Figure 21. Kassarjian, 1969 faculty guide.

Kassarjian orchestrated our first collaboration. He had run for the Junior College Board of Trustees and lost. Ever the good social scientist, he gathered the little information voters had on each candidate for each seat on the board and wanted our help in replicating a study recently published in *Administrative Science Quarterly*. Neither Masao nor I liked the methods in the published piece, for good reasons too

arcane to recount.[20] We darted off in different directions with frequent meetings to update each other. He took a new look at his work on attraction models, the representations of how people are attracted to the choices they face on the ballot or more generally in life. That caught my eyes early on. These were like models of gravitational pull but were far more general in the kinds of attractive forces that could be represented. Forces interact to create attraction. Multiplication is the mathematics of interaction. Prior to Masao's insight, these models were considered too expensive in computer resources. Instead of the seesaw balances of standard linear-compensatory models, Masao envisioned ratios balanced by geometric means. It may seem obvious now. Back then it was very novel and impactful. Applying that new insight created reduced forms of our attraction models that were as easy to estimate as standard linear models. The article on the new approach to estimating attraction models using generalized least-squares procedures was probably the most important piece in my tenure packet. I had seven pieces in top-tier journals. That was enough on the research side in those days.[21]

The faculty voted 50/2/2 in favor of my promotion. One of the negative voters specifically commented that mine were, "Cadillac models, but we will never have enough data to estimate them." Umm, we are talking about B-school tenured faculty in the mid-1970s. Not everyone could see the obvious. That was counterbalanced by a surprise *yes* vote, "Given how vocal he has been in faculty meetings, I was sure I would vote against him. That was before I read his research." I valued the overall faculty endorsement, but I was still apprehensive that my adversaries were further up the pecking order. The dean—one of the few deans I liked—had (unbeknown to me) changed my third-year review from the faculty consensus of *normal progress* to *normal progress with reservations.* What was the *programmatic* need for a psychometrician? Was *programmatic need* even a criterion to be considered at tenure? Were there political issues?

These were political times. We discussed Angela Davis's firing at our faculty meetings in 1970. Some senior faculty in the business school were incensed at the intrusion on academic freedom (*UCLA: The First Century*, p. 179). I wasn't alone, and I didn't think I was being very outspoken. We raised money to substitute for salary temporarily. Davis sent back one check for summer support when she was

20. The main issue was using a regression model when the dependent measure was binary.

21. Scholarship, teaching, and community service were the three categories in a tenure review, with research being the dominant criterion. I did have one service credit. Because of my background in testing, I was asked to help Malcolm Kerr with comprehensive exams for the master's in public administration students. He was a good man, and I enjoyed working with him. His son, Steve, was a UCLA ball boy, who later starred at Arizona and in the NBA as a player and now a coach. Malcolm left to become the president of the American University in Beirut. A tireless advocate for peaceful relations with Arabs in the Middle East, he was kidnapped and assassinated by an anti-American faction in Lebanon.



Figure 22. From *UCLA: The First Century*, page 169.

being sought by the FBI. It contained a nice note stating how she couldn't fulfill her obligations under the then-current situation.

There were mass demonstrations on campus in the early 1970s. At one, the police beat up a kindly old linguistics professor, Peter Ladefoged. Some of his doctoral students were taking my advanced multivariate-analysis classes around that time.[22] Most faculty held their spring classes outside in protest. One demonstration in particular was memorialized in a photo (*UCLA: The First Century*, p. 169). I was walking across campus one spring morning and saw a crowd of several hundred students gathered at the northwest entrance to the administration building. To get a better vantage I entered another door and came out at the front of the rally. A representative from the chancellor's office came out and told us the chancellor would meet with a few of us. I don't remember any previous discussion of involving the chancellor, but of course, the crowd demanded the chancellor speak. I joined the small group that went to

22. Ladefoged pioneered many of the field-measurement techniques in linguistics and phonetics. He nurtured his students to develop top multivariate skills and tailor analyses for the kinds of data he gathered. One worker in his lab independently created a special case of multimode factor analysis parallel to the best stuff in the field. We structured a psychology doctoral program for this undergraduate dropout on the basis of a completed dissertation and incomplete coursework. That was the complement of Ladefoged's own experience of having all of his doctoral coursework waved and needing only to complete a dissertation to take his slot on the UCLA faculty. That was before the *acting* title was approved.

the chancellor's office. Several students gave impromptu, impassioned pleas for the chancellor to speak. I was silent, just observing how frightened the chancellor seemed. Nonetheless, he accompanied us back to the rally and spoke openly and confidently to the crowd. I'm the guy with the slicked-down hair and the goatee between the camera and the chancellor. You only see a partial profile, but that's me.

The only other political bit was when I was lured to join a first meeting for a group of social scientists organized by Tom Haden in preparation for his 1976 Senate bid. The way he pitched it, I could only envision the failed 1964 effort to package Pierre Salinger like breakfast cereal, including jingles. I said "No, thanks." My attentions were outside of politics.

I greatly enjoyed building the collaborations that made good use of my strengths and handled my weaknesses. It was an early lesson in how work gets done by broad coalitions of sometimes small organizations, each organized around its core competencies.

Chapter 2

Socio-Tech Systems and Arts Management

"Abundance of knowledge does not teach men to be wise."

— Heraclitus

I was attracted to other parts of the business school. The behavioral science and socio-technical systems areas and the Arts Management Program provided lessons in the human side of enterprise that were somewhat missing from my quantitative background.

The Path to and from Arts Management

Even before tenure, I wandered to other parts of the business school. When Harold Williams became dean in 1970, he replaced the sub-department structure with less formal *areas*. Organizationally, this centralized power a bit by reducing the sway of the traditional disciplines and made it easier for faculty such as I to wander. I had learned about stable, temporary systems and transorganizational systems—fancy names for business as usual in Hollywood. All this *systems* stuff resonated, given my upbringing and experience. As I previously mentioned, I spent two summers during graduate school working with him in the systems-design group at Litton's Advanced Marine Technology Division (AMTD). I wandered into the socio-technical systems and the behavioral-science faculty groups in our school. Classic texts, such as "The Causal Texture of Organizational Environments," (Emery and Trist

1965) stuck with me, particularly their writing on *turbulent fields* would come back to me when I started studying radically new products almost 20 years later.


The Ivory Tower

US must face revolutions

By Steve Carhart

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or Local 542-0279 (evenings)

Figure 23. Summer jobs ad in the MIT paper at Litton, 1968.

I had never done group-process-related training in my psych background, but even before I taught any non-quantitative stuff, I was pulled into an early consulting gig discussing generation-gap issues with a bunch of supervisors at the Pepsi-Cola Mgt. Inst. Long years of work on the floor led the best to be promoted to supervisor. It was mostly men who couldn't communicate with their increasingly adult sons and daughters. I was not going to try to explain the late 1960s to anyone. I mostly listened. The supervisors grew up in the Great Depression, were profoundly affected by world war, had finally found a modest sense of prosperity, and couldn't understand why their kids wanted something else.

That gig was a prelude to my learning about the more process-oriented side of behavioral science. In the behavioral-science group, I found one of the wisest colleagues I've ever encountered. Everyone around UCLA is smart. Wisdom is a rare asset. Bob Tannenbaum's wisdom came from the kind of deep understanding of individual and group behavior that you can read in his *Harvard Business Review* classic "How to Choose a Leadership Pattern." Marshall Goldsmith has written about how special Bob was. Bob and Joan Lasko led doctoral students in a yearlong program studying group process (T-groups) and leadership. After I spent a summer learning the basics at the National Training Labs in Bethel Maine, I joined in Bob's course for one year as if I were another doctoral student. I was shaken when Bob announced his early retirement in 1977. I asked to interview him on his decision as a way of coming to grips with losing a newly found mentor. He sat with me for hours as we discussed his decision-making process, and I acclimated to a future at UCLA without him. Among the many reasons that drove his decision was a sense that the school was moving from the open-

ness that Harold Williams fostered back toward the historical disciplines. I began to sense it, too.

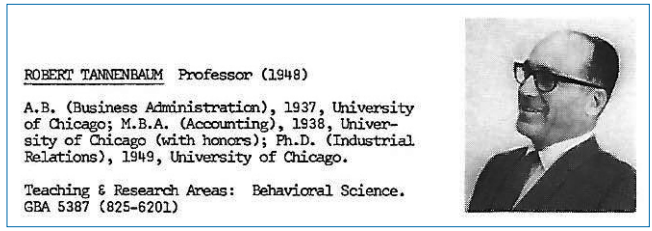


Figure 24. Robert Tannenbaum, Prof. of Mgt. UCLA (1915–2003).

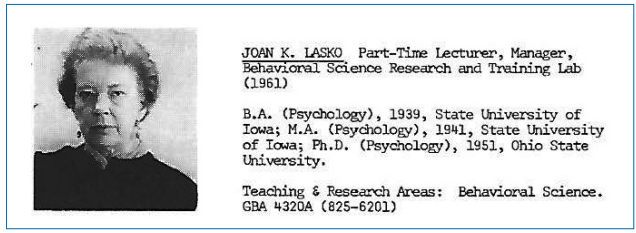


Figure 25. Joan Lasko, 1969 faculty guide.

During these years, I met Marshall during his doctoral-student days. He and I teamed up with Jim Goodrich, then a doctoral student in political science, who is now the dean of the Business School at Cal State LA. Calling ourselves the Group for Action Research, we worked on citizen involvement in the city-planning process (Cooper *et al.* 1974). I developed an actionable sampling plan for Venice, CA. Citizen involvement was central to Marshall's dissertation. He had learned a lot. The three of us went downtown to talk with staffers in the city-planning office about bringing community voices into their work. I felt as if we were in a valley surrounded by heavy artillery firing at will. I learned the lesson that do-gooders from the big U can't do much without coalition partners who know how to get things done on the ground.[23]

Working with these faculty and grad students in the behavioral-systems areas was fascinating in those days. Remember when Native Americans took over Alcatraz in the early 1970s, claiming it under the Surplus Federal Lands Act? At the same time, another group of Chicanos and Native Americans hopped the fence to a

23. Marshall and Jim have gone on to do a lot of good in their careers. See: http://www.marshallgoldsmith.com and follow #100Coaches Program.

deserted Army Communications Center outside Davis. They declared it Deganawidah-Quetzalcoatl University (D-Q U) for the founder of the Iroquois Federation and an Aztec leader deified by his people. They named Leroy Clifford the president. Leroy dropped out of the socio-technical systems doctoral program to get involved. He was Oglala Lakota Sioux with a master's degree in agricultural economics—a smart, nice guy who breezed through my introductory statistics class. The Feds deeded the land to D-Q U after the other Native Americans agreed to leave Alcatraz.

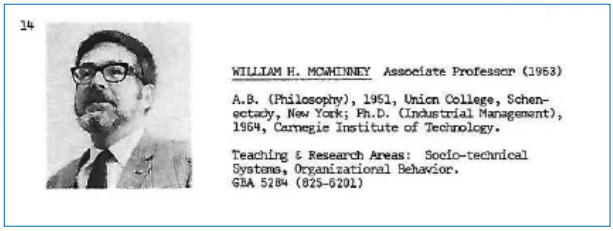
Leroy called back to his former mentor, Will McWhinney, about using some faculty and doctoral students in a long-term planning exercise that engaged the whole university community. Will and I turned out to be the only faculty to go, along with at least a dozen doctoral students. At the opening meeting of the whole community, a deeply drunk Native American student usurped the microphone to tell us how we had stolen his last refuge. He had to go into the wilderness to live as a warrior. With an eight-inch knife sheathed at his side, no one tried to change his mind. We moved on … chilled. Leroy greeted us and promised a surprise menu for a Native American feast on Sunday at the end of our stay.



Figure 26. Patch and badge from D-Q U.

We broke into small teams working with different groups. Wisdom resided in Black Elk College, which provided residencies for medicine men and shamans along with engagements that helped pass on traditional wisdom. This was the home for many of the reservation Indians. The savvy urban Chicanos who constituted the other half of this indigenous-peoples mix took more standard courses. Problem 1 was that only

in theory did these indigenous peoples mix well together. The urban Chicanos took over most of the available levers of power—further alienating the reservation Indians. Problem 2 was that, near the end of our planning exercise, observers from AD Little, the management-consulting firm, pulled an already-developed plan out of their back pocket and said, "This is what the Ford Foundation will pay for." We ate our surprise feast of turkey, stuffing, and corn while feeling that we should have known what to expect from the feast and the Ford Foundation.


14

WILLIAM H. MCWHINNEY Associate Professor (1963)

A.B. (Philosophy), 1951, Union College, Schenectady, New York; Ph.D. (Industrial Management), 1964, Carnegie Institute of Technology.

Teaching & Research Areas: Socio-technical Systems, Organizational Behavior.
GBA 5284 (825-6201)

Figure 27. Will McWhinney, 1969 faculty guide.

I learned a lot, met some fascinating people, and published a couple of interesting-at-the-time papers but didn't find a research home.

In a few places, I've mentioned unexpectedly ending up directing the Management in the Arts Program at UCLA (1976–1979). I always had been involved with the creative arts. I wrote fiction and poetry and drew for pleasure as a kid. High school was devoted to college prep except for a couple of creative-writing classes. I started the Jazz Club in my high school. In college, I fashioned a fictional minor in visual art to help talk my way into a few studio classes. My paints, brushes, and a guitar were the only recreational tools I took to grad school. When I first arrived at Urbana for grad school, I joined Star Course, a supposedly undergraduate club of students who were ushers at on-campus concerts. I remember many excellent concerts and carrying a Stradivarius violin for the Guarneri Quartet. I continued my own art at a slow pace once my dissertation was finished.

I went into serigraphy and other graphics along with my parents who were into it as a post-retirement thing. They had spent the early years of Dad's retirement doing mosaics and graphic arts. They spent a few great years teaching graphics on cruise ships sailing all over the Pacific. As tenure approached, I figured I should focus my creative energies into writing, or I might be looking for another job. But by the fall of 1974, my tenure packet was assembled, and I needed a break. So, I got back into visual arts—serigraphy at a co-op studio in south Santa Monica. There, I met Ann as she and two other lovely young ladies were taking an etching class. I had

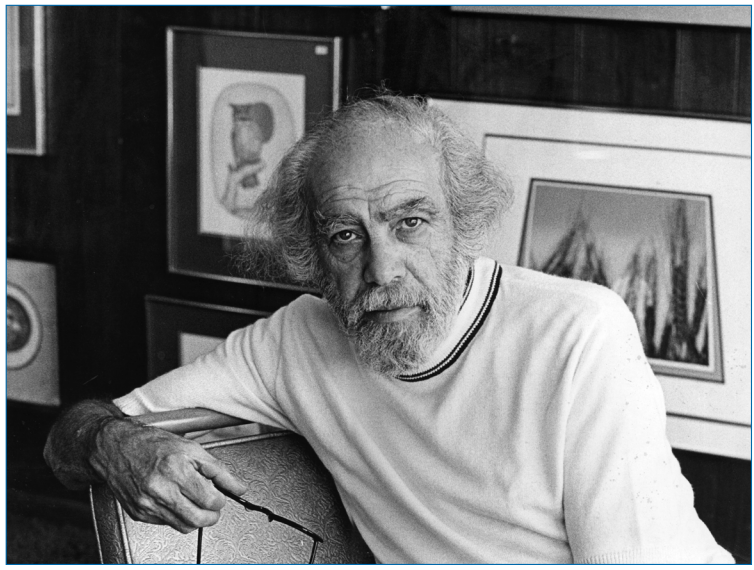


Figure 28. Joel Cooper at the Cooper Gallery.

just stopped by to show a colleague and buddy, Mike McCaskey, my studio before a planned dinner across the street. We unsuccessfully tried to pick up these young ladies. I was smitten and pursued Ann. Within a month we were together and have been together ever since.

Years before, when I was at home during a summer in graduate school, I worked with my dad on his first mosaic based on a simple graphic in a folk-song book (below). From mosaics, he shifted into printmaking. At some point, my father got the bug to open a gallery. I helped him start the Cooper Gallery in the design district.

I think it was in 1974 that I decided to showcase faculty art in an exhibit. I knew Fred Case, Marshall's dissertation advisor, was an etcher and many other talented faculty were not sharing these creative sides with their colleagues. I set up a champagne opening that became a real celebration.

I did get some guff from Elwood Buffa, who wanted hard liquor at the reception rather than champagne. El was associate dean and a deity in the operations-management community. Stacks and stacks of his basic text would line the front displays at the student bookstore when his class was offered. It's hard to say how long he harbored a grudge over such a minor issue.

I was surprised by the number of people who urged me to make the art show an annual event. I decided early on that the next event would be different. In the spring of 1975, my tenure review was still muddling along outside the department, and I couldn't focus on research. I got the idea to put on a play with open



Figure 29. The image that inspired my dad's first mosaic.



Figure 30. Israeli Dancers Mosaic, now at my son's home in Chicago.

casting for students, faculty, and staff in any role to organize the community around its creative sides. I picked a stage version of Fielding's *Tom Jones*—probably more like the movie. Thanks to a solid contingent of theater people from the Management in the Arts Program (a joint effort of the business school and the College of Fine Arts), the event was a ringing success—two performances and a great expression of community joy. I had appointed myself as director of this play, not having much of a clue about how to pull this off. I had a lot of help muddling through and again drew accolades from the community. I remember two arts-management students, Alvin Spector and Earl Shub, in particular made me look better than I probably was.

Meanwhile, inside the Arts Management Program, a palace coup was brewing. *Success has many fathers*. I wasn't one of them. One of the many fathers was Ichak Adizes—an early advocate for the program who never thought he received enough credit. Somehow, he convinced the deans that the founding director, Hy Faine, wasn't doing this right or that right and only Adizes could bring the program the distinction it deserved. I wasn't really aware of what was going on, but Adizes as the incoming director asked me to be the deputy director. My only specific duties would be to organize the speakers program for the following year. With tenure in hand, I said, "Yes."

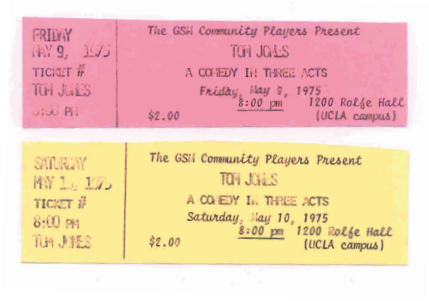


Figure 31. Tickets to my production of Tom Jones.

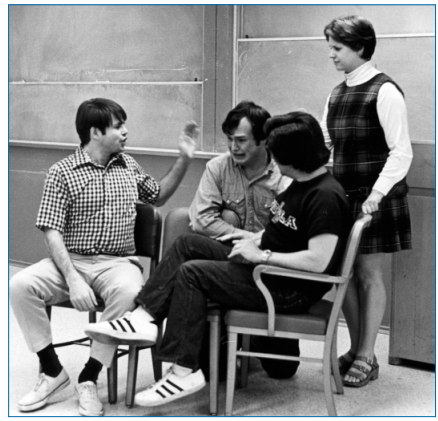


Figure 32. Rehearsal for Tom Jones.

The first speaker was Ardis Krainik, then the arts manager directly under Carol Fox, the impresaria of the Lyric Opera of Chicago. I didn't know of Krainik's background as a mezzo-soprano. She set a high standard for communicating the challenges facing arts-management students. I also remember an informal talk by Martin Bernheimer, the head art critic for the *LA Times*. We were in the faculty lounge on the fifth floor of the old building. He sat at the far end of a long coffee table with me at the other end and students all around. He held the audience spellbound with engaging stories. I noticed tiny writing on his tie—illegible from my seat. Afterward, I walked up and asked him about it as I stared closer. As the tiny type came into focus, he said, "Oh this. I call this my Dorothy Chandler tie. I wear it whenever we meet." It said, "Fuck You Fuck You Fuck you …" maybe 100 times in rows across the front. She never ventured close enough to him to read it.

Adizes created firestorms wherever he touched down. I kept to the speakers program and my other activities and was relatively oblivious to the trouble he was creating. Before the end of the academic year, Harold Williams and El Buffa forced Adizes out. I was the only one with any continuity with the program. Almost by default, they asked me to direct the program. Charles Speroni, dean of the College of Fine Arts, concurred. Why I accepted is complex. It was clearly not aligned with the sharp edge of my research abilities. Whatever edges I possessed back then were more quantitative than artistic. I liked the students, and they were nearly the only part of the business school my wife could relate to at that time. It felt like my romantic image of a children's crusade before I knew that "crusade" is a bad word or what the actual children's crusades looked like.

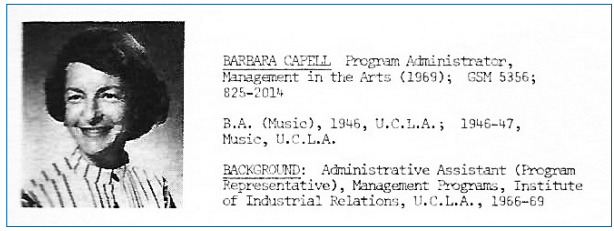
Throughout the turmoil, the program was an ongoing success. Barbara Capell was the very able administrative officer. She had a deep background in the arts and



Figure 33. The director at rehearsal.

knew the ins and outs of UCLA as well as all the granting agencies. We ran a world-class internship program, financially supported by the National Endowment for the Arts (NEA), the Smithsonian Institute, the California Arts Council, and the Federal Work-Study Program (CETA). We placed our students in six-month, full-time, paid internships with major not-for-profit arts organizations throughout the country as well as some international placements. Livingston Biddle ran the National Endowment for the Arts, and Republicans still had a vestige of *noblesse oblige* when arts funding came up. The students were great. We only took students with strong backgrounds in the arts. We could make good managers out of them but could not teach regular MBA students to be effective managers in arts organizations. I did have to handle the guilt when one of our NYC interns was raped at knifepoint in the vestibule just outside her apartment door, while another intern watched inside the apartment—on the phone with police. The guy was caught and convicted. Nonetheless, it was horrible. I spent time listening as a few students *came out* in my office. They never saw me as part of the homophobic environment. Most of the complaints referred to their student peers rather than the faculty or administrators.

One of the tasks I inherited from the previous regime was David Geffen's interest in teaching a course at UCLA. I assumed he wanted to show off to his friends, who were Hollywood's best and brightest. I wanted him to think through what the lessons were and which speakers were most appropriate for each. He was very


BARBARA CAPELL Program Administrator, Management in the Arts (1969); GSM 5356; 825-2014

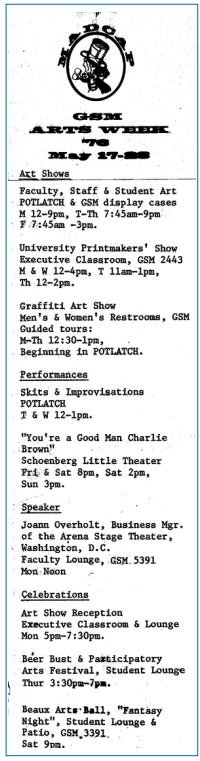
B.A. (Music), 1946, U.C.L.A.; 1946-47, Music, U.C.L.A.

BACKGROUND: Administrative Assistant (Program Representative), Management Programs, Institute of Industrial Relations, U.C.L.A., 1966-69

Figure 34. Barbara Capell, 1977 faculty guide.

thoughtful in his choices. I sat in on Frank Wells, the Rhodes scholar who was then president of Warner Bros. I have very little recall of what he actually said, but I do remember being very impressed with his thoughtfulness and perspective on his industry. Jack Nicholson told scandalous stories about "Missouri Breaks" that made it into the trades. The course was tremendously popular. David told me once that everywhere he goes he runs into students who said they were in that class. It was a first positive experience for David with UCLA.

Another inherited task wasn't as successful. The LA Music Center Blue Ribbon 400 was a premier women's fundraising group. It had scheduled a planning work-


GSM
ARTS WEEK
'76
May 17-23

Art Shows

Faculty, Staff & Student Art
POTLATCH & GSM display cases
M 12-9pm, T-Th 7:45am-9pm
F 7:45am -3pm.

University Printmakers' Show
Executive Classroom, GSM 2443
M & W 12-4pm, T 11am-1pm,
Th 12-2pm.

Graffiti Art Show
Men's & Women's Restrooms, GSM
Guided tours:
M-Th 12:30-1pm,
Beginning in POTLATCH.

Performances

Skits & Improvisations
POTLATCH
T & W 12-1pm.

"You're a Good Man Charlie Brown"
Schoenberg Little Theater
Fri & Sat 8pm, Sat 2pm,
Sun 3pm.

Speaker

Joann Overholt, Business Mgr. of the Arena Stage Theater, Washington, D.C.
Faculty Lounge, GSM 5391
Mon Noon

Celebrations

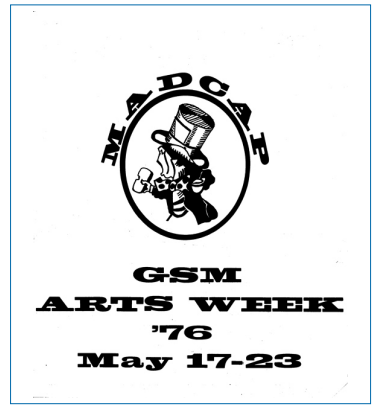
Art Show Reception
Executive Classroom & Lounge
Mon 5pm-7:30pm.

Beer Bust & Participatory Arts Festival, Student Lounge
Thur 3:30pm-7pm.

Beaux Arts Ball, "Fantasy Night", Student Lounge & Patio, GSM 3391
Sat 9pm.

Figure 35. Arts Week Agenda.

Figure 36. Publicity sticker I created for Arts Week.



shop to be run by the former program director. I tried to keep that commitment. At the time, I thought the content of my little lecture was fine, and I screwed up by picking an exercise that was too easy for the group. They felt talked down to. I recently ran into an acquaintance who was at that session. She had no recall of the exercise but said I talked about UPC symbols. I have no idea how I worked them into the 1976 talk to the top fundraising group at the Music Center. Few academics were even talking to grad students about big data back then, much less to the women of the Blue Ribbon 400. Such performances are not my strong point.

A third leftover involved co-teaching a class in organizational behavior for creative organizations. The other half was a professor from the health sciences who thought creativity was some foreign, special property that only *those people* had. I felt that understanding our own creativity could provide perspective on the more traditional content of org-behavior classes. She and I had such different approaches to the content that the tensions were far too apparent to the students.

I continued to try to organize the Graduate School of Management (GSM) community around their creative sides. We created Arts Week '76 as a multi-arts festival.

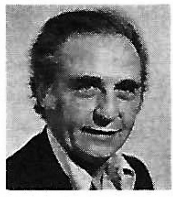
I tried to put a permanent financial base under the program through the NEA Challenge Grant Program. After sending my grant proposal through the UCLA channels, I was summoned to meet with Elwin Svenson, the vice chancellor for Institutional Relations who oversaw the arts, athletics, and all the organized research units on campus. Despite the ties I had built within the NEA and the likelihood of funding in the second round, Svenson told me *he* decided who at UCLA got funding through the Challenge Grants. I was free to spend all my time trying to raise funds for the program, but I'd get no help. I knew at that point, I would not stay.[24]

I established a connection with students that were quite different than the ones I had been getting when teaching quantitative courses to MBAs. Ann recently found this photo inscribed "To our fearless leader Lee Cooper who shared with us his vision of what arts organizations can achieve, who pushed us beyond what we thought were our limits, and who gave us confidence in our training and ourselves. Our deepest gratitude, The Class of 1979." At the edges of the photo are Hy and Ruth Faine. Hy was the founding director of the program, who I reintegrated once the defeated army left the battlefield. He was the Harvard–trained lawyer who organized arts unions in New York (chairman of the Associated Actors and Artists of America and national executive secretary of the American Guild of Musical Artists). He was selected as the regents professor who would start the Arts Management Program in 1969. To have him sidelined was beyond shameful.

24. Decades later, we shared many wonderful concerts at Royce Hall and never once discussed that meeting. I did hear fascinating stories of the first Peace Core training he and Abbott Kaplan brought to UCLA.



Figure 37. Art Mgt Class of 1979.



HY FAINE Adjunct Professor (1970); GSM 5385; 825-1151; 825-2503

B.A. (Psychology), 1933, City College of New York; J.D. 1937, Harvard

TEACHING - FIELDS/SPECIALIZATION: Issues of Arts Management; Environment of the Art World; Industrial Relations in the Arts

BACKGROUND: National Executive Secretary, American Guild of Musical Artists, 1946-71; Member, New York State Council on the Arts, 1965-71

Figure 38. Hy Faine, 1977 faculty guide.

I was grateful to our dean, Harold Williams, for helping me understand the boards of directors for major arts organizations. Boards are boundary organizations that help manage the relations with important constituencies in corporations, foundations, government, the patronage community, public, and other arts organizations as well as artists. I also learned that the boards of major arts organizations were among the few places the captains of industry could meet without the Securities and Exchange Commission (SEC) listening in. This was a lesson from the future SEC chairman.



HAROLD M. WILLIAMS Professor (1970); 825-7982; On leave, Chairman of the Securities and Exchange Commission

B.A. (Political Science), 1946, U.C.L.A.; J.D., 1949, Harvard

BACKGROUND: GSM Dean, 1970-77; Formerly Director, Norton Simon, Inc., ARA Services, CNA Financial Corporation, Signal Companies, Montgomery Street Income Securities; Trustee, Aerospace Corporation; Member, National Advertising Review Board; Energy Coordinator, City of Los Angeles; Co-Chairman, Citizens Commission on Los Angeles County Government; Director, Los Angeles Area Chamber of Commerce. Chairman of the Board, Norton Simon, Inc., 1969-70; President, Hunt Foods and Industries, 1968-69; Executive Vice President, General Manager, and President, Hunt-Wesson Foods, 1962-68

Figure 39. Harold Williams, 1977 faculty guide.

I was also grateful to Abbott Kaplan. I recruited Abbott to teach in the program after he faced mandatory retirement as the founding president of State University of New York at Purchase, the arts campus of the SUNY system. Nelson Rockefeller had selected Abbott to build the campus destined to occupy his family estate. Abbott had a PhD in adult education from Columbia, came to UCLA after WWII in the Institute of Industrial Relations, became the head of the UCLA Extension, and brought John Houseman and Gordon Davidson to UCLA to start the UCLA Theater Group, which later became the Center Theater Group at the Mark Taper Forum. Abbott had a deeply refined sense of how universities could enrich the communities around them. In the fall of my senior year in high school, the father of a girlfriend gave me two tickets to a UCLA Theater Group performance of "Between Two Thieves," a play about the trial of Jesus in a modern court that broke the fourth wall between actors and the audience. It made a memorable impression on me.[25]

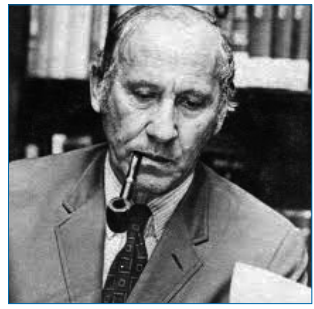


Figure 40. Dr. Abbott Kaplan.

In an attempt to create a network of university educators and arts managers, I organized the first professional conference for arts managers at UCLA in early March of 1978. On the first morning of the conference, a horrendous rainstorm shut off the power to all of UCLA. I was in a plenary session listening to Danny Newman. The room had many outside windows, so we weren't blacked out—very dimmed out at the worst. Danny, the guru of season subscription sales at the Lyric Opera of Chicago, didn't miss a beat. He had sold 104% of capacity of the Lyric for many years and was dedicated to spreading the word on the value of subscription sales. On the other side of the building was my new colleague, Mike Hanssens, giving his first professional talk ever to this audience of arts managers and some academics on the econometrics of altruism. He had put his bullet points on transparencies and the projector went dead when the power went out. He was always good at talking off the cuff, so it wasn't a disaster.

25. Playwright Diego Fabbri, adapted by Warner LeRoy.

I worked on the team that wrote *Art in the Economic Life of the City*, which won a research award from the National Endowment for the Arts. My solo part was a financial model setting goals for what nonprofit arts organizations should seek from walk-up buyers to long-term patrons and all other funding sectors. I published a couple of other articles including "On Art, Organizational Behavior, and Democracy." That was an outtake from my chapter in the book. The other pieces were more technical on using the information available to arts organizations to make better management decisions—the primitives of data-driven enterprise for the nonprofit arts. Cooper and Jacobs (1984) spelled out the system designs for using evidence-based tools in not-for-profit settings. Dan, in particular, did a great job of showing how silly the traditional assumptions of economic theory were when applied to arts organizations.[26] Where economic theory fails is a good place to look for evidence of what's really going on. I tried to develop some of the peer-review traditions that have helped advance other disciplines. It was like yelling into a bottomless well. The echo never came back.

Artists, arts organizations, and the arts managers are the core of the multidisciplinary teams that propel the arts. Most often these are temporary systems, such as we see in so many parts of the entertainment industry. The problem for an arts manager is how to steer the organization on a course determined by its stated mission and obtain the resources needed to thrive. It's further complicated by the segmentation of resources coming from intercorrelated markets. Scaling the house is a matter of how many differentiated experiences can be shaped around a potential singular experience. House revenue interacted with patronage, foundation, corporation, and government support. Beyond the complexity is also the underlying notion that the mission of an organization can help motivate employees and partners and help control organizational behavior as a bonus. People put more of themselves into an effort they value. These are lessons we'll learn again.

26. Niskanen presented a lecture to the arts management faculty and anyone else interested on the theory of mixed bureaus applied to not-for-profit firms. This was our response.

Chapter 3

My Academic Agenda

"Expect the unexpected; for it is hard sought and difficult."

— Heraclitus

"Everything that exists exists in some quantity and can therefore be measured."

— E. L. Thorndike

We were moving into an era when a manager could face a million new numbers a week. The first challenge to management in information-rich environments is transforming the raw data into information that is relevant to management. That takes a robust modeling framework (attraction models) and working to connect new data sources into the growing framework. Market simulators enable the *what-if* questions that are basic to tactical and strategic planning.

I described some of the factors pushing me away from arts management. Strong factors were pulling me toward somewhere else. My five-year walkabout helped me gain perspective on the importance to me of my research agenda. The battle was between the myth of a rational economic man and the dynamics of how real people were attracted to the choices they made in life. I always thought of economic man as greedy and myopic. *Nonsatiety* is the construct of greed. Economic man conveyed value as measured by *utility*, and *utility* was context free, among other silly assumptions it imposes on human behavior, as I describe later. Tversky laid out the issues that essentially demonstrated the differences in world view, *Weltanschauung,*

between psychological approaches and standard economic thinking. You can study this experimentally, which was not my interest. The experimental economists went on a 20-year campaign to prove him wrong and failed. Thus, you now have areas called *behavioral economics* and *behavioral finance* that look to behavioral decision theory for occasional doses of reality.

The Michael Lewis book, *The Undoing Project*, turns the collaboration between Amos Tversky and Daniel Kahneman into a compelling tale. That's quite a trick for a topic so steeped in quantitative psychology. My interest in the book was piqued by my academic kinship with Amos. We share an academic grandfather, Louis Leon Thurstone. As I mentioned earlier, Thurstone hired my mentor, Tucker, on the academic version of the Works Progress Administration at the University of Chicago in the 1930s. As head RA, Tucker was tasked to hire the rest of the RAs who were to do the mainly manual calculations needed for Thurstone's advanced analytical techniques—multivariate analyses using tables of plotted tetrachoric correlations and old manual versions of the Friden or Marchant calculating machines. Clyde Coombs was Tucker's first hire. After receiving his PhD degree at the University of Chicago, Coombs went on to the Michigan faculty and started doing foundational work in mathematical psychology. Tversky was his student. One of Tversky's earliest publications was a book with Coombs and Robyn Dawes,

If you wish to avoid a page of really geeky stuff, you are welcome to reconnect with the discussion of my long-term academic agenda in the bottom of the next page.

The difference between mathematical psychology and psychometrics is a minor shift in *Weltanschauung*. Mathematical psychologists try to characterize psychological states or traits probabilistically, formalize the underlying axiomatic structure, and analyze the shifts between one state or trait or another. I always felt that axiomatization formalized and froze theoretical structures too early. I was into exploration and more fit for the school of psychometrics that sought to develop the tools for extracting meaning from psychological data. I believed that, if you could model the data that actually characterized human choices, you would build the empirical evidence that *rational economic man* was at best an inaccurate and inconvenient fiction.

I first heard Amos speak at the spring 1970 meetings of the Psychometric Society at Stanford. At that point, his brilliance was clear, but his work was in the very arcane area of *representation theorems*. Then, he started working in areas parallel to me. His "Features of Similarity" article took a set-theoretic approach to multidimensional scaling (MDS), while my dissertation advanced more psychometric methods for MDS. I moved into attraction models to represent choice. Tversky spoke in the early 1970s to Jacob Marschak's *Interdisciplinary Colloquium of Mathematics in the Behavioral Sciences* on his "Elimination by Aspects" choice theory.

The geeky hook came from my reading of Tversky's "Features of Similarity," "Elimination by Aspects," and "On the Relation between Common and Dis-

tinctive Feature Models" (Sattath and Tversky 1987), and by Krumhansl (1978), "Concerning the applicability of geometric models to similarity data: The interrelationship between similarity and spatial density." Krumhansl said:

> In a recent article, A. Tversky […] questioned the application of geometric models to similarity data and proposed an alternative set-theoretic approach. He suggested that geometric models are inappropriate because the similarity data may violate the metric assumptions underlying such models. In addition, he demonstrated that the stimulus context and the nature of the experimental task can affect the similarity relations. It is suggested that a geometric approach may be compatible with these effects if the traditional multidimensional scaling model is augmented by the assumption that spatial density in the configuration has an effect on the similarity measure. A distance–density model is outlined that assumes that similarity is a function of both interpoint distance and the spatial density of other stimulus points in the surrounding region of the metric space. The proposed relationship between similarity and spatial density is supported by empirical evidence. The distance–density model is shown to be able to account for violations of the metric axioms and certain context and task effects. Other issues are discussed with respect to geometric and set-theoretic models of similarity. p. 445.

To my way of thinking, Krumhansl provided a crucial hook that Tversky could use to unite his models of perception with his models of choice from the set theory/math model side of quantitative psychology. I knew I had the pieces to do the same with the psychometric side. I wanted to put my puzzle together before he did.[27] This guided my selection of 40 pounds of books and articles I allowed myself for a six-month sabbatical on Mykonos, along with an HP-11c with 99 steps of programmable memory. I came back with 15 years' worth of research ideas. It was more than academic ego. The binding of these methodological streams on the measurement side enabled practice in the empirical world, rather than experimental settings. Looking back, it was a pivotal moment. If you ever want to create data-driven enterprises, you had to enable the measurement systems that gave data meaning and connected forward to the choices. Experimental connections won't suffice.

My long-term academic agenda began to gel during my sabbatical in Greece in the first half of 1979. I had a decade of accomplishments in a variety of areas, and I had to decide where my academic home was going to be. The quantitative side of marketing—marketing science—seemed the best fit for my skills. The first variant of my

27. He never made the connection. His brilliant career, cut short by his death in 1996 from a metastatic melanoma, went more deeply into behavioral decision theory for which his co-author, Daniel Kahneman, won the Nobel Prize in Economics in 2002.

agenda was to establish a system of models that went from perception to preference to choice that could scale to the market level while maintaining fidelity to systematic individual differences. This stood in contradistinction to the models of economic man as a utility-maximizing normative automaton. The economic view of the time held that all deviations from the average were random and chaotic, while I grew up academically in the school of thought that asserts that stable, systematic differences exist between groups of people—differential psychology. Beyond the normative simplicity of economic man was the notion that the utility this mythical man attached to potential choice objects was *context free*. Such a view cannot handle obvious situations, such as the classic Red Bus-Blue Bus problem (*cf.* Debreu 1960). Say you have a transportation choice between a red bus and a taxi and prefer a taxi 4:1 (80:20). If a blue bus is added to the transportation choices, the traditional economic models are forced to predict that taxi preference drops to 66.7:16.6:16.6 since the 4:1 preference ratio must be maintained for each of the bus choices rather than 80:10:10 (i.e., since color is irrelevant). Silly. Context matters. Nakanishi addressed this in our first joint effort (Nakanishi, Cooper, and Kassarjian 1974).

We were developing competitive attraction models—powerful models for the probability that one option will be chosen from a competitive set. Voting choice was the first application. Such models require ratio-scale data. Binary data are not allowed since zeros don't play well in multiplicative models. You could think of them, however, as counts of the possession or non-possession of a series of attributes: endorsements, incumbency, occupation, ballot position, etc. This was voting for multiple offices of the Junior College Board of Trustees. Masao came up with a simple counting scheme: If you have m options (e.g., candidates or brands) c of which have an attribute, then assign m/c to the options possessing the attribute and $(1 - (c/m))$ to those that don't. If all options have the attribute (i.e., $c = m$), this reduces to 1, which makes no difference in a multiplicative model. It takes a maximum value of m if only one option possesses the attribute and a minimum value of $1/m$ if only one option doesn't possess the attribute.

This transformed zeros and ones into numbers that were meaningfully usable in ratio-scale models. More fundamentally, we asserted that, in multi-attribute attraction models, you should recognize that attributes differ in value to the person voting or making marketplace choices. We need a reflection of distinctiveness to convey how the importance of the attribute is shared by the choice options possessing it. Most *importance weights* are estimated empirically. Failure to separate the role of distinctiveness leads to biased estimation of the underlying *importance*.

While we required this transformation for binary data, we did not need it for ratio-scale data. Yet, the failure to use it for ratio-scale data would lead to biased estimates. We still need an index to show how an attribute's value is shared among the alternatives that possess it. The first task of my sabbatical was to figure out

what this index of distinctiveness implied for ratio-scale data and then for interval-scale data.[28]

I used one of the few things in statistics where I could bridge back to my short study of physics. *Moments of inertia* are multivariate generalizations of *variances*. I built a distinctiveness index by comparing the *moment of inertia of an individual point* in a high-dimensional distribution of points to the *central moment of inertia*. This could be done for both interval-scale and ratio-scale measures. I proved that, for binary data, this reduced to the Nakanishi-Cooper-Kassarjian (*NCK) distinctiveness index* Masao had previously designed. This is the geekiest of accomplishments, and I'm very proud of it.[29] Because of it, psychological data could have common footing with econometric data in market-level attraction models. Explanatory power dictated the winners. It was an *homage* to my psychometric upbringing. I see a long-term trend in just throwing any choice data into a logistic regression and thinking of it as a linear model with a funny error distribution. It is not. It is a multiplicative attraction model at its core.



Figure 41. Mykonos harbor.



Figure 42. On Nicholas's boat with Bob Lee and Ann.

28. Ratio-scale data are like *dollars* where two dollars are worth twice as much as one dollar. Interval-scale data are like temperature in *Centigrade* where 2°C is not twice as hot as 1°C, but a 1°C temperature increase has the same meaning throughout the range.

29. This distinctiveness index also reflected Heraclitus' maxim of the regulating tension of opposites. "All things are in flux; the flux is subject to a unifying measure or rational principle. This principle (logos, the hidden harmony behind all change) bound opposites together in a unified tension, which is like that of a lyre, where a stable harmonious sound emerges from the tension of the opposing forces that arise from the bow bound together by the string." Heraclitus.

I came back from Mykonos with what we called *zeta scores* generalized to all data types and pursued the MDS side of developing the linkage. I went down a rabbit hole searching for a common reference space underlying similarities, preferences, and choices. I went through weeks where I had to solve a different problem every day or my whole research program would fall apart. It doesn't take many weeks of that to test your commitment. I was committed. After that, there were weekly problems that threatened my whole future. I eventually worked through those and came out the other side with a much clearer sense of the future in this search for a reference space. I named the program RASCAL, which stood more for the struggle than any standard acronym. I finally saw the future of this research path, and it wasn't all that bright.

I'm still looking for the cartoon I had on the wall next to my old desk in my study. It showed a man hunched over a typewriter with his wife and small children hovering behind. She says, "Sssh children. Daddy must write something funny or we'll all starve to death." I ran across it many years ago, after we didn't starve, and cut it out immediately.



Figure 43. Japan Academy of Commerce Award.



Figure 44. Mort Drucker poster.

Masao lured me willingly back to the market-measurement side. My generalization of the NCK Distinctiveness Index (i.e., zeta scores) provided the linkage to bring all kinds of data into market-share attraction models. Scanner data were on the immediate horizon. The challenges Masao saw were in using that link to expand the array of competitive influences we could parameterize

into our models. Fully cross-competitive models were routinely criticized for extreme collinearity—the point at which the explanatory variables are so highly correlated that you can't obtain good estimates of the influence of each separate one. Reflecting to market context using zeta scores eliminated the problem. We wrote a book in 1988 that developed this class of models to aid decision-making in real-competitive markets. I developed a market simulator for tactical brand planning in competitive markets based on the real data and the models published in the book. The simulator, turned into a brand and channel management multi-team game, won the grand prize from a *PC Magazine* judged software-development contest.[30] The book won a prize from the Japanese Academy of Commerce, the first time a book not originally published in Japan was chosen for the honor. The award had a cash prize, a trophy, free software, and other swag, but all I really wanted was the original of the Mort Drucker cartoon advertising the contest. I only got a poster from the session at COMDEX where the award was given.

My agenda expanded with each new data source that became available. The sub-discipline I identified with most closely was *marketing science*. Winer and Neslin (2015) wrote on the history of this field. I was pleased to be mentioned in it. My own synopsis follows.



Figure 45. Ashton-Tate Trophy.

30. I want to thank Laurel Neustadter and Brian Bunker who helped mightily with the code for CASPER, Competitive Analysis System for Promotional Effectiveness Research, in Ashton-Tate's *Fred* programming language. For a very brief time, *Framework* was adopted as a UCLA B-school-wide standard for spreadsheets, word processing, and graphics.

You have to think back to the early days. Large-scale competitive analysis was done inside corporate firewalls for the most part. Data intermediaries syndicated transaction data to clients, often with a good array of causal variables. In competitive markets, there are arrays of data for each market player. Nakanishi and I developed models that simultaneously analyzed these arrays to reflect the full range of competitive interactions and the full range of data levels (e.g., nominal, ordinal, interval, and ratio) for each competitor (Cooper and Nakanishi 1988). We also modeled total market volume and showed that, under robust assumptions, you could combine share and total market volume models into real market simulators. I showed how you could visualize and animate the complex, competitive market dynamics as these changed over time or circumstance (Cooper 1988a).[31] In Cooper, Klapper, and Inoue (1996), we showed how the methods could be extended to three-mode arrays or beyond. In Cooper and Giuffrida (2000), we showed how to use machine learning (i.e., rule-generating data miners) on what the competitive market models left behind to develop stable, generalizable knowledge. It was the first to get through the review in *Management Science* for a simple reason. We showed that, once you've pulled out all the systematic information captured by the best traditional methods, more systematic information came from datamining the supposed garbage. Cooper and Nakanishi (1983) connected these models to ideal-point models and the broader area of MDS. Rhim and Cooper (2005) showed how to combine these models with normative market-entry models. Carpenter,

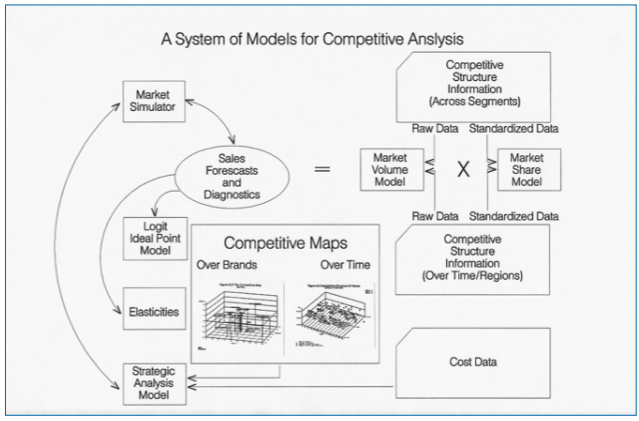


Figure 46. A system of models for competitive analysis.

31. Probably the greatest throwback into my psychometric history came when I thought about asymmetric arrays of cross elasticities. I thought of them as scalar products with ratio-scale properties. You could factor them to look at underlying structure. They were the only data I'd encountered that fit a special case of the three-mode factor analysis my mentor had specified late in my doctoral studies (Tucker 1969).

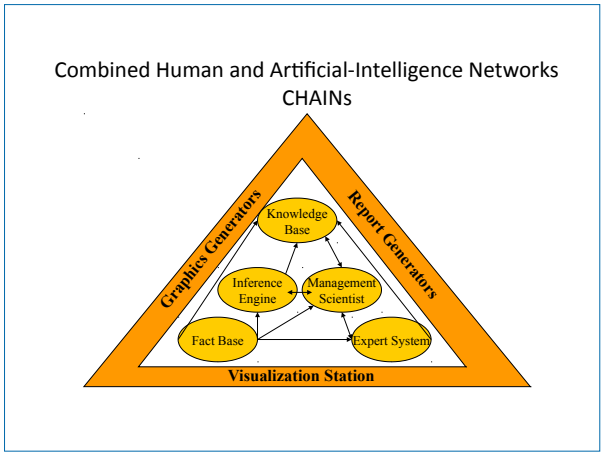


Figure 47. Combined human and AI network.

Cooper, and Hanssens (1988) developed asymmetric competitive models and their normative implications. Midgley, Marks, and Cooper (1997) showed how to do strategic modeling with machine learning (i.e., genetic algorithms) when standard normative-economic assumptions aren't realistic.

In the 1980s, real markets, real data, and the challenge for real managers intrigued me enough to start teaching product management using real data. This merged data modeling with decision-support systems. I started thinking and writing about combined human- and artificial-intelligence networks (CHAINs) (Cooper 1988b). In the process of teaching, I found the numbers and decision support were half the problem for the manager of a cross-functional team. I'll deal with the other half as I get to the systems driving strategic planning below.

With a few normative exceptions, these are tools of exploration with sufficient statistical development to know we dealt properly with the unknown. They were designed as lunar exploratory vehicles rather than Ferraris. When the terrain is uncertain, a Ferrari isn't very useful.

Although my work with Rhim introduced market growth (i.e., brand-entry decisions), it took the work of Bronnenberg *et al.* (2000) to nest all of these frameworks within a system of methods for modeling empirical market evolution. I think Bronnenberg did a brilliant job creating this larger framework.

I've written somewhere that analytical tools have a focal length like camera lenses: telephoto, portrait, wide angle, or close up. Even with Bronnenberg's work widening the angle, it's the widest-angle view that was least served by the then-existing methods.

If you want to use these models to drive an enterprise through a real and uncertain economy, you need to understand the networks of risks: technology risk,

human risk, financial risk, and market risk. My work (Cooper 2000) on using Bayesian networks to drive strategic planning provides a quantitative framework for strategic planning that is compatible with simulation results based on the more focused methods already developed. Even without the detailed models, the Bayesian framework is far superior to the rhetorical alternatives (e.g., scenario planning, *cf.* Schwartz 1996). Telling a story about possible futures is not as valuable as a risk-driven network analysis that can be readily updated as assumptions change, models improve, or plans and assumptions become reality. The network will forecast the outcome of a wide variety of scenarios, generating numerical expectations for each variation. As I elaborate elsewhere, the 3D printing industry was transformed from rapid prototyping into direct manufacturing using this framework.

From tactical brand planning to strategic enterprise planning, I've helped build management as a data-driven, quantitative skill. In my dissertation, I offered direct criticism of the simplicity and bias resulting from the model of a rationale economic man. In my career, I helped construct the empirical and analytical alternatives that do not rely on such a rigid ideology. The thinking is covered further in Chapter 5: Project Action.

Tversky and Kahneman made more substantial and singular contributions demonstrating time after time that the assumptions of rational economic man are not supported experimentally, while providing many experimental results supporting their alternative theories. My contributions were as one in a cadre of pioneers that showed the assumptions of rational economic man are not supported in the vast data characterizing markets and competition, while developing the scalable methods for getting a more realistic understanding.

Until I started Strategic Data Corp. (SDC), my agenda was quite arcane. Another tale supporting my *GSMmy* award came from the *Dallas Morning News* (March 12, 1986) article by the Business Day columnist Robert Miller. The title was "Technology being tapped to understand consumers." He starts by saying, "Some of the subjects are so esoteric, the mind suffers from the bends just by reading the lecture titles." He launched into an eight-column-inch description of *The Institute of Management Science* conference being held in Dallas. Then, he says, "You've been patient. Now for a few of the subjects to be discussed. 'A Four-Mode Factor-Analytic Approach to Parameter Heterogeneity in Scanner-based Market-Response Models,' by Lee Cooper of the University of California at Los Angeles." All this without a colon in my talk title.

Psychometrika's motto, which was printed on the cover for the first 50 years, was, "Devoted to the development of psychology as a quantitative rational science." I was one of the pioneers in bringing psychometric thinking to managerial decision-making. I did it with behavioral data, and then with scanner data. In those cases, I chose not to try to promote these methods commercially. Such efforts I

left largely to others, providing a small amount of consulting to help others along. Information Resources, Inc., AC Nielsen, and other data intermediaries had spent a great deal of time and effort building the data collection and handling infrastructure. With the move to Internet data, I felt pioneering models was not enough for me or the field. Those were the days when it took 36 hours to analyze 24 hours of weblog data. Infrastructure was needed. Here, I had to lead to have the effect I desired. That's the story of *Midlife ~~Crisis~~ Startup*. That book is available free from the ResearchGate website. The epilogues appear later in this book.

More developments follow, but I want to interject some history on the collapse and rebirth of the marketing faculty. At the end of the 1981–1982 academic year, a large group of faculty left for a variety of reasons: Jim Bettman, Rich Lutz, Bart Weitz, Morgan Jones, and Debbie Roedder. Masao Nakanishi, who had just been visiting for the year, went back to Japan. I had a farewell party at my house in Nichols Canyon. Ann just found a famous photo of the departing class.



Figure 48. The faculty exodus of 1982 (top and bottom).

We gained Bob Meyer in the fall, and Greg Carpenter joined us in January 1983. Mike Hanssens and I were the only continuing faculty on the marketing-science side. We devised a plan to look larger than we were at the Spring Marketing Science Conference in Chicago. We agreed to do two presentations each – airtime for eight. It did help us in recruiting Barbara Kahn, Sunil Gupta, Jagmohan Raju, and Randy Bucklin in the next few years, building one of the strongest marketing-science groups in the world in the immediately following years. The behavioral subgroup hired Kent Nakamoto. Some great collaborations developed between the behavioral and marketing-science faculty. Carpenter and Nakamoto's work on pioneering brands started in the office next to mine, the one Nakanishi used to occupy. In 1987, Don Morrison came—the first ever senior-level hire in the marketing group. Jennifer Aaker, David Bell, and Gavin Fitzsimons followed shortly. All ten are now chaired professors: two at UCLA and the others at Stanford, Wharton, Harvard, Northwestern, Duke, and Florida.

Chapter 4

The Hike 'N Camp Fest

"Everything changes, and nothing stands still."

— Heraclitus

In the face of constant change, organizations, particularly those driven by their mission, occasionally need to regenerate their sense of mission. Bonding often comes from working as a team in very different circumstances than normal.

This is really Bob Meyer's story—one of a host of great Bob Meyer stories best told by the original author. With acknowledgment, I relate it as follows.

It's May of 1983, and Bob proposes that the marketing faculty take their young families camping in the San Gorgonio Wilderness. The larger group winnowed down to Bob, Mike Hanssens, and me. I don't remember why the rest of Mike's family couldn't go, but my three-year old son, Joey, was just getting over the chicken pox. We had camped with Joey since he was an infant. I packed like I would for an easy overnight hike I might take Joey on. I have on light hiking shoes, and Mike has the boots in which he walked across Lichtenstein. The photo below shows our beginning. The snow seems far off. Not 50 yards down the trailhead, we get into the snow. I have no idea when the trail Bob had planned diverged from the trail we were following. We slug on for hours until Bob saw that we were about 800 feet above the place where he thought we would camp for the night. We are not about to give up 800 feet of hard-gained altitude. We set up camp in a somewhat level patch, in a snowfield on the side of a big slope.

Mike's shoes have already begun to deteriorate. After an inebriated evening of great camaraderie and terrible food, we all manage to get a good night's sleep.



Figure 49. Snow in the distance.



Figure 50. Snow 100 yards in.



Figure 51. First sign of shoes disintegrating.

In the morning, we prepared for the ascent of the peak. Bob brought out extra snow pants, gaiters, ice axes, and, most importantly, plastic bags to put under our socks to keep our feet dry. Bob sensed that we were totally unprepared for the adventure he envisioned and packed accordingly. The ascent to the top of Mt. San Gorgonio was much more arduous than I imaged. We took an alternate route

through a snowless scree field and reached the summit. Bob pulled out a questionnaire, and we help Bob set a world-altitude record for conjoint analysis studies. I think his record still stands.

The prospect of working our way back down the scree was daunting enough that we decided to go along the crest looking for an easier way down. The first obstacle we encountered when it was too late to turn back was a snowfield that went to the crest. We had to traverse it to regain the crest trail. We used the snow shovels and ice axes to inch our way across. I remember holding on by my frozen knuckles and toes and loudly complaining that I could have ended up with my three-year old son on this slope. I don't think Bob was amused. We regained the trail, but were soon faced with another, narrower snowfield with large boulders on either side descending the first 150 feet of probably an 800-foot slope.

The new plan was to work our way down the side until the field was clear and we could slide. Mike was the first to lose his footing. He careened spread eagle, without any control, barely missing the life-threatening boulders on the side. That's him below, the dot in the center of the snowfield, alive and unharmed.

Bob and I worked our way down the side, half envious of Mike's slide, but pretty sure we would not be as lucky if we lost footing. At one rest point on the trek back to the parking lot, Bob snapped the photo above of the now disintegrated boots. If



Figure 52. Bad food and good company.



Figure 53. Outfitted from Bob's stash.



Figure 54. World-altitude record for conjoint analysis.



Figure 55. Bob Meyer, principal instigator.



Figure 56. Deteriorated boot.



Figure 57. Mike sliding 800 feet below.

it weren't for the extra plastic bags Bob brought that we all put on under our socks that morning, we would have ended this trek with a few less toes at least.

The final insult came closer to the end when the snow I was walking on gave way and I found myself standing in an icy stream with only my head and shoulders above the snow. Bob didn't see me cave through but looked up and was freaked when he couldn't find me. Mike and Bob rescued me, despite my inhospitable mumblings.

This was my bonding experience with Mike and Bob that helped us to build the area back to full health. We had a good number of much tamer family camps before Bob and Barbara left UCLA—great memories with the young kids playing in idyllic mountain surroundings. The first one holds a special place in our memories. Organizations periodically need to regenerate their *raison d'être*.[32] Because of the ardors of the journey, we need each other to succeed.

32. Elliot Mittler (1974) introduced me to organizational regeneration in his dissertation research. It's particularly relevant for temporary systems, such as theater companies or long-term projects.



Figure 58. Beach football, recruiting Mike Hanssens.



Figure 59. Families at a Hike ‘N Camp Fest.



Figure 60. One of the many faculty retreats at Lake Arrowhead.

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Chapter 5

Project Action

"Disruptive Innovation describes a process by which a product or service initially takes root in simple applications at the bottom of a market—typically by being less expensive and more accessible—and then relentlessly moves upmarket, eventually displacing established competitors."

— Clayton Christensen

Strategic planning for disruptive innovations requires more than the tools for managing in information-rich environments. The interplay and dynamics of strategic risks must be understood in a way that can be updated as future events unfold and assumptions turn to facts. Storytelling will not do.

In the early 1990s, I participated in the Multimedia Round Table conferences organized by Martin Greenberger, then the IBM chaired professor at our school. These conferences explored the convergence of digital technology and entertainment. This was in the days when the fundamental bundle of assets in the multimedia PC was still being debated. Steve Mayer, one of the founders of Atari and originally the head of Atari's Advanced Engineering, was a regular at these conferences. In the early years at Atari, I marveled at how little my knowledge of marketing research had to offer, as Atari created a new industry. No need for sophisticated forecasts, Atari knew that it had a hit arcade game when the coin boxes jammed because they were overfilled with quarters.

After several years of our interactions at the Round Table, Greenberger invited me to join a group of three traveling for a day to the Intel Architecture Labs in the mid-1990s. The deal was that we would listen and give feedback on the work of in-

ternal Intel research teams on Monday in Oregon. On Friday, representatives from Intel would come to UCLA and listen to research ideas that seemed aligned. What I remember were small teams at Intel of really bright physicists doing ethno-methodological research to understand how consumers used technology in the living room, rather than the office. On Friday, I pitched an idea on developing quantitative research methods for radically new products. Martin named his effort *Project Vision* and dubbed mine *Project Action*. Intel funded our two projects and three projects from other parts of UCLA. Everything was funded a year at a time. The first year of the research, I learned as much as I could about disruptive innovations and discovered that the real issue concerned having a strategic-planning framework broad enough to cover the disruption and robust enough to handle complex risk scenarios. Intel funded an additional two years of my work in strategic planning for radically new products.

In that first year, Sarah Appleton Knapp, an entering doctoral student, did a great job of helping organize and digest the broad relevant literature. I would run across technologies new to me (e.g., *Documentary Petri Nets*) and would ask Laura Baron, Penny's daughter and an applied math undergraduate also working for me at the time, to develop a tutorial. After leading me through the tutorial, we would decide if this technique fit the need as I envisioned for it. Laura thought this was her best job ever. We went through a few before I asked her to look at Judea Pearl's work on Bayesian belief networks. This was it. *Scenario planning* was the rhetorical approach in vogue (Schwartz 1996). Planners would tell stories of possible futures, rather than forecast and think through how robust their plans were to the envisioned future states. If events didn't happen as the scenarios postulated, one was left with little insight as to how the changes affected the likelihood of success. Bayesian belief networks[33] were designed to be updatable, as assumptions were supported or contravened by ongoing events. I adapted the Bayesian methods to strategic planning for radically new products and published it in the *Journal of Marketing* (Cooper 2000). It was the only article I ever sent to that journal. It was selected as the lead article in the January 2000 issue and won the outstanding-contribution award from the Marketing Science Institute (MSI).[34]

33. I was writing about Bayesian belief networks in early 2002, when Judea's son, Daniel Pearl, was kidnapped and murdered in Pakistan while working for the *Wall Street Journal*. I was tremendously shocked and saddened by the news.

34. The H. Paul Root MSI Award is given by the American Marketing Association to honor the Journal of Marketing (JM) article that has made the most significant contribution to the advancement of the practice of marketing. I would like to thank David Stewart, then editor of JM, and editorial board of JM for selecting this article as the lead for the January 2000 issue and supporting the article for the Marketing Science Institute award.

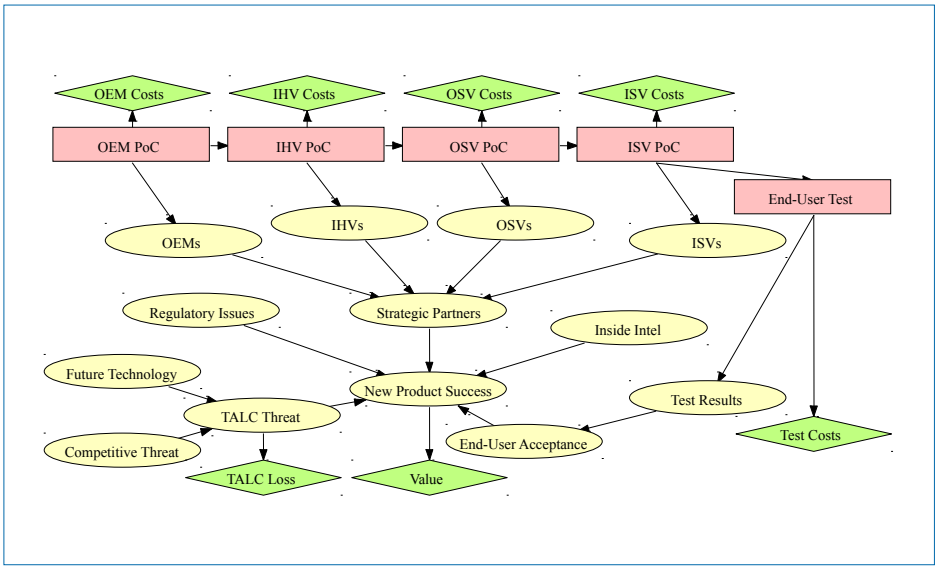


Figure 61. Bayesian network for a prototypical new product from Intel.

Travis Kalanick

In January 1999, the future CEO of Uber, then a UCLA undergraduate, came to my office. I was teaching an advanced MBA class Marketing Strategy in the Digital Economy, and he was doing a startup called Scour.net. He was a bright and inquisitive kid. I remember some of our initial conversation. He talked about his startup and his summer at the Boston Consulting Group. He was looking for help. I gave him two pieces of homework to see if he was serious. 1) "Strategic Marketing Planning for Radically New Products," a late draft of my 2000 *JM* piece and 2) "Barriers to Digital Convergence," a long report Troy Noble and I did for Larry Kubota. Nippon Telephone and Telegraph was his client. Troy interviewed 40 tech leaders and organized their comments into the critical-issues grid I discussed in the 2000 paper.

Travis came to my office on a Thursday. By the following Tuesday, Travis was done with the first assigned reading, halfway through the second, and wanted to meet to discuss some issues. We met at my regular office hours the next day. He had done his homework. Our interesting discussion led to shaping an agenda that should appeal to the teams in my spring class. Two very good teams wanted to work with Travis on Scour.net. We ended up with seven MBA students helping him with customer acquisition, branding, and product/experience strategies.

I had never heard of Travis or Scour.net before our first meeting. Perhaps I was influenced by the memory of how welcoming Ghiselli was to me that kept my door

open to this undergraduate outside his turf. I asked my sons (then 18 and 12), and they both knew and probably used Scour.net to find music. That clinched it. I helped.

Travis and I kept in touch until fall when I offered another team and shared my progress on the due diligence for and funding of my own startup. I caught up on his story through a talk he gave at FailCon in 2011. That video showed a lot of growth. Much has happened since then.

I found out only recently that Richard Wolpert, currently the CEO of HelloTech, was on the Scour.net board of directors along with Michael Ovitz, the former super-agent. Richard oversaw the digital portfolio at billionaire Ron Burkle's Yucaipa company that was a major backer of Scour.net. Richard tells the rest of the story in his new book (Wolpert 2017). Richard brought a $55 million deal from Rob Glaser, CEO of Real Networks, with a strict "no shop" admonishment (i.e., bad things will happen if you use the current discussions to try to get a better deal elsewhere). Travis and team insisted on shopping it and ended up in bankruptcy court. Richard's story is definitely worth reading.

Yucaipa was also part of the $5 million B round with my startup, SDC. Richard left before the May close of my B round. If he were there, he would have advised me to take the $11 million that was on the table. Nobody wanted a haircut. That mistake, along with a hostile dean, ultimately cost me control of SDC. Richard and I also advised Lawrence Ng at different times at Oversee.com. Many places we almost met, but finally, we were part of the same angel-investing group.

PromoCast

PromoCast was the most formalized analytical system I worked on until I started Strategic Data Corp. My long-time friend and colleague, Penny Baron, had partnered with Wayne Levy to start Efficient Market Services (EMS), Inc., a data intermediary focused on efficient consumer response (ECR; i.e., getting the right product in the right place at the right time and right price). Years earlier, Penny was one of the co-founders of Information Resources, Inc. (IRI) and brought the first scanner tapes to me at UCLA in the early 1980s. Penny had the delightful ability to explain my ideas to others better than I could. She always understood what I wanted to try and let me see where current practice affected my approach. Once we figured out those things, she communicated with a pace and fluidity that always made my thinking clearer than I ever could.

Before we got far into development, Penny gave me a practical quiz. One of her basic products involved maintaining baselines for expected product sales. Sending negative baselines is typically misunderstood by clients. I designed an algorithm

where baselines were always nonnegative when stochastically justifiable and signaled when something systematic was going on. It was simple, but that was the point. If I over-engineered the simple stuff, I'm not sure Penny would have trusted me as much with her real agenda.

There were many services EMS, Inc. offered manufacturers; IRI and Nielsen offered similar services. The value to retailers was less compelling. Penny decided to take on the retailers' planning efforts. Retailers plan promotion events basically 13 weeks ahead. Can we develop smart methods for forecasting the results of promotion events early enough to affect the integrated supply chain? I helped Penny design an event-history database structure that could feed models at the UPC level for the broad array of promotions and accumulate the appropriate indices. It was a state-of-the-art piece published in *Marketing Science*. The state-of-the-art left a lot of potentially useful information behind that became grist for the data miners Giovanni fashioned.

By the time the datamining article was published in *Management Science*, Penny had closed EMS, Inc. The retailers' margins may be too narrow to support such value-added services. I've always wondered what would have happened if the data mining was part of the original PromoCast. Could EMS, Inc. have survived? You have to ask Penny for the real story.

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Chapter 6

Strategic Data Corp.

"Asses prefer garbage to gold."

— Heraclitus

We had helped build the infrastructure that let academics develop models of market dynamics from real data when the challenge was a million new numbers a week. What infrastructure was needed when that rose to 9 billion a day? That's not fundable within the university. My startup was formed around technology-enabled marketing and driven by an actionable segmentation scheme that could provide the asses with garbage while giving gold to the other segments that demanded that.

So, there I was in 1999. I'd been on the faculty 30 years. Having created and taught classes in marketing strategy in the digital economy, I understood the disruption occurring in the digital world. I had planning and discovery tools I knew were amenable to use in that world. I watched some of the students from my classes drop out to do startups and asked myself if I had anything to add to the Internet's first disruptive wave. Was there something I could do outside the university that would help further the kind of career I'd had inside? I never thought about being something other than an academic. I wanted to be something more. That's the moment I became an entrepreneur. I started thinking, talking, and writing about technology-enabled marketing. In particular, I thought about technology-enabled marketing in e-commerce.

An online store could have practically infinite inventory, but very limited visual geography. The smarter the e-retailer could be about knowing the customer, the

more effective it should be about presenting items of interest on the limited screen space. I learned from my teaching prep that the virtual supply chain was completely integrated except for the tip of the snake: demand forecasting.[35] Demand varies by segment. Segment and customer-oriented recommendation engine (SCORE) was the name I gave that enabled part. I carefully selected measures from the US Census to reflect six underlying socio-economic dimensions and segmented the zip code files into 22 groups. (N.B., It was actually a hierarchical-clustering scheme that used data density to signal which level of clustering to use. Akihiro Inoue crunched the numbers from Japan.) Further splitting by gender and broad age groupings provided the basis for learning how the preferences in each group were reflected in product choices for each particular online retailer. All I needed was the zip code, age, and gender, the basics of direct-mail marketing, and I could provide the e-retailer with recommendations personalized for each customer. Each online customer would be greeted by the perfect clerk.[36] The original design protected privacy by running analyses within the eretailers' databases, not outside. Only the instruction code went across to SQL servers on the inside. The same segmentation system, called RealSegments, would reveal customer patterns specific to each different e-retailer. If you combine SCORE with the trending mechanism Giovanni called MOMENTUM, you have a general framework for online recommendations and personalization.



Figure 62. The all-UCLA founding team at an SDC in a planning session at UCLA: Troy Noble, Kate Winegar, Giovanni Giuffrida, Jason Knapp, and David VanMiddlesworth.

35. Jason Knapp, then a recent Anderson alum and rising star at AT Kearney, knew the gap in the virtual supply chain as a result of a major consulting project with HP. He instantly saw the role of SDC and agreed to join our founding team.

36. PerfectClerk was the name that one of the SDC founding team members, David VanMiddlesworth, gave to our first service. I always conjure up the memory of walking with my older son into the Brooks Bros store closest to Johns Hopkins University. "Can you direct us to the med-school interview suits?" I asked. "Right this way, sir."

This was a UCLA-driven startup. While the core of the original technology was from a segmentation scheme whose mathematics dates back to my graduate work at the University of Illinois, UCLA pervaded the talent that made this venture go:

- Giovanni Giuffrida was a UCLA doctoral student when we met. He finished his PhD while working for SDC as CTO.
- Jason Knapp (UCLA MBA) was VP of Client Services and SVP.
- Ravi Narasimhan (UCLA MBA) was director of Technology. He finished his MBA while working at SDC.
- David VanMiddlesworth (UCLA Executive MBA) was CFO and VP of Administration.
- Kate Winegar (UCLA MBA) was VP of Marketing.
- Troy Noble (UCLA MBA) was the manager of Client Services.
- Caroline Cicchetti (UCLA BA and MBA) was director of Client Solutions and Support. She finished her MBA while working for SDC.
- Kevin Burke (UCLA MBA) was product manager.
- Vanessa Beddo (UCLA PhD statistics) was an analyst while in her doctoral program.
- Michael Judd (UCLA MBA) was the business development manager.
- Robert Jew (UCLA BS and MBA) was in product management.
- Jeri Conard-Kennedy (UCLA executive MBA) was part of some very early meetings and planning.
- Xuegao An (UCLA MS and PhD nuclear engineering) worked directly with me in the SDC's Office of Research.
- Asha Vellaikal (USC MS and PhD in electrical engineering) was our first director of Technology—just to show our inclusivity.
- Donald Morrison (chaired professor at Anderson) was on the advisory board.
- Dominique Hanssens (professor at Anderson, later named to an endowed chair) was on the advisory board.
- Bart Bronnenberg (assistant professor, later full professor at Anderson) was on the advisory board and was a retained consultant.
- David Midgley (visiting professor at Anderson) was on the advisory board.
- Akihiro Inoue (UCLA PhD, professor in Japan) was on the advisory board.
- Skip Brittenham (UCLA Law) was on the board of directors.
- Paul Brindze (UCLA Law) was legal counsel.

I was proud of the depth and breadth of the UCLA connection. With all there was to be proud of, I did not have the support of my dean, Bruce Willison.

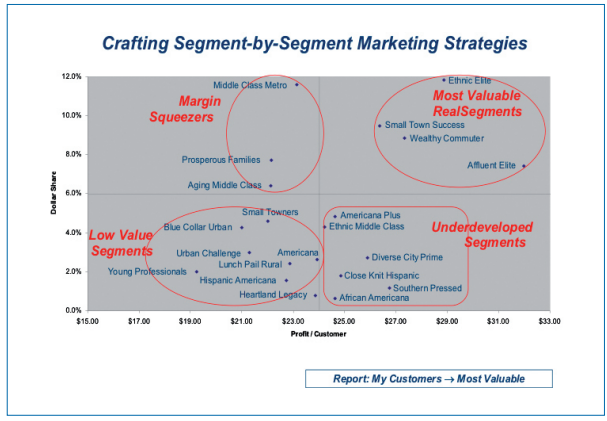


Figure 63. Developing a marketing strategy from what real segments means to an e-retailer.

I had been told that, in discussions with the dean, the head of computing services was blaming all his deficiencies on the employees that were looking to jump out of his reach. Here is the email stream that sets the example:

> On Wed, 9 Feb 2000 22:36:51 -0800 Lee Cooper <lee.cooper@anderson.ucla.edu> wrote:
>
> Bruce,
> I have been informed that several personnel from Anderson Computing & Information Systems have approached Strategic Data Corp about jobs. If you have any objections to their being granted interviews, please let me know.
> Lee
>
> ---
>
> From: bwilliso@anderson.ucla.edu
> On Behalf of Bruce Willison
> Sent: Thursday, February 10, 2000 6:56 PM
> To: Lee Cooper
> Cc: dhanssen@anderson.ucla.edu; dmorriso@anderson.ucla.edu; Dunn, Stacey
> Subject: Re: ACIS
>
> Thanks for asking, Lee. Here's how I see it: we have a near crisis situation given the people SDC has already taken; yet, we can't prevent our employees from talking to the company. But in many similar situations, I've seen the hiring company be smart enough not to recruit/interview addi-

tional folkes [sic] from the same company. We may well have legal steps available to us to prevent it; at the least, the firm would be making strong enemies here at the school.

Bruce G. Willison
Dean
The Anderson School at UCLA

My reply:

Bruce
I believe it is in the long-term and short-term interests of the Anderson School to maintain good relations with the Strategic Data Corp.
We are building the best empirical marketing science group in the world at Anderson. Data reflecting our digital age will drive next wave of methodological development by the outstanding scholars we have in this area. At the same time, we are threatened by the exclusive relation that Wharton established with Media Metrix (a major source of web panel data), the alignment of the Haas faculty with another webmining firm, and other faculty-industry alliances that could hamper our access to the data and problem settings for marketing management in the digital age.
As I did 20 years ago with the advent grocery scanner data, I am now establishing the infrastructure for the next generation of empirical marketing science at UCLA. Then, I brought the first scanner panel data from IRI to UCLA before any other academic institution had access – leading to many years of publications in top journals by me and my colleagues. The same was true for store tracking data that the retail grocery business uses for managerial decision-making. Because of my research and industry ties we were among the first to receive and use multi-category "single source" data from AC Nielsen. I am the first to have access to and publish analyses of promotion event data (*Marketing Science*, December 1999). I am the first to get a datamining article through the review process in *Management Science* (February 2000).[37] And my article on "Strategic Marketing Planning for Radically New Products" was selected as the lead article of the millennium in the *Journal of Marketing*.

37. Giovanni provided the brains behind the rule-generating data-miner. Rule-discovery algorithms became a disciplined way to proceed when normal methods have been exhausted.

SDC is building the relations with digital enterprise that facilitates the connection between the scholars and the data that drive their thinking. This generation will not have to spend the years I devoted the last time around to setting up the data infrastructure.

Six of SDC's employees are UCLA alums. Five are alums of the Anderson MBA program. Maintaining good relations between the Anderson School and the firms that hire Anderson alums is clearly in Anderson's interest. Having visible success stories of Anderson-led efforts in the digital economy will help recruiting the next classes of Anderson MBA students.

My efforts are bringing me in contact with the leaders who are shaping the convergence of computing, communication, and entertainment. These experiences are being translated directly into the content of my classes on both market assessment and product strategy in the digital economy. There is a true synergy between my developing the research infrastructure, bringing rich real-world content into my classes, and my efforts to help build SDC.

SDC did not "take" any employees from Anderson. All three former ACIS employees were seeking alternative employment. Two were extremely active in that search, and you knew (or should have known) that to be the case for at least one of them. Even if recruitment had occurred, a premise that we do not grant, the UCLA employment manual in no way restricts recruitment of staff personnel by former employees. If you believe you know of some provision that applies, please inform me. For you to threaten legal action without a basis is an unfriendly act.

To lay the problems of ACIS on SDC is an irresponsible act. Institutional review of ACIS problems had been initiated long before SDC started. Van's departure was certainly anticipated after his graduation from the Executive MBA Program. Caroline's departure is largely the result of two years of superior performance being rewarded with two years of inferior merit increases. The inability of ACIS to reward meritorious performance is not SDC's problem. The inability of ACIS to recruit replacements for anticipated departures is not SDC's problem.

I must also decry the reprehensible treatment of Caroline Cicchetti on her departure. After giving proper two-week notice she was faced with the last-day prospect of finishing her ongoing assignments or cleaning out her personal effects. She explicitly asked Bob Belanti [N.B. he was the head of ACIS at the time] if it was okay to finish her projects and then come back to collect her personal effects. He granted her request. When she returned her personal effects had been thrown in the trash.

> So, in summary, I have described unfriendly and irresponsible acts toward SDC at the same time that I have outlined why good relations with SDC are in the best interests of the Anderson School. I believe it is appropriate for you to act in a way that remedies this situation. The ball is in your court.
> Lee

I received no reply from Bruce. I had "strong enemies here at the school." In practical terms, this meant I had until October 1 to find a CEO to replace me. At that point, I would have to file a UCLA form on outside professional activities. If I was still CEO, Bruce could cause trouble for Strategic Data Corp. and me. Any accommodation with UCLA would have required the dean's approval and he saw me as an enemy. That forced me into a series of decisions that led me to cede control. The most direct upshot was the CEO moved the company away from the short-term and long-term interests of UCLA and its data scientists.

I wanted to build a business and be the conduit for bringing Internet data to the cadre of academic researchers developing new methods for using these resources. It didn't quite work out as I desired. After another year of battles, I returned full focus to UCLA. My enemy in the dean's office greatly limited my options. After being pushed out, as far too many founders are, I wrote a book about what impels midcareer faculty to engage beyond the walls of the Ivory Tower and some of the entrepreneurial problems they might encounter.

If Willison was the *rock*, Richard Janssen, the new CEO, was the *hard place* I was wedged between. There are occasions when I would benefit from being able to forgive and forget my issues with Janssen. I can't do it yet. On my side, I was willing to give him the power when the promises were of billions. That I retain a grudge after a sale for $150 million is just a negotiation over price, as the old saying goes.

I still believe that my original e-commerce strategy was a bigger and safer bet. We had a recommendation engine that personalized customer experience far better and easier to port to new clients than collaborative filters, which Amazon was employing.

It made independent e-stores, e-chains, or e-malls better competitors against Amazon. If Amazon saw that happening, SDC could become an acquisition target. The Internet ad business went in the toilet in 2001, but e-commerce never stumbled with 21% growth in 2001 and 48% growth in 2002.

Instead of arriving in a thriving e-commerce sector with the tools of technology-enabled marketing and the best tool makers in the world at that time, Janssen cut off the brain trust and steered the company into three down rounds and gave all of the employee and ex-employee option holders difficult decisions with strike prices that reflected rosier expectations based on an e-commerce strategy. The tech

team ultimately won the day. Too many of the early employees walked away with no part of the pie.

The professionally unforgiveable act was that he changed my equations. At a spring 2002 afternoon workshop called the UCLA Faculty Startup Seminar,[38] I put a question to the keynote speaker, Bill Sharpe. William F. Sharpe is the founder and chairman of Financial Engines, Inc., professor emeritus at Stanford, and the 1990 Nobel Laureate in Economics. He claimed to want to have nothing to do with the management of his company, Financial Engines. He wanted to turn that completely over to professional managers. I challenged that stance, saying that he was still a product manager responsible for the quality of the product that underlies his company. "What would you do," I asked, "if your CEO changed your equations?" Perhaps taken a little aback by the question, he responded, "I'd quit."

I didn't seriously ponder quitting then. I was never an employee but had an exclusive consulting contract that ran until the end of 2001 and didn't want to consider the consequences of breaking it. Skip insisted that I stay involved to protect his investment and that of the investors he brought in. Other than Skip's assurance of funding, I didn't try to leverage his desire for me to stay involved in any other benefit. I chose to continue to try to work together with Richard.

We did a bake-off—Janssen's approach versus the one I developed with Xuegao An. When Janssen lost, he said we have to do two out of three, then three out of five. Every time he'd peek at the answers and tweak some more special cases to boost his model. The idea of testing against fresh data was an anathema to him. Xuegao left when it became clear that Janssen would never implement our developments. That's unforgiveable.

As I said in the 2004 book, I couldn't start writing until I had a positive framework for a dark but unfinished story. Walking one morning with my wife, Ann, I focused on the special feeling of that first summer—the culture we had nurtured in the early days of the startup. In particular, I mentioned the summer interns for whom that summer was their first exposure to a serious work environment.[39] If you get to that point in a startup, deeply inhale. That wonderful aroma may not last.

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38. "How to Start a Company without Quitting Your Day Job," March 20, 2002, UCLA Office of Research Administration.

39. Alex, Nick, Brandon, Jonathan, Daniel, Jeff, Matt, Eric, and David. As of 2017, Alex went on to get a UCLA PhD in neuroscience and is now an adjunct assistant professor in psychiatry at UCLA. Nick is a senior software engineer at Google (after studying AI at MIT and a stint at Amazon). Jonathan is in the NYPD's Cyber Crime unit. Daniel is an emergency room physician. Jeff has worked in financial analysis at William O'Neill & Co ever since graduating from UCLA. Eric has finished his MBA at Harvard and returned to working with biomedical devices. David is a senior software engineer at Asana. My apologies to Matt and Brandon. I've lost track.

Chapter 7

Venture Development Project

"All things are in flux."

— Heraclitus

University labs are rich sources of disruptive innovations. Learning to do strategic planning in the face of turbulence and disruption is key to finding a niche that sustains the growth of a startup. Solid business analysis can also help some fail early, when it's much less costly. This effort puts the Bayesian networks developed in Project Action to the test on campus startups. They work.

UCLA Technology

I wanted to be both inside and outside the university. That was one of the motivations for the startup. Things always seemed more intellectually vibrant when inside and outside interests align. With SDC, I was told from both the outside and the inside that I couldn't have both. I considered that a fundamental mistake for the future of the university and society. Of course, I chose the university. I started to work on how other faculty could have both.

I started teaching venture development and strategic planning using my framework and Pearl's Bayesian methods. I started writing a book on my entrepreneurial adventure and helping UCLA technology find its way to market. This is how I framed it at the time.

Problem Statement and Objectives

"What makes an entrepreneur?" has been a topic of continuing interest at least since Schumpeter's (1934) discussion of entrepreneurs as distinct from business owners and managers (*cf.* Carland *et al.* 1984). Timmons (1999) summarizes six dominant themes: commitment and determination, leadership, opportunity obsession, tolerance for risk and ambiguity, creativity and self-reliance, and motivation to excel. Of these, "commitment and determination are seen as more important than any other factor" (p. 220).

While faculty are entrepreneurial in many ways, those faculty who wish to do startups based on their innovations are faced with a fundamental dilemma. Focusing faculty commitment and determination on the startup historically implied a dereliction of normal faculty responsibilities. Balancing commitment to the university with commitment to moving an innovation to market is what seems appropriate, but this implies a violation of what others call the most important characteristic of a successful entrepreneur.

Why can't the faculty simply turn the innovation over to veteran entrepreneurs and get back to the lab? After all, finding experienced management to bring the innovation to market is high on every venture capitalist's agenda for a startup. The answer has two parts. First, university faculty are the source of radical innovations—innovations that ultimately could be developed and applied to many markets. As Christensen (1997) points out, the key with radical innovations is to find the market that fundamentally values the kernel of the innovation, in as close to its unadorned form as possible.[40] Once taking root and succeeding there, the innovation can diffuse to other markets. So, the long-term success of a radical innovation depends on a deep understanding of the limits of technology and how it can be adapted to different markets—a depth of understanding possessed most likely by the faculty innovator, and by few, if any, others. Secondly, veteran entrepreneurs are most often valued by a combination savvy regarding a particular market and the six dominant attributes mentioned above. Industry experience is a prerequisite on most VC's checklist when evaluating the top management of a funding candidate.

Clearly every startup needs industry/market knowledge to succeed. My uncertainty concerns if it is appropriate to give executive authority to someone with market knowledge, but who lacks the depth of understanding of the technology needed to navigate beyond the confines of the initial market.

40. As I updated this in 2015, Clayton Christensen has been confronted with evidence that his account of company failure wasn't well supported (Lepore 2014). My use of Christensen's writing concerns how radical innovation thrives, which is well supported in his writing and in numerous others.

> It seems to me that a new model of shared top authority or partnership is needed to keep the innovators involved in the commercialization of their efforts, while ensuring that startups have the management expertise they need to succeed.

I developed guideposts for this new partnership model through interviews with the key stakeholders: UCLA faculty, venture capitalists and people involved in organizations such as the Tech Coast Angels (TCA), personnel associated with university technology transfer, such as the Office of Intellectual Property Administration (OIPA),[41] and other faculty addressing issues of entrepreneurship from university settings. The preliminary faculty interviews were conducted as an adjunct to the screening interviews I did for innovations that might be candidates for the Venture Development Project (VDP). To as great an extent as possible, interviews with OIPA staff, and with TCA members hitchhiked on VDP contacts. Interviews with other faculty addressing issues of entrepreneurship from university settings were conducted at REE USA 2003, Roundtable on Entrepreneurship Education for Scientists and Engineers, held at Stanford University, October 22–Oct 24, 2003.

I decided to use what I had learned to help technology move from UCLA labs to the commercial world. Students had deep interest in startup planning. My published work in strategic planning would be the academic base. My experience in my own startup would serve as a real-world check. My fellow faculty mostly from the engineering and biomedical centers in the southern part of campus certainly needed the assistance. I wrote a concept piece to bring the vice chancellor for research on board:

> ### Venture Development Project – Fall 2003
>
> **Situation:** UCLA's huge research engine is cranking out innovations at great speed, but very little commercialization of those innovations is occurring.
>
> The business development specialists at OIPA (e.g., George Abe) help bring faculty researchers in contact with VCs, can help identify what needs to be done, but don't have the manpower to help them do it.
>
> Anderson students are very interesting in learning about new- venture initiation but are not organized in a way that systematically helps UCLA faculty bring innovations to market.
>
> - Four-person teams or individual "independent studies" are the standard:
> - Very little manpower,

41. The Office of Intellectual Property Administration (OIPA) deals with patents, tech transfers, materials transfers, and the related contracts and grants.

- No knowledge from one team left to inform the next team.

Remedy: I'm designing larger-scale efforts that include market assessments and build permanent and updateable knowledge- management systems to help the next generation of efforts.

1. There is an obvious role for the VDP to play as an enabler on both sides. There is another role. One of the broader problems is that faculty don't know how to talk to VCs and VCs don't know how to talk to faculty. They think they are communicating, but it is more stereotyping than authentic communication. TCA[42] is an example.

   I think there is a need for a translator. And I want to try playing that role with the faculty I help.

   I think there is a need for a faculty advocate, independent of OIPA. And I want to play that role (with respect to some efforts). And I certainly don't want to do this behind anyone's back.
2. I'm working with Roy Doumani at CNSI.[43] CNSI has a different set of tech-transfer guidelines than OIPA. In particular, allowing faculty innovators to continue to interact with an innovation, even after it is reduced to practice (and possibly licensed) should really help the commercial potential of the innovation. That part makes sense in terms of how products are developed. Vice Chancellor for Research is over both OIPA and CNSI. Do I treat them as co-equals? Guidance.
3. We are prototyping a VDP course this spring. Hope to have it in full operation next year.
4. We are funding in as part of the capital campaign for the Price Center.
5. We'd like your general approval of our effort. We really can't go to private funders without you being aware of our efforts.

His response translated to, "Fine, fine, but don't look to me for resources." While the Price Institute did provide some summer support for writing my 2004 book, the Price Center never included funding for the VDP in its capital campaign.

The VDP did help evaluate startup potential and do strategic plans for 17 potential startups and one ongoing enterprise:

42. The Tech Coast Angels (TCA) rotate meetings on various local campuses, but they bring their language with them. These sessions were largely impenetrable to most faculty.

43. California NanoSystems Institute (CNSI).

- Global Care Quest, Inc.: Neil Martin and Valeriy Nenov, UCLA, provide visual clinical-intelligence systems to surgeons and clinicians. It offers a portability application that allows surgeons to review previously diagnosed images and clinical information; an information system that displays relevant patient data in the operating room prior to a case starting and throughout the surgical process; and a hospital-wide surveillance and remote monitoring system. It was acquired by Karl Storz in 2009.
- U-Machines: It is a MEMS[44] toolkit developed by Thomas Tsao at Caltech.
- ORFID: Yang Yang, UCLA, of ORFID Corporation developed an entirely new class of organic semiconductor materials and RFID[45] applications with find broad utility in a diverse range of industries. ORFID's technology will enable the development and production of revolutionary products, from flexible organic displays to implantable biosensors and "smart" packaging. The company's intellectual property portfolio covers the production of RFID devices on flexible polymer substrates using hybrid ink-jet printing technology.
- Immunosensor: Eva Harris, UC Berkeley Sustainable Sciences Institute, developed a field test for Dengue fever.
- Remendable Polymers: Fred Wudl, UCLA, developed a class of polymer materials that remember their shape and adjacencies, so that cracks and breaks could be repaired by a simple heat gun.
- CoreMicro Solutions: C.J. Kim, UCLA, created microfluidics technology using electro-wetting on dielectrics, moving and manipulating tiny fluids by controlling the electrical properties of special bio-chips.
- Quality School Portfolio (QSP): Eva Baker, UCLA, created QSP as a web-based tool to collect and analyze student data, to assess and monitor student performance and progress, to use data to inform curriculum, instruction, and program development, to make plans for school and district improvement and tracking progress, and to meet the requirements of the *No Child Left Behind Act*.
- Senex: Sheldon Ball, Veterans Administration Hospital and UCLA, created a comprehensive electronic, medical diagnostic encyclopedia, renamed Anvita e-Reference, and later acquired by Transcend Insights.
- Interactome and ALEX:[46] Shimon Weiss, UCLA; two startup projects involving non-invasive, luminescence-based micro-assays, parallel to his work with microdots.

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44. Micro-electro-mechanical systems.

45. Radio frequency identification.

46. ALEX: alternating laser excitation.

- Stream Management Systems (SMS): Panayiotis Michael, UCLA Computer Science doctoral student; SMS was a database management system specially designed to store and analyze information arriving in high volume and high speeds through high-bandwidth network connections.
- Informed Consent: Stanley Korenman, UCLA, developed an automated, online system for obtaining informed consent for medical procedures and research.
- Simulation-Based Learning: Eric Savitsky, UCLA, developed an advanced robotic simulator that combines 3D virtual reality technology and motion detectors that provides "tactile response" for remote teaching of surgical procedures.
- Salvaregen Health Biomarkers: Robin Farias-Eisner, UCLA, developed proteomic-based systems for early diagnosis of ovarian cancers.
- Holistic Health Clinic: Allan Pantuck, UCLA, developed an innovative urology clinic focused on women's health.
- Interface Sciences Corporation (ISC) NanoSports: Brad Paden, UC Santa Barbara; ISC Nano Sports is a special-project entity of ISC in Santa Barbara, California. The purpose of ISC Nano Sports is to commercialize the use of self-assembling monolayers for sporting goods applications.
- Diabetes Diagnostic Co., Allan Tobin, UCLA, developed glutamic acid carboxylase based (GAD) techniques for early detection of the onset of Type I diabetes.
- Vala Sciences, Inc: Jeffrey Rice, the Burhnam Institute and UC San Diego, developed the use of high-throughput image recognition for drug discovery.

We did a lot of good for these 17 nascent companies. We analyzed the stakeholders, looked at the critical issues facing the company, the business ecosystem, and the parts of the broader environment essential to success of the venture. We did a detailed risk analysis that quantified the expected payoff under multiple scenarios. Sometimes we moved the ventures forward and sometimes we showed there was nowhere to go. *Failing early* is a great benefit when it saves the time and efforts of all involved in what is most likely a lost cause. The ongoing enterprise was 3-D Systems, Inc.

3-D Systems

Most of the help we provided was in the form of MBA student teams taking on these ventures as team projects in a course I led titled Strategic Marketing Planning for New Ventures. The team would be augmented by graduate students and often faculty in the technical area of the new venture.

One project was different. A student named Rajeev Kulkarni was a product manager at 3-D Systems. He wanted to do a solo, confidential project on his then-young company. I told him I would expect a team's worth of effort, not a solo act. I insisted because these analyses are laborious to do right. At the time, in 2004, 3-D Systems was oriented toward the tool and dye sector with its new, metal 3D printing process. He saw the complex risk analysis at the heart of the course as an opportunity to assess the best course forward. He used Bayesian networks based on his in-company surveys to urge shifting away from tools and dyes and to pivot to direct manufacture. Their successful pivot helped Rajeev get promoted to chief product officer, VP at 3-D Systems Corporation.

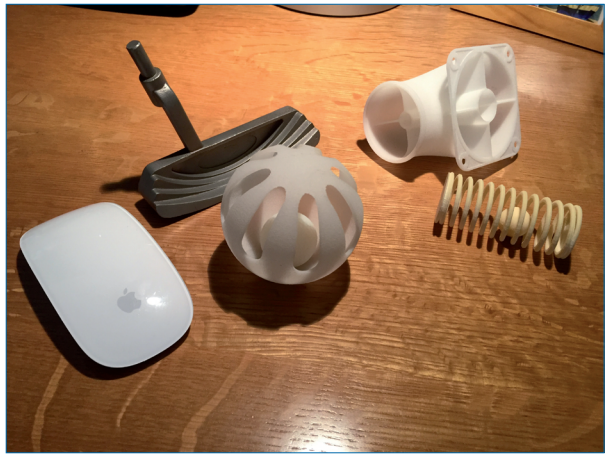


Figure 64. 3D Systems parts (2004) with an Apple mouse for scale.

VDP Bottom Line

The VDP was doing good things. I didn't understand why the department or school offered so little support. I used my time and the support of a single one-quarter-time RA. Without the resources needed to do it right, I had few alternatives. I was left with continuing my efforts in lieu of retirement—essentially working for free. Some people retire to gardening. I decided to become professor emeritus in November 2004, after 35 years of service. I was recalled for one final year. No additional resources were forthcoming, and I decided enough was enough.

One retirement alternative might have been to facilitate UCLA tech transfer from the outside. I tried to start *The Faculty Innovations Group* and *New Venture Systems*. Neither got much past the drawing board.

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Chapter 8

The MBA Classroom

"He who can, does. He who cannot, teaches."

— G. B. Shaw

"Education is learning to use the tools the race has found indispensable."

— Josiah Royce

This is a candid look at business-school pedagogy. I experienced many different teaching styles and circumstances—some successes, some not. The error in Shaw's quote is the either/or. The solution I found is teaching by doing: project-based learning. That is more in line with what is etched over the proscenium at Royce Hall.

Business schools (and others) typically think of required courses as either *core* or *common knowledge*, where the required common knowledge could vary across disciplines. Other classes are elective depending on the selected major focus (e.g., marketing, finance, strategy, etc.).

When I came to UCLA, faculty discretion over curriculum design (particularly in elective courses) was relatively sacred. Hal Kassarjian would not share his syllabus with me, fearing I would be too influenced to adopt his design. It was part of academic freedom to him. I should be free. The pendulum has swung far the other way.

I was the first at UCLA to design and implement business-school courses in multivariate analysis, multidimensional scaling (MDS), measurement theory, and phi-

losophy of science. All these were well-received, small-enrollment, elective courses, more often populated with doctoral students than MBA students.

In the early 1970s, I co-taught an elementary statistics course to an early arts-management group with Sam Culbert. Our design recognized that learning happened at four levels: individually, in dyads, in small groups, and as a whole class. We designed a multi-level learning experience that reflected this hierarchy. During the class, I handled content, while Sam managed the group processes. The response was polarized. Maybe 40% loved it, and 60% hated it, with no one in the middle. I was adamant that we cover all the basic statistical material in the class without thinking much about the additional burden of learning the behavioral content. Regardless of the polarized results, multi-level learning has an enduring role in project-based teams.

Partly to develop my classroom skills, I studied with the Committee Workshop, an improvisational sketch group that moved a branch of their SF operations down to West Hollywood and ran both shows and classes. Reflecting back, the most important lesson was first to accept the reality of the scene before you and second to figure out the "Yes and" that brings it to the next level.

I also spent a substantial chunk of time learning to lead process-oriented groups from mentors such as Bob Tannenbaum and Joan Lasko, as I mentioned much earlier. Partly as a result of this training, I taught parts of drastically redesigned *core* in the MBA program, a substantial departure from my normal elective course offerings. The *core* started as a three-quarter course in the first year called the *Nucleus*. Fall was *Individual Decision Making*. Winter was *Managerial Decision Making* (i.e., decision-making in small groups), and spring was *Complex Systems*. I taught both the fall and spring offerings in different years. I ended the fall course with three specific exercises. In my 2004 book I summarized the sequence:

> When we started UCLA's modern approach to management in the early 1970s, the first year was divided into two components: common-knowledge courses and the nucleus. The common-knowledge courses included basic accounting, economics, finance, statistics, human resources, and marketing. These were akin to the colors on an artist's palette – the building blocks of a managerial art. The creative art was designed into the more experiential components in the nucleus. The first-year nucleus consisted of three quarter courses: the first in individual decision-making, the second in managerial decision-making, and the third in managing complex systems. In the individual decision-making course – one of the courses I taught in the mid-1970s – we ended with a three-week series of games.
>
> The first week, we used one of the many technology-based survival games. Teams were given a list of available materials and personnel, and a survival goal. Surviving a plane crash that left the group stranded in the desert, or in a lifeboat, or in remote

Alaska, or on the moon, they had to move to a rescue location, taking only the most necessary equipment. While the exercise was really about some of the issues and traps in task-group communications, the MBA students invariably approached it by seeking some engineering or related expertise, thinking that technology had the right and wrong answers to the proper prioritization, and defending their problem solution as the right one in the face of equally viable, creative alternatives proposed by other teams. Students experientially learned that the agreement on a picture of reality helped them set the priorities and communicate their solutions.

Equipped with newly minted belief in their group decision-making skills, the students approached Exercise Kolomon.[47] This exercise presented a developing country with a relatively uneducated population, minimal infrastructure, substantial but undeveloped natural resources, and a potentially hostile set of geopolitical neighbors. Setting national priorities was the nominal group task: determining allocations to the military, the education sector, nascent industry, and infrastructure projects. In this exercise, students learned that establishing a common picture of reality was a necessary but not sufficient condition for problem solving. They struggled with intractable conflicts until they took the step back to ask about values. Only after seeking a consensus on the *value* issues involved could the group move toward a solution.

Now armed with task-group skills and aware of the need to share not only pictures of reality but basic values as a prelude to problem solving, MBA students entered the third week of exercises. The final exercise, called *Star Power*,[48] sets up a rigged game: a three-tiered, low mobility, hierarchical society in which arbitrary teams traded with other teams. Depending on the arbitrary assignment to a tier, the different teams started with varying levels of initial endowments – conveying a covert and unearned advantage that tended to persist in the trading game. After a number of trading rounds, the team that was ahead got to rewrite the trading rules for the next set of rounds. The sense of entitlement, justified or not, that went with success in the early rounds translated into a new set of rules that would make Machiavellians blush. The rules went from "You must agree to any trade we demand" to "Give us all your coins." When I, as professor, would confront the winning teams with the obvious greed and short-term thinking inherent in the new rule set, the response, too often, was that I had unfairly tricked them. After they had written the most conspicuously unfair rules imaginable, I was the one who was being unfair. Maybe they were right.

There are two lessons here. The first concerns MBA programs and students, and the second concerns venture capitalists.

47. I apologize to the authors, but I have no reference for this management game.

48. The copy I have of the *Star Power* provides no insight into authorship. I hope someone is glad that the memory of the game has not been lost, even if the authorship has.

> First, MBA students come with a sense of entitlement. They've succeeded in school, advanced in work, and gained entrance to prestigious MBA programs. Like Lake Woebegone, everyone is above average. I do not deny the accomplishments that have gone into MBA students getting to their current stage. I merely claim that they have to set aside that sense of entitlement to see the game clearly. Mine has not so far been the winning position. Student complaints over the immediate utility of the soft knowledge in process-oriented courses, along with the hegemony of the traditional disciplines, led to the nucleus being trimmed, a quarter at a time, out of existence.
>
> The advocates for each color on the common-knowledge palette would correctly complain that students needed to know more about *red*, or students needed to know more about *blue*. The need for integrative experiences was replaced with courses in *the strategic uses of blue*, or *engineering applications of red*. The problem with MBA program design is analogous to what Collins and Porras (1994) call the "Tyranny of the OR." It was either more discipline-based courses OR more courses translating disciplinary knowledge into managerial art. The challenge, correspondingly, is to embrace the "Genius of the AND." How can we emphasize both disciplinary depth and trans-disciplinary artistry? While I do not claim to know how to resolve this dilemma for our MBA program in general, I do believe that new ventures pose fundamentally cross-disciplinary problems for managers. Immersing students in strategic problem solving for new ventures requires both disciplinary depth AND integration of skills.

I didn't find a research home in either behavioral science or arts management, so I returned to marketing science with a broader set of process skills and questions of how these would affect my teaching. Lots of my colleagues were teaching cases. I tried it and did not like it in most instances. It always seemed to me that much more time was spent describing a context around an issue that a six-minute lesson filled two hours.[49]

In 1987, I developed CASPER as a market simulator for a brand-planning course. CASPER used real data and real market models in a game where both brand teams and grocery-chain teams competed. Each brand team made offers of promotion price, display, and/or feature support to each of three grocery chains. The chains independently decided on which offers to accept and played out their strategy against real data in the subsequent set of weeks. The cycle was played through three times. This was a demonstration of the model structure you need to do tactical brand planning in an age of big data. The models were fully documented in *Market-Share Analysis*. The class was well received in the early years. It demand-

49. Fifteen years later I found one case about trying to jump a technological generation (The Kittyhawk Case, HBS 9-697-060). I used it to germinate my discussion of disruptive market change. By that time, I created and was teaching a class in marketing strategy in the digital economy.

ed a lot from the students: understand high-parameter asymmetric market-share models and category-volume models and how to use tools for investigating history, graphing, and scenario generation. I led, and few followed. Eventually, I wanted to try something else.

I did another version of the product-management class where Nestle's product team presented their approach to brand planning, provided real market data in one category, and offered a $5,000 prize for the team that came up with the best brand plan. The student teams implemented all applicable models themselves and used forecast results to support all plans. What Nestle really seemed to want was a showcase for their methods. I demanded and got a broader perspective. The course was a success that wasn't repeated. I call such classes *expensive successes*.

In the mid-1990s I was ready for something new when Martin Greenberger invited me to join a threesome going to listen and talk to Intel Architecture Labs in Oregon. Out of that came my work on strategic planning for radically new products. Strategy thought of as comprehensive problem solving matched well with the richness of Bayesian risk networks. I brought that into the classroom in a series of courses that led to the Venture Development Project (VDP). These all developed increasingly realistic project-based learning with stiff milestones: key stakeholders, critical issue grid, risk network, scenario generation, and decision support. We developed analog ways to carry projects forward across teams as well as having multiple teams attacking different aspects of the same project. This stream characterized my final decade of teaching before becoming emeritus.

Since my return from sabbatical in 1979, I had set my goal to teach how to manage in information-rich environments. By the time I reached emeritus, near the end of 2004, I had achieved that goal as well as my research goal. I was rewarded a lot more for the research than the teaching. Put the two together and you have an unusual path for a 35-year career. How that career advanced in light of the received view of what is expected from faculty is the topic of the next chapter.

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Chapter 9

Life as Peripheral Faculty

"No man is an island entire of itself; every man is a piece of the continent, a part of the main"

— John Donne

At some point after becoming emeritus, I started to get more perspective on the academic life I had chosen.

Promotions

I was hired as an acting assistant professor that automatically converted to the regular ladder if I completed my dissertation within two years (N.B. I did it in a bit over one). As I mentioned earlier, it was the same appointment as Angela Davis received. The comparison of the 1,800 people who attended at her first lecture along with me with the seven at my first lecture was never lost on me. I never expected to be center stage.

The tenure process was smooth in spite of my level of evaluation apprehension. I relished my research and writing and published enough in top-tier journals to get faculty support for tenure. The path to full professor was hard. I stuck to my peripatetic agenda: from quantitative marketing to behavioral-science/human systems development to arts management and back to marketing science. Despite setbacks, I was promoted to full professor by age 43. I was proud of that. I rose to full Professor Step V and never sought to go higher. At the time, I didn't think I

would be promoted further and, in some ways, didn't believe I deserved to go to distinguished levels.

The "would" part of this was that I never felt like I was a favorite son of any dean. I was probably closest to Harold Williams through our mutual work in the arts, which was the farthest diversion from my core skill set. He's the guy that downgraded my pre-tenure review we had back then. I've mentioned this before, but it bears restating that he had reservations that my kind of data-analytic modeling skills were programmatically relevant to the School of Management. It was 1975. This was the era before *big data* had any caché. As I said, I was playing from the periphery, rather than center stage. I had the fundamental resources of a great university and that's all I needed from UCLA: colleagues and computers. The rest I got by partnering with sources of big data and with faculty colleagues in many parts of the nation and world.

Distinguished faculty at UCLA have remarkable records of achievement and leadership in important areas. I was a frontiersman and a pioneer in some ways, rather than a leader. The great commercial expansion of big data had its origin in marketing science. We hacked the trails and established the connections to create the first models of how these new data sources could be focused into models of consumers' decision processes. Ok, that's literally path breaking. Distinguished faculty take it the next step. They do the path-breaking work and lead a cadre of fellow scholars along the path. Marketing science had its distinguished faculty. I didn't think I was one of them.

I did take academic leadership in arts management, succeeded, and was punished for it by a five-year delay in promotion to full. I took academic leadership in the Venture Development Project (VDP), succeeded, and was largely ignored, except by the engineering and science faculty we helped. Being a pioneer, without creating a movement to lead, was a much better fit for me within UCLA. We'll see if the same tune is played for action research.

Alliances

The faculty who wanted followers vied for the new doctoral students. I saw almost no one following my path, so I never competed. I made alliances with visiting faculty and visiting scholars as well as colleagues from specialized conferences.

Masao introduced me to generations of Japanese marketing-science scholars. He invited me to the Fourth Management Science Summer Colloquium, Osaka University, Osaka, Japan, August 1975. I got to meet Prof. Osawa, who organized the colloquium; a generation of established Japanese management-science scholars;

and a younger generation of scholars, such as Hotaka Katahira,[50] who, as a graduate student, helped arrange the colloquium. I also had the honor of presenting to the 1989 International ORSA/TIMS[51] Conference (with Masao Nakanishi) and the Japan Institute of Management Science, Nishinomya, Japan, November 1996 (invited colloquium).

Through Masao's tenure and visiting appointments, UCLA became a place to connect with other scholars. While Makoto Abe was MIT trained, he had an extended visit to UCLA in 2006. Yoshihiro Sugita received his PhD from UCLA in 1986. Takaho Ueda visited around 1990. Tsutomu Kume visited in the winter of 2005, and Takuya Satomura visited around 2013.

Of course, Masao sent his student, Akihiro Inoue to finish a PhD at UCLA under my direction. Not much direction was needed. As with Masao before him, Akihiro took the best and toughest classes from across the whole university to advance his already clear research agenda. He hit the ground running. His academic background in Japan put him into the elite ranks of UCLA doctoral students. I felt he was more my junior colleague than a student. Akihiro and I published two pieces together: Cooper and Inoue (1996) and Cooper, Klapper, and Inoue (1996).

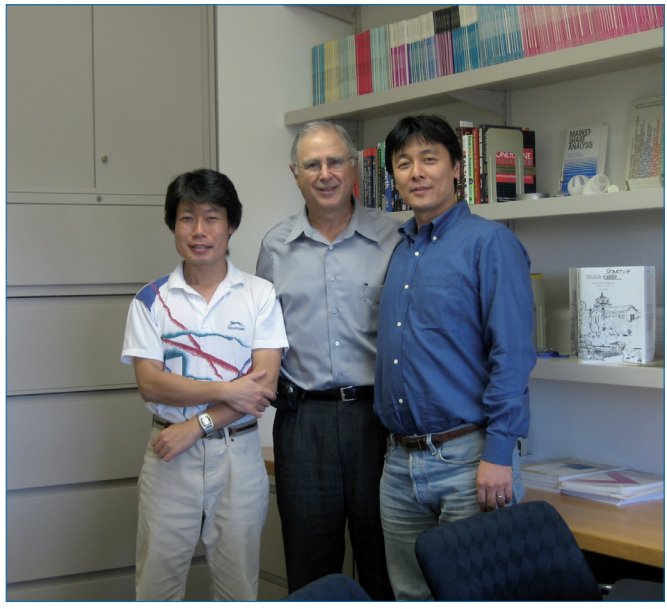


Figure 65. A visit from Makoto Abe and Akihiro Inoue.

50. I mentioned the *Dallas Morning News* summary of mind-bending titles. A Katahira paper was listed right after mine.

51. Operations Research Society of America and The Institute of Management Sciences.

I greatly enjoyed his time at UCLA. Akihiro also did much of the work associated with the US Census-based segmentation scheme that drove the early development of my startup, Strategic Data Corp. I am very grateful for his contributions.

Daniel Klapper was a visiting scholar in the late stages of a dissertation under Lutz Hildebrandt at Humboldt University. He came for a six-week visit with tremendous skills in three-mode factor analysis and a work ethic to match. It was a pleasure working with him. Lutz invited me for a residency supported by the German Science Foundation in 1998. I could only give it two weeks in December, not Berlin's tourist season. It was interesting to witness the reclamation of a once-great university. Lutz, maybe a year older than I, showed me his birth certificate emblazoned with a swastika. He knew nothing of World War II until he was 20. Daniel, 20 years younger, had studied the war and the Holocaust in almost every grade.

I also traveled much into the former East Germany to lecture on market-share attraction models. I lectured to Oliver Heil's class in Wiesbaden. My mother's foster mother was from neighboring Frankfurt-on-Main.

The only other PhD student who specifically was admitted to study with me was Sarah Appleton Knapp. I was just beginning work on studying radically new products, and she wanted in. She did a great job as RA on Project Action the first year. She switched to the doctoral program in the Psych. Dept. to further study behavioral decision theory, where her true interests were. It was through Sarah that I met Jason who played such a major role in my startup.

Teaching

I preferred house lights to stage light, both in the classroom and on professional stages. I had a number of classroom failures when expected to teach from the stage. My classroom successes were mainly when I played the methodologist, helping students figure out how a collection of tools and methods could advance their own projects or agendas. Unless the successes were weighted much more heavily than the failures, this would never pass as a distinguished teaching record. It was barely acceptable to the department.

I expected to do better at stage teaching. I know that alignment of agendas between teachers and students is a major component of student satisfaction. On stage, the alignment was rarely good. My early lectures were completely scripted with detail on all derivations. I didn't want mistakes. I remember Maurice Tatsuoka teaching my first graduate-level multivariate-analysis class. He would fill three blackboards with derivations, stand back, and use his eraser to rapidly correct a half-dozen minor tweaks. Note taking was impossible. I wanted at least to be my own ideal teacher.

Even with improvisational theater training, I brought a quantitative mindset to the most analog courses I taught. This appealed to a very thin sector of the MBA audience. When faced with a heterogeneous audience, alignment suffered. Another flaw in my stage teaching is I like teaching to the top of the class or beyond. Since I'm probably partial to quantitative intelligence, this figured into whom I thought of as the top. I thought over-explaining was disrespectful. I'm sure I grossly under-explained to a number of otherwise very smart students. I was not good at coming up with real-world examples, especially for methods that dealt with the future more than the past. I was also not drawn to the parts of the literature that were good sources for such examples. When teaching marketing research or market assessment, for example, I would devote final topics to talk about multivariate analyses such as MDS and/or factor analysis. Part of me was horrified by the standard treatment of factor analysis as nothing more than principal-components analysis and that all solutions are two-dimensional. I would say something like, "You probably are not going to understand factor analysis, but I'd rather you not understand it *right*, than not understand it *wrong*."[52] Then I'd delve into the five basic decisions the analysis must make to do it right with cryptic explanations I'm certain now were way beyond the classes' grasp.[53] I'd rather do that than give the class marginally better understanding of a coarse tool.

All these flaws disappear with project-based learning. The motivation to solve the problem and advance the project is sufficient to drive the needed depth of learning. You get a lot more engagement when students care about what they are doing and know the difference it makes. That's alignment by design.

The audience for this is small and highly self-selected prior to the capstone course. The kind of projects I supervised in the VDP class were ambitious and now have a second life as a special option in the required capstone, years after I stopped running it.

I had the academic career I hoped for. I had complete control over my research agenda. I never had to teach the core marketing course, never served as department chairman, and never ran for the Staffing Committee. I shunned what some consider the stepping stones to power. I had a sense of accomplishment and was ready to become emeritus. Thirty-five years was enough. I had no idea about future engagement with UCLA. Emeritus status provided the freedom to come and go as I pleased, without plans. It's cool.

52. These are the kind of statements that won me the GSMmy.

53. Cooper, L.G. (1994), "Tracking the Components of Customer Satisfaction," Marketing Study Center Working Paper No. 240.

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Chapter 10

Litigation Support

Res ipsa loquitur

I became emeritus over two years before SDC sold. I was 60 and quite capable of generating income supplemental to my adequate UCLA pension. One scenario involved continuing the moderate level of litigation support I'd done at a few intervals during my academic career, without the one-day-a-week limit I'd always used as a shield against deeper involvement. That is what I decided to pursue before the fate of my startup was known.

Since the late 1980s, basically after I was promoted to full professor in 1987, I'd taken on a number of consulting projects for law firms. Legal training in those days didn't seem to entail much quantitative thinking. For that kind of group, I would help them figure out what the numbers behind a case said.

A former student, Bob Saxe, first got me involved. I meet Bob years before when he was randomly assigned to me to mentor him thorough the doctoral research-paper requirement. A shy, quiet member of a generally outgoing group of doctoral students in the behavioral sciences, he timidly gave me a copy of his master's thesis to see if it might be worked into the needed research paper. It was a bold and thoughtful piece of work. The requirement was easily satisfied, and I encouraged Bob to be just as bold in subsequent work. I cast him as the judge in the play "Tom Jones" during the arts-management days. I used to counsel friends and former students who did advanced statistical consulting, some of which involved litigation support. After getting his PhD, Bob did such consulting. When he needed to think things through, he would call. At times, this became formalized as consulting. His

wife, a partner at a major law firm, turned to me for some consulting that couldn't be kept in the family.

After that, I worked on many different puzzles. In four years with one local firm I handled so many arcane issues that, for decades after I left, when they would get stumped they said, "Gotta call Professor Cooper."

Another former master's student, Larry Mattson, who did a brilliant thesis in the 1970s on perceived risk in the amateur film market—why Fuji and Agfa Gevaert couldn't bust the Kodak monopoly despite their resources—after getting a PhD in international relations, wound his way into jury research, and ran a jury-research and litigation-strategy firm. At one point, he wanted me to dedicate all my available consulting time to working with him. Despite my respect for him, I wasn't interested. He did, however, connect me with a very different kind of attorney. This one was an MIT physicist before law school. While he valued my quantitative skills, he also recognized that after over two decades on the marketing faculty, I was connected to the academic literature in very useful ways. After decades of critiquing student questionnaires and research designs, I was counter punching against lighter-weight opponents.

One successful experience with a Century-City firm chilled me so deeply I avoided litigation for a number of years. The Hard Rock Café, a hip, themed restaurant that had ruled a practical monopoly in its segment for over 15 years had its monopoly busted by a Planet Hollywood restaurant that opened just down the street from its prime New York City location. The manager of the leading themed restaurant sought and was denied an equity stake in the Hard Rock Café. He took an equity stake in a nascent foreign rival, Planet Hollywood. He used the Hard Rock's staff to train the upstart's new employees. I think the same designer was used for menus and written material. The most savage part was when this manager artificially lengthened the wait time to get into the Hard Rock Café to push the impatient to go to the new place down the block. He eventually got enough defectors to launch his competitor. My part of this ugly arbitration was estimating the damages. That's not too tough. Once on the case, however, I became the expert they went to for countering the claims of the other side. The other side came up with all these half-baked theories on why co-location happened, and I had to counter on why what seemed to be the rule for many car dealerships didn't apply to themed restaurants. I had worked on numerous aspects of the case before the administrative law hearings. Shortly before that actual hearing date, my attorneys informed me that I couldn't testify on my empirical analysis of damages. They had agreed to separate issues into two sequential hearings. The first did not include damages. I'm not sure why the attorneys waited so long to inform me.

I always thought my value was first in seeing what the numbers behind a case told us and second in having a wide enough palette of analytical methods to distill the meaning. With that excluded, I was left to talk about why retail sites would or would not co-locate. A quick catch up on some of that literature showed that, by the late 1980s,

over 100 articles dealing with store-location models referenced the Nakanishi-Cooper (1974) paper on market-share models as their basis. This was news to me, but welcome news. Still, what was a minor part of my overall effort was becoming my whole area of testimony. I didn't like that. The attorneys suggested that the council for the other side might bring up something that let me introduce my analysis of damages. I said to myself that no attorney asks a question without already knowing the answer. No good attorney would fall into that trap. So, what happened may have been secretly contrived by the attorneys, but what I experienced was surreal.

Direct examination first qualified my expertise in store-location modeling and pioneering advantages. I did get to talk about the data reflecting food and beverage sales in the many weeks before and after the new restaurant opened, but nothing about what analysis might reveal. The rest was counter punching, a critique of an easily criticized survey done by the other side. On cross-examination, the well-respected attorney on the other side tried to see how real my resume was. It's real, and he soon took another tack. It came down to a discussion of pioneering advantage and co-location. His first one-two combo tried to set up McDonald's as a pioneer. I denied McDonald's was a pioneer, and I am old enough to have seen it spread by an aggressive franchise model in a market crowded by localized, mom-and-pop fast-food offerings. McDonald's was faster through smart use of manufacturing design. Designing a successful new competitor in an established, if disorganized, market is not pioneering. He never got to follow up that thread. His second gambit involved having me explain why these other themed restaurants had started gathering in the same general locale. I said, "Someone showed it can be done successfully." I thought about the old myth of Columbus showing his patrons how to get an egg to stand on end but kept it to myself.

I had generally argued that placing Planet Hollywood next to the Hard Rock Café was an unwise business decision unless your purpose was to dilute Hard Rock's pioneering advantage. He switched here and asked if my opinion would change if the profits were actually up at both Planet Hollywood and Hard Rock? While maintaining my normal appearance on the stand, I started having vivid visual hallucinations that I was fishing in a clear mountain stream and I saw a trout bubbling within casting range. I cast the line and said, "Yes, it would." I refused to try to set the hook too early. He asked, "If I speculated for you that the pioneer's profits in the big city are higher now than when Planet Hollywood opened, would that help you?" I drew the fly a little closer but didn't strike on that nibble. I said, "Yes, it would." He continued, "Would that indicate that you might be wrong?" Now I could set the hook, "It would indicate to me that you had not analyzed the data adequately." He was hooked, reeled in, and flopping on the shore as the attorneys on my side distributed a seven-page summary of the analysis I'd performed. The parties settled not long after, before the judge made a decision. The Hard Rock Café was happy. The attorneys I worked with were disappointed. They wanted a victory. In the final analysis, the attorneys were the pawns of

their clients. To the extent that I allowed the attorneys to push me, I was their pawn in return. That is why I wouldn't commit my time outside UCLA solely to litigation. It was years after this experience before Malcolm Wheeler convinced me to help him with a different case—my final case.

Mal was primarily known for his work in class-action defense. This case was a defense against a class action that claimed the advertising for a model of SUV portrayed the vehicle as more rugged than it was. It wasn't the case about rollover, although the plaintiffs would have liked it to be. I was brought in because the plaintiffs had hired an expert who had butchered a factor analysis. Mal knew this was one of my areas of expertise. I primed the attorneys with basic questions that so exasperated this expert witness in deposition that he stood up ranting that just because he wasn't Lee Cooper he still knew something about factor analysis. His attorney was trying to pull his expert back into his seat while saying, "This is off the record. This is off the record." The attorney I'd tutored just smiled and said, "No, it's not."

The only pride I took was from being able to teach the attorney enough about factor analysis that he could properly pursue the needed questions.

The plaintiff's attorneys eliminated that analysis from their case, shifted slightly, and moved on. I was called on to deal with more quantitative issues and another expert was brought in on the defense side to deal with the consumer decision process. This dragged on for a couple of years. It perfectly covered the years between retiring from the regular faculty and when my startup sold to News Corp.

At the trial, I held up well on the many areas covered in direct examination and through 70% of the cross-examination. Usually the questions were narrowly focused and so were my answers. One question seemed open enough for me to introduce a series of points and I went for it. The plaintiff's attorney objected to my answer as nonresponsive. The judge read the transcript on his monitor and said, "I'll hold that everything after 'xxxyyy' was non-responsive." I'm lost. I have no idea what points are in and what points are out. After that I just babble as appropriately as I could and swear privately I'll never testify again. That was 2007. I don't miss it. All the rules of evidence and legal procedures create an epistemology that I don't understand very well. The rules of scientific evidence and the bases of best practices I understand. If valid and reliable evidence is gained, it feeds the network of scientific knowledge. It increases scientific belief in the relations it confirms and decreases scientific belief in the relations it disconfirms. If evidence is gained in violation of the legal rules of evidence and procedure, it cannot be used in court procedures, regardless of its scientific reliability or validity. I understand the need for such rules, but not how to operate effectively in such an environment.

Chapter 11

Epilogues to Midlife ~~Crisis~~ Startup.

"In bocca al lupo"

— A Sicilian toast.

"In the mouth of the wolf" is the toast Giovanni taught me that characterized steeling one's self for the fierce nature of startups. It also fits the time when you are no longer in charge and others control something you created. I published *Midlife ~~Crisis~~ Startup* three years before Strategic Data Corp. sold to News Corp. I wrote the first epilogue two years after the sale. The book and my slice of the acquisition were welcome booby prizes. I've written a further epilogue on what has happened since the earn-out period expired. These epilogues to the 2004 book are next.

My primary backer in SDC was Skip Brittenham. I have known Skip since I was in high school and he was at the Air Force Academy. When I joined the UCLA faculty, he was in the UCLA Law School. We reconnected then. He runs a very powerful entertainment-law firm, and I called him for a recommendation for an attorney for my Internet startup. I wasn't willing to go to Pasadena for a recommended startup-oriented lawyer. Skip's response was, "Coop, we're all over that!" Ziffren Brittenham had a whole Internet practice, which was more like the head of a *keiretsu* than a law firm. We had to pitch the technology to Paul Brindze, who led the Internet practice, and a small panel he gathered. They assessed the pitch for the need it was addressing and how the success of my startup might assist the other startups in the *keiretsu*. After passing the screening into the Internet practice, the first $1.25 million financing round was little more than passing the hat at the part-

ners meeting. When Skip figured out what these methods could do, he wanted me to put all the academics who could do this stuff under contract. I had told him of 40 but knew those numbers would swell if someone started handing out contracts. I engaged only two: Bart Bronnenberg and Eric Bradlow. When I first wrote the book, a thoughtful advisor convinced me it was prudent to disguise the names of the players outside of my co-authors. Before the company sold to Fox Interactive Media (a News Corp. subsidiary) in 2007, he had good reason to be cautious. As I update this in 2015 and beyond, I feel less need to be circumspect.

I have maintained all essential text of the epilogue, updated the names, and related the status of the technology circa 2015. I now think it is okay to peek.



Figure 66. Title from my 2004 book.

The $150,000,000 Epilogue

This epilogue relates how the story ends: the sale to a major media company, the earn-out provisions and benchmarks, how the contract was violated, and how the ultimate buy-out was negotiated.

No Peeking

You need to read the story before reading the end game – at least Part I. You need to understand how I built the board of directors before you can appreciate their role in the end game. Penny Baron, at my request, stayed on the board to the end, even after Steve Mayer and I resigned. Ed Muller stayed on the board until he took over as the CEO of a multi-billion-dollar public company, Mirant, and shepherded it out of bankruptcy, through a merger leading to Genon, and a final merger with NRG. Remember, Ed had been willing to be my CEO, but the board wanted more "Internet DNA." Especially, you need to understand the tacit compact I had with the most powerful board member when I allowed myself to be removed from power at the end of 2001. You need to understand why this board member, Skip, would be a backer of an Internet advertising and e-commerce venture. If I allowed the chosen CEO to run the show, Skip would not let the company fail, if humanly possible. This is the only way you can understand

the small, unsecured, bridge loans that Skip and the CEO took out of their own wallets to avoid another financing round. Down rounds are not pretty. You need to understand the small, but powerful and dedicated technology and the management team that drove the company. You need to understand the detailed focus of the CEO to understand the kind of deal he initially negotiated.

I ended Part I with the story of the Series E and the line "Perhaps one day I will actually be able to profit from what I helped create." Let's see.

The Two Sides of Value-Based Pricing

The technology team had created a massively scalable, display-ad delivery structure with optimization built in from the beginning. New clients always seemed to start out loving SDC. The performance bump brought in revenue levels the clients had never previously achieved. The value-based pricing model that had always been the SDC approach started producing substantial revenues, enough to be cash-flow positive, and pay off the short-term loans from Skip and the CEO.

At first, clients greeted the SDC revenue increases as found money. As clients started writing big checks to SDC, they started thinking of ways to reverse engineer the system—contracts that forbade such notwithstanding. Despite clients never being able to match the performance SDC provided, a pattern emerged of SDC having difficulty holding onto large clients after the large checks started flowing. Cash flow was running about $1 million per month. That is not bad for a 14-person company, but the growth that would change SDC into an initial public offering (IPO) candidate was not in the cards. A strategic sale was the most likely exit. The game became treating each new client as an advertisement—bait for the few whales that were still afloat.

While there were numerous clients that could have resulted in sales, the first major bite came in the late summer of 2006. One of the major social networks came sniffing around. Myspace had been acquired in the previous year by News Corp. It had a huge user base then but little in the way of a revenue model. The interactive division, Fox Interactive Media, struck a deal with Google in which Google would pay around $250 million a year for all the advertising revenue it could generate from *searching* on the social network, despite the fact that social-network users do not search in the same way that users of Google search. Google, Yahoo, or MSN searches are most often part of the consumer decision process—a natural place to gain advertising revenue. On social networks, something else is happening. The SDC focus at this point was on optimizing revenue from display advertising. The search deal should not have affected the display-ad revenue that SDC could generate.

Then, SDC put together a proposal that indicated what application of SDC technology to the massive user base on the social network could mean in revenue. It was the embodiment of one of my high-level principles of Internet startups: add value and stay close to the cash register. The CEO of Fox Interactive Media began serious negotiations.

I was not close to those first negotiations but do know a few things. News Corp. was extremely closed lipped about the talks. They insisted that SDC could not shop the deal around to other clients or potential whales—all of whom came calling once the informal rumor mill started. Both complete buy-out and performance-based deals were discussed as well as hybrids. Then talks came to a crashing halt. No matter how important the talks were to SDC, the head of the Fox Interactive Media had bigger fish to fry. He was concerned his deal with the media parent did not give him enough upside to share in the success of what he was creating. He left to start other ventures.

Normally, when a division CEO departs, all his or her deals crash. The new CEO has a different agenda, wants a fresh start, or does not want to share credit or take the blame for the prior CEO's unfinished efforts. There can be a myriad of reasons. This was another place where having a board member as powerful and connected as Skip came in to play. In Hollywood, these movers and shakers always meet up on one project or another. In the fall, at a meeting on other issues, Skip asked the new CEO of Fox Interactive Media, "What's up with the SDC deal?" The candid and, perhaps, flustered response was, "I have no idea, but I'll find out, and let you know."

The negotiations were restarted with vigor within two weeks. If you do not have board members with that kind of access and clout, you might end up with nothing, regardless of how good your technology is or how great a fit the combination might be.

The Forest and the Trees

While many combinations of deal terms were discussed during the tedious negotiations during the next two months, the final deal reflected the very detail-oriented CEO that headed the SDC team. What emerged was a minutely detailed contract that provided an upfront payment of $40 million, $5 million of which was held in escrow for 18 months to cover the potential of fraud on SDC's part. There was an additional $10 million payment for bringing online a new ad server capable of serving 9 billion display ads per day from an ad inventory that could possibly be around a million different display ads. This would be the largest ad server in the world, and SDC had three months to get it going and six months to be fully opera-

tional. While the specs for this server were daunting and the deadlines demanding, I never doubted the tech team. The CTO confided to me later that, as soon as he heard in the early fall of 2006 that a deal was in the works, he started development. My original co-founder, Giovanni, had returned to Sicily many months before this deal developed but left the Office of Technology in the brilliant hands of Fabrizio Blanco, whom Giovanni had recruited and developed.

The real money was tied up in the earn-out that SDC's CEO negotiated. The first part seemed relatively straightforward. There would be an early window on the performance of the system. Some months after the system was fully commissioned, they would take a reading of the average revenue levels achieved from each class of display ad and compare these to historical figures that the social network provided. If the average revenue from each of the four classes of display ads had increased by 35% over the baseline historical levels, SDC would get $6 million (early lift low criterion). If the average revenue from each of the four classes of display ads had increased by 50%, SDC would get $10 million (early lift high criterion). If average revenue fell short of these increases, SDC shareholders got nothing.

After the initial reading on performance, there would be three annual contingent payments based on sustaining revenue increases. In Year 1, SDC shareholders got 35% of the revenue that exceeded 125% of the base rate for all ad classes, up to $90 million. In Year 2, SDC shareholders got 25% of the revenue that exceeded 155% of the base rate for all ad classes, up to $120 million. In Year 3, SDC shareholders got 15% of the revenue that exceeded 175% of the base rate for all ad classes, up to $90 million.

The SDC CEO also negotiated fat retention bonuses for himself and key SDC employees, provisions that allowed SDC employees to work only on projects that advanced the earn-out, guaranteed staffing levels at 17 full-time equivalents (FTE), and guaranteed 4.5 FTEs selling the performance ads that SDC was to optimize. The negotiations were so detailed and tedious that Skip had to intervene several times to keep Fox Interactive Media at the table. In the end, however, $360 million was on the table from performance on Fox Interactive Media's main Internet properties, plus more if the technology was extended to newly acquired sites or extended to other sites on the web.

The contract weighed over two pounds and was written at a level of specificity that the SDC CEO said was likely to assure shareholders of a final settlement over $200 million. What was not obvious to him was that the world, particularly the online world, changes at a speed that did not mesh well with his desired level of detail and specificity. He negotiated with his eye on each tree, but without seeing what was changing in the forest. Nonetheless, even the initial payment would be welcomed by the investors and common shareholders, many of whom waited seven years for this overnight success.

Possibly the most important part of the deal was that Skip was named the SDC shareholders' representative and given a central role in overseeing the compliance of News Corp. with contract terms. Van, the former SDC CFO, was enlisted to support Skip's efforts.

Celebration

We signed the deal in late February 2007, in the same magnificent board room in Skip's offices where I had pitched the initial idea, and where the very first board meeting was held. It was the first time the SDC CEO and I had been together in over five years. Past animosities were set aside. The company value was not the billion he promised, and it took seven years, not the 18 months he envisioned, but given the crash of the first Internet bubble, everyone was pleased with the outcome and teased by the prospect of three years of potentially large payments. When the first payment was received in March ($35 million plus $5 million sent into an escrow account), there were a lot of personal celebrations—me included.



Figure 67. The six Miros in Skip's boardroom.

The deal was announced, but not the price. When speculation circulated that it was only $50 million, I think the new CEO of Fox Interactive Media thought that was not a substantial enough amount for his first deal. It is speculation on my part, but soon the unattributed rumor circulated that the deal was for $150 million. I am guessing that number did not come from anyone connected to SDC. I know it did not come from me. The potential size of the deal, $360 million, was not reported until the next quarterly report from News Corp., buried in a footnote on reserves.

It was early June before Skip could arrange a celebration dinner at his house for all the former SDC board members and employees. At one point, Skip's wife, Heather, pulled me aside and confided that before Skip would go on a major trip he would say to her, "If anything should happen to me on this trip, whatever you do … don't sell the SDC stock." I am sure, however, if anything had happened, the bottom line on this epilogue would not have been nearly so good.

Benchmarks

The CTO had the system operational before the due date and used only about 25% of the hardware that had been spelled out in detail in the contract. The traffic allocated to the system was cranked up on the media company's schedule, slower than we expected, but the technology was always ready for the load. The first contingent payment ($10 million) was made on schedule in the early fall of 2007.

The next hurdle was the early indication of lift. Early lift high would pay $10 million. Early lift low would pay $6 million. Anything less would pay nothing. SDC had until around the end of February 2008 to hit the benchmark. By that time, the world had changed.

The search-ad deal that Fox Interactive Media had struck with Google was performing miserably. To assuage Google, half the traffic to the leaderboard ad on the most popular page for each user was redirected away from SDC's optimization to the Google's display-ad division, making it harder for SDC to hit the lift goals.

The performance goals themselves came under scrutiny. Rumors spread by former Fox Interactive Media employees that the initial rates were just fabricated. One person said her then boss told her to create performance numbers that SDC could never hit. Despite the concentrated efforts of the technology team, no historical figures could be obtained that confirmed that the base rates had been set accurately. The alternative, which the SDC CEO had negotiated into the contract detail, required access to historical data that were never available.

Fox Interactive Media never provided the 17 FTE that SDC negotiated, nor did the division provide the 4.5 FTE for the performance-ad sales staff, meaning the ad inventory that is so crucial to optimization was missing. Instead, Fox Interactive Media focused on what are called CPM campaigns (often brand advertising that simply pays a given rate per thousand eyeballs), which the SDC ad-engine optimized and served but played no role in the earn-out for SDC shareholders. While the contact provided that SDC staff need only work on projects related to the payout, they were pulled off to some 10 to 15 other projects.

Even in the face all the potential misrepresentations, and failure to provide the guaranteed resources, SDC exceeded the early lift low criterion. It exceeded the ear-

ly lift high criterion if you dealt appropriately with the display ads sent to Google. Without those ads, SDC was 99.96% of the high criterion. Fox Interactive Media would not certify and pay the early lift high bonus.

Skip held a series of meetings to try to get a handle on all the issues. I put together explanations of some of the quantitative side and tried to bring as much clarity to the issues as I could. The SDC CEO did the same. Then, Skip called the CEO of Fox Interactive Media with a list of complaints. The first response was, "We consider you a friend of the company and will try to work this out." News Corp. was known for playing hardball, but this was Hollywood. If you screwed a major player on one deal, it might come back to haunt you on a dozen others. That certainly did not stop the dirty deals. It just meant many balls were in the air at once. If you looked at the game too narrowly, you did not see what was really going on. For example, while these discussions were beginning, the whole of Myspace was in play as a chip in a high-stakes game for control of another online media giant. If that chip were to be played before summer, the SDC shareholders would get $150 million in addition to the $56 million already paid or in escrow, in lieu of all future earn-out payments.

The SDC shareholders, including me, did not know if they would get their share of the additional $150 million in the early-termination clause, the up to $310 million in potential future earn-out payments, or only the $6 million from the early lift low criterion. Or we might get nothing more than the initial payments—a pretty wide range of fantasies. The only thing I was committed to was making sure I did not spend it before I had it in my pocket.

The discussions with Fox Interactive Media dragged on in a seemingly endless array of details and delays. The focus had been on how to revise the contract to come close to the original meaning given that the online world had changed. By summer, no resolution was at hand. Skip decided to re-gather the facts and bump the issue up the corporate levels at News Corp. Skip called the major shareholders and got commitments to fund a litigation war chest, if needed. There were, however, alternatives. The escrow payment was due, and Skip had that $5 million delivered to him as shareholder rep, rather than the shareholders. He retained a forensic accountant and a litigation firm, just in case. Then, he called the COO of News Corp. and set up a meeting to lay out the case. The COO would never have taken a call from me. With a $5 million war chest and Skip doing the talking, SDC got the attention it needed.

The COO of News Corp. agreed that there were potentially issues to be resolved. He offered to send a high-level attorney from the corporate headquarters to figure out what would be a fair resolution. At last they were discussing a buy-out of the contract, rather than a revision of the earn-out terms.

The first thing that was acknowledged was that at least the early lift low criterion was achieved. By August, the shareholders were paid that $6 million. The

rest of the inquiry dragged on and on, as the bottom began to fall out of the general economy. By sometime in late October, an offer was finally put on the table: $69 million plus the $5 million in escrow. For Skip, of course, this was the beginning of the fun. I think he had a figure closer to $120 million in mind. It was mid-November 2008, with the economy rapidly moving south, that the final figure of $94 million, plus the $5 million in escrow, was agreed to. One of the factors was simply that the COO of News Corp. could sign off an amount under $100 million. Exceed that threshold and the deal had to be signed by *the* Rupert Murdock, a prospect that no one wanted. Bringing a media mogul in at this late stage would have quashed the deal regardless of the clear merits of SDC's position.

The first deal point was that the money had to be paid in cash before the end of the calendar year.

The Best Phone Calls Ever

Skip called to tell me the result when I was visiting Steve Mayer at his place at the Calistoga Ranch. The conversation was pure joy. Even better, Skip gave me the task of calling a number of investors I had brought in and some of the other board members. I wish everyone could have such a joyous task assigned to them.

In late 2008, lots of people were watching their 401ks turn into 201ks. To have new money come in at that point was just short of a miracle. Attitudes had changed. I remember in the spring having conversations over tennis with one of the major stockholders about the potential for an additional $150 million coming out of the deal. At that point, he was debating between a 104-foot cabin cruiser he would keep in the Caribbean or an upgraded jet with his share of the deal. By mid-December, when the payment came, he was just short of stuffing the cash in his mattress. There would be celebrations and extravagance, but the economy was a game changer, even for the rich.

For me, the payment was a great consolation prize. I started the venture mainly to let the marketing-science faculty have a crack at the rich data that were driving the e-commerce revolution. The first generation of products/services needed to form the basis of a profitable venture, or the resources to achieve my greater goals would not exist. That dream ended in early 2002 when I left the board of SDC, but I am enjoying the booby prize. Having started on the UCLA faculty in 1969 at 25 and retired at 60, I figured I earned time to play and the resources to make the games fun.

After all the shares had been redeemed, Van framed my original certificate for Share #1.



Figure 68. SDC Share #1.

Caveats for Entrepreneurs

In total, $150 million was paid for a 14-person company. Around $9 million was invested in five rounds of financing at SDC, giving a 16-times return on average. Last money in, Series E, got a 23-times return. My strategy of investing in the Series E, once I lost my fight to get better terms for the company, paid off handsomely. All the common shareholders, including me, did well, despite the serious dilution created by the C, D, and E rounds. The option holders who left the company were faced with the difficult choice of whether or not to exercise their options and pay a stiff strike price, when the prospects for a sale were not rosy. Those who took the risk were rewarded. Others didn't. I tried and failed to avoid that risk. I wish that they could have shared in this exit.

My wife and I have had a great time traveling to thank, in person, the friends and colleagues that helped create this venture and make it a success. We have held celebrations in Santa Monica, Los Angeles, Los Osos, San Francisco, Calistoga, Deer Valley, Chicago, Atlanta, Philadelphia, Tilburg, Fontainebleau, Catania, and Osaka. This is the good side of *success has many parents*.

So, what are the *caveats*?

Management Team: As an entrepreneur, you hope to create value, and SDC did create value and generated great value for News Corp. I assembled a great management team, mostly from alumni of the UCLA Anderson School: mainly Jason, Ravi, Kate, and David, but many others in earlier times that are mentioned elsewhere. One of the hallmarks for Anderson graduates is their ability to work in teams—individual initiative within a team framework. Free-riders are a drag on

corporate performance and a killer in a startup environment. Our management team had the right skills and spirit. The company would fail without their efforts.

Technology Team: I talked Giovanni into co-founding SDC while he was still in the UCLA Computer Science Doctoral Program. He had worked as my RA for several years on big-data R&D projects. Still, going from RA to co-founder is a major change. He took a great leap of faith with me. He recruited and developed an exceptional technology team. The team spirit of the management team was mirrored in the technology team. Giovanni led the team, but despite the brilliance of many of the members, there were no prima donnas. General plans were set in top management meetings with Giovanni as a major voice. Technology plans were developed in the tech group, and problems were solved both individually and in the group. Debugging and testing was public enough for everyone to understand what the main issues and accomplishments were. The company fails without Giovanni and his team.

Advisory Board: I assembled a great advisory board. Without the help of Eric Bradlow (Wharton), Bart Bronnenberg (UCLA, Tilburg University, and now Stanford), and Akihiro Inoue (Kwansei Gakuin University and Keio University), the problems the company faced in the very early days might never have been solved. No solutions, no company.

The rest of the advisory board was composed of very senior faculty and industry players. They never got deeply involved. These were the minds that could take a successful startup to the billion-dollar company we envisioned. I've always regretted that we didn't get the chance. If they had not endorsed my efforts, the early funding might not have materialized even in the easy-money days.

Board of Directors: A board of directors is a boundary organization, facilitating bridges to the vital constituencies outside the firm's control. I have discussed Skip's vital role. The company fails without him, but other board members played crucial roles, too.

Skip brought in billionaire Ted Field, at that time a frequent co-investor with Skip. Ted's wealth and influence added to Skip's already substantial clout. While they were angel investors, their clout was more akin to the VCs that sit on the boards of many startups. When entrepreneurs seek funding from *smart money*, part of that exchange is for the clout in the end game. During the early discussions of funding (Series A and B), much lip service was paid to the role of *smart money* in getting first clients and filling out the management team. The cliché was that we were getting access to *fat Rolodexes*. Clout in the end game turned out to be a far more tangible reason they earned their share of the company. The same should be true of VCs. They extract a substantial fraction of a startup in exchange for dollars *and* benefits that might seem elusive to entrepreneurs at the beginning. Isn't all money *smart money*? The answer is "No," particularly if a strategic acquisition is the exit. The web of business interests in

a VC's portfolio provides a buffer against large companies taking advantage of their leverage over smaller startups in acquisition negotiations. Find VCs who can stand with you in discussions with major players in the field, then align the incentives of those VCs with the interests of all other shareholders.

All board members must be of the stature that makes board meetings a panel of peers. Board membership is such an important and powerful position that the entrepreneur must know *why* each member is there. Steve Mayer experienced hypergrowth as one of the original seven at Atari and dealt with the board-level politics after Warner Communications acquired Atari. He also founded the Kleiner-Perkins funded Digital F/X. He was always a strong advocate for common shareholders, in his prior experience as a founder of major technology companies and in his role on the SDC board and as a personal sounding board for me. Penny Baron was one of the three founders of IRI, one of the largest marketing-research firms in the world, and the prime mover behind Efficient Marketing Services, Inc., a major venture-funded information intermediary between manufacturers and retail outlets. She understood big data, and how to drive ventures that aim to capitalize on big data. Lee Stein and Bryce Benjamin both had great experience as entrepreneurs and shared their experience and insight in those early days when it was all new to me. Lee and Bryce both left the board after one year, Lee making room for Ted and Bryce making room for Ed Muller.

Ed was accustomed to negotiating multi-billion-dollar energy deals. Without his savvy in the Series C, D, and E, which combined brought around $3 million, the common shareholders, including me, would have fared far worse. Whether there was a billion dollars on the table or one dollar, Ed demonstrated the same intellect, vision, and intensity. He loved negotiating deals. To Ed, it was *all* business regardless of the size. Ed was the CEO candidate that could have made SDC the billion-dollar company we first envisioned. The business model would have been closer to the original vision of e-commerce support and personalization. Advertising optimization was part of that, but not the main focus. Opportunity missed.

Richard Janssen came onto the board representing the Series B investors. Whether or not he always intended to try to take over the company, I do not know. He certainly had the credibility as a serial entrepreneur and never has become entangled in the civil or criminal investigations of his previous company, Homestore.com. The first lesson here, however, was that entrepreneurs should be wary of rich guys that still had something to prove. He had been forced into the COO role in the previous company he founded and would never have been content to play second fiddle in SDC. The second lesson is a little subtler. I thought my battles with Janssen were over who would control the technology. He seemed ill equipped, and I felt personally and professionally affronted that he would try to impose his vision. What I missed was that he wanted control of the company, more than control of the technology. Once he had won that battle, he stepped back and let the people with the know-how to address

the technology do their job. My fear that he would dominate the technology and my arrogant annoyance with anyone who would challenge my technological vision blocked my insight into what was really happening.

Timing: SDC's first round of funding ($1.25 million) came in times of easy availability of angel and venture funding, January 2000. The company would most likely have failed to get funded if I had waited even six months longer. The other side of this is, if you are funding a startup when funds are easily available, you should know that condition will not last.

The $5 million Series B closed on May 1, 2000. The NASDAQ was already six weeks past its peak. There was $11 million on the table when the terms were being negotiated on March 23, 2000, one week after the market peak. There could have been more. Because we set a $5 million cap, the Series-A investors were all persuaded not to exercise their participation rights, which would have expanded the funding pool by around 25%. I should have taken all the money that came with no consulting strings attached, all but $1 million of the total. That would have required redrafting the offer term sheet at a time when markets were approaching free fall. The $5 million cap was more than enough to build out the company under my original e-commerce strategy. It was not enough to build out the ad-server optimization strategy the company went to under the new CEO.

Even with all these unlikely victories, if we had started re-negotiations with Fox Interactive Media even three months later, the macro economy would have trumped the deal.

Timing is crucial. Entrepreneurs are swept up in their vision but must not be blind to the larger scales of forces on which their success also depends. That is why I, at Marshall Goldsmith's suggestion, used the chart over time of the NASDAQ market to highlight when different organizational events occurred in the macro-economic climate.

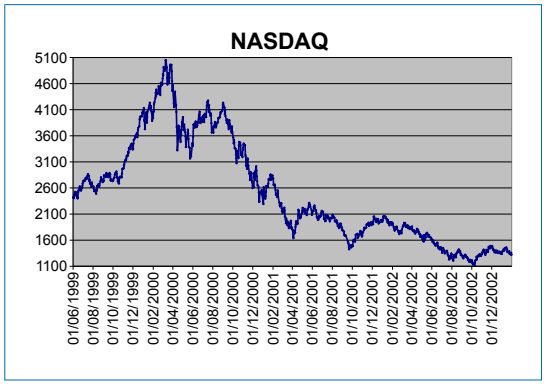


Figure 69.

Understanding Risks: Many things have to go right for an entrepreneur to succeed. The sources of risk do not add to the overall risk, they multiply the risk probabilities, just as overall systems reliability is the product of component reliability. Even if each component is quite reliable, say 95%, a system with 100 such components has less than a 1% chance of operating.

The situation an academic entrepreneur faces is much less certain. The sources of risk have to be segregated into the *must haves* versus factors that contribute to the likelihood of success in a *the-more-the-merrier* sense.

For each source of risk, you should ask, "What is the likelihood of success, given that the board was missing the key player?" If the answer is near *zero*, the factor is a *must have*. The *must haves* I've discussed included the management team, technology team, early problem solvers on the advisory board, and key players on the board of directors as well as the timing of both the early funding rounds and the timing of both the sale and later contract renegotiation. I think the chances of success without one of these key factors is very near zero, but even if we say the startup had a 10% chance of surviving each of these key factors, the overall chance of success would be one out of 100 million.

The odds are stacked against the entrepreneur. That is not a stable system for innovation. It may not be a rational choice for someone to attempt to start a venture, particularly an academic entrepreneur. We have alternatives, typically tenured professorships at research universities. In that environment, we have a greater understanding of the tacit rules governing success in our academic careers and typically have succeeded.

On the other hand, the solutions to the complex societal problems, even global problems, are maturing in university labs today. Many billions of dollars have gone into research that could spark the industries capable of getting us out of the deep hole we face. If some possibly irrational faculty members do not attempt to take things from the lab to the marketplace, the opportunity costs could be staggering. Universities need to provide better infrastructure to make the transition less treacherous. They need to make it easier for faculties to be both academics and entrepreneurs. Some are. Private universities, such as MIT and Stanford are better set up to make startups easier, with established angel groups and venture funding sources, service providers, and mentors. Still successful exits are rare. We may know of dozens of success stories, but each of these universities has thousands of faculty and hundreds of government- and foundation-funded laboratories.

Public universities are not as well situated. Some have boundary organizations, such as the Wisconsin Alumni Research Foundation that helps to commercialize technology developed at the University of Wisconsin. Even UCLA has finally established a business incubator in the California NanoSystems Institute. More have been established recently.

Probably the easiest area for reform involves aspects of the *conflict of commitment* regulations. Typically, faculty are free to consult one day a week without prior approval. This doesn't need to change. Faculty are precluded, however, from taking a management title/role in a startup without prior approval. This requires formulization of relations before one really knows what is required in the longer term. Nascent organizations have enough obstacles without having faculty founders wonder how a dean or chairman will feel about a particular startup. Remember I had an enemy in the dean's office at a time I was still vulnerable in some ways. As long as university duties remain the primary obligation of faculty, no restrictions should be placed on outside titles or roles.

The next easiest area of reform governs disclosure to the university patent or tech-transfer office of scientific findings. The mandate to *disclose* inventions flows from the Bayh-Dole Act of 1980, which encouraged patents to commercialize inventions arising from federal funding. Such a mandate fits better with a technology-licensing model than a startup model. In a licensing model, lab developments fit more or less neatly into existing industries. Existing firms may find it easier to commercialize such developments than, say, a startup might. With radical innovations and disruptive change, new markets are created, and specifying field of use is a much less certain activity. Further, radical innovations have the potential to affect multiple markets. Keeping the oversight of the new technology in the hands of the innovator is very important. No one is likely to understand the core of the new technology better than the faculty who created it. No one is better equipped to know how to tailor the technology to fit future markets. If you hire executives for their market knowledge, you undersell the multi-market potential of disruptive technology.

Good and dedicated people are working to rethink the historical role of faculty entrepreneurs. I'm sure there's progress. I hope such efforts change the odds in favor of innovation.

Epilogue to the Epilogue

In 2010, Fox Interactive Networks sold the SDC technology (renamed the Fox Audience Network, FAN) to the Rubicon Project in exchange for 20% of Rubicon's equity. Around 100 FAN employees went over in the transaction. Retention bonuses for the key SDC employees were paid by then and only Giuseppe DiMauro from the original tech crew went over for 10 months to ensure the technology platform migrated successfully. He then became the SVP of engineering at Vdopia. Fabrizio Blanco and Jason Knapp went to Specific Media, which transformed into Viant as a holding company for Specific Media, Myspace, Vindico, and Xumo. Fabrizio was named the

CTO and Jason was the chief product officer of Viant. Jason is now a VP at Viasat and co-chairs the selection committee of the San Diego incubator EvoNexus. Ravi Narasimhan was recruited by Adam Bain, former CEO at FAN, to help start the monetization team at Twitter in 2011 and then became the group product manager at Google and was recently promoted to director of product management.

Giovanni, SDC's original CTO and co-founder, left in 2004 before the sale to News Corp. He founded the Neodata Group in Sicily, which manages 25% of the Italian very premium advertising traffic. He is on the faculty at Universita' di Catania.

Chuck Wu, SDC's chief hardware guy, also left in 2004 and became the VP of technology integration at Autometrics, Inc.

Eric Bradlow was an assistant professor at Wharton when I first hired him to consult for SDC. He is now, in 2017, the K. P. Chao professor, professor of marketing, faculty director for Wharton Customer Analytics Initiative, chairperson, Wharton Marketing Department, professor of economics; professor of education, and professor of statistics.

Bart Bronnenberg was an assistant professor at UCLA when I hired him to consult for SDC. He rose to full professor at UCLA by 2007 and became professor and Center Research Fellow, Tilburg University, the Netherlands. In 2017, he was recruited to Stanford as senior faculty.

The SDC experience was a success in technology entrepreneurship, not systems entrepreneurship, with obvious overlaps. The shift from the ecommerce strategy to display-ad optimization moved SDC into a niche where it could not shape the overall web of enterprises cooperating and competing in e-commerce (Hagel 1996). The flow of e-commerce data to the academics interested in model development was crimped, not ended. I was disintermediated. That cut off my network of marketing scientists who were curious and willing to spend time developing new models for a deeper understanding of online buyer behavior, and SDC became a company that offered a valuable service, not a shaper of the wider web. While the academic community in marketing science has continued apace, much of the focus has shifted to research within companies in this space. That's why I consider my slice of the $150 million a booby prize.

Chapter 12

Life Goes On

"May this earth, blessed and purified with great understanding and deep compassion, protect and nurture the virtues and wholesome seeds"

— Thich Nhat Hanh

In mid-January 2010, Ann and I lost our younger son to complications from Type I diabetes at age 23. My heart goes out to any parent who has suffered that kind of loss. It is permanent. My memories of that time are still too vivid to write about. I will say, for weeks after, I could concentrate for at most five minutes before wandering back to some dark and sorrowful places.

In May, Skip invited me to the talks coinciding with the board meeting and annual dinner for Conservation International (CI). He had been a board member for many years. I had supported CI partly as a way to say "Thank you" to Skip. I was surprised by how the talks held my attention. The mission had shifted from preserving species in *hotspots* to trying to build sustainable systems for man and nature to coexist. Conservation International was doing important work, and I wondered what I could do to help.

The obvious place to start was by designing a project that could attract a team of MBA students doing a capstone project. Skip connected me with Niels Crone, then COO of CI. Niels was an Anderson alum who had taken the MBA capstone, then called Field Study and now called Applied Management Research (AMR). After substantial time at McKinsey, he switched to CI and rose in the ranks.

I invited Niels to come to UCLA and speak to interested students about projects with CI in general and specifically about upcoming projects with Suriname. In

fall-winter AMR 2010–2011, an AMR team lead by several members who wanted careers in the non-governmental organization (NGO) sector, took on a project with the country of Suriname and CI. Jody Menerey (MBA 2011) and I traveled to Suriname in June for a three-day kickoff conference. The conference was attended by high-level representatives in the government, private sector, and universities and was organized by CI's regional staff. Conservation International flew in their top energy advisor, two staff economists, and the project manager, Hari Balasubramanian, who worked on all the early UCLA projects. Our part of this much broader effort to do sustainable planning for the country was just one AMR. After quite a winnowing process, the AMR team did an excellent business-ecosystems analysis of ecotourism. The CI staff did a marvelous job of collaborating on the effort. Charles Corbett was the faculty advisor, and I was sort of an extra advisor. The AMR report went directly back to the government of Suriname and CI.

Russ Mittermeier (then CI President) and Jennifer Morris (then CI EVP) presented the results of the UCLA-CI collaboration to the Parliament of Suriname, leading the parliament to call for a five-year sequence of collaborative efforts to do green-economy studies in other major sectors of Suriname.



Figure 70. Hari Balasubramanian, Jody Menerey, and Lee Cooper in Suriname 2010.

The second AMR followed. This one came with a pre-packaged advisor, a popular finance lecturer with no research experience. The AMR team advertised that fact. I didn't understand why he was used as a calling card. It was a warning sign. I had much less interaction with this team, an early meeting, some conference calls, lurking on project calls with CI, and some specific email streams on issues, all of which had been resolved.

The staff economist at CI, who I knew well by then and respected highly, sent me the AMR team's first draft for comments. I was shocked. All the needed material was

probably there, but the presentation was in some lame variation of "Introduction, Method, Results, Discussion," the kind of paper that reports on all the team's efforts to ensure the faculty member can tick off all the boxes. I told the team they had to produce a version that presented recommendations for, in this case, the government of the province of San Martin, Peru. After a *you're-not-my-dad* reply, the team figured out the reasons in about as much time as it took me to write them out. The team said they would send two versions: one that was a client-facing document and another for the faculty advisor. I thought it unnecessary to do the second version and told the team and George Abe, then the faculty director of AMRs. Privately, I informed George that the Graduate Division mandate, under which field studies were accredited as a master's requirement, was as an alternative to a comprehensive exam, not a master's thesis. I said the report I called for was a much better exam than the original version. George did not change his opinion, accepting the two versions.

I learned from that history that you need advisors that are aligned with the project. Solving the problem for the client should come first. Conservation International is just one example, but a good one. The AMR teams were supported by both regional CI staff and CI specialist staff. In the case of Suriname, the regional CI staff connected our team with the right sources and resources, including a local university whose students helped with data collection at departure and arrival points. The point was to understand the problem comprehensively enough to provide specific recommendations that are backed up enough to pass the scrutiny of high-level staff. That, to me, is a comprehensive exam, some version of which we should seek in all our AMR reports.

With Suriname wanting five-year's worth of studies, the *ad hoc* AMR teams did not provide the assurance of continuity needed to fulfill this mandate. The alternative I designed at the time involved Net Impact (the leading national student organization focused on sustainability issues), the Leaders in Sustainability (LiS) Program at UCLA (a popular campus-wide graduate certificate curriculum started at UCLA Anderson and by then under the aegis of the UCLA Institute of the Environment and Sustainability (IoES), and Dr. Mark Gold, then associate director of the UCLA IoES. Net Impact was to offer positions for CI Venture Fellows, from four to eight MBA students each year that will be project-team leaders on these efforts. Depending on the size of the efforts in a particular year, these CI Venture Fellows could recruit other team members. The LiS Program will sponsor special-topic classes that provide a vehicle for course credit for the student side of the collaboration. Mark Gold was to be instructor of record for these courses, using his skills developed in over two decades of heading Heal the Bay. I planned to remain as a special advisor to the projects and liaison with CI.

The LiS Program introduced me to the IoES. I pitched the idea to Madelyn Glickfeld, assistant director for Outreach and Strategic Initiatives, and Glen MacDonald,

then director of the IoES. Through them, I met Tom Smith, director of the Tropical Research Center. One of Tom's many initiatives was to bring UCLA caliber, master's level training to the Congo Basin. He wanted to develop a network of international research and training centers in Central Africa. The goal was to establish a series of in-country centers of excellence focused on higher education and scientific research to help meet the environmental, health, and economic challenges facing Central Africa. UCLA first established a modest facility in Yaoundé. It has attracted researchers from around the world. What attracted me to the idea was the framework of a matrix pedagogy. The rows were the skills to be developed by a graduate program, while the columns were the problems in the local environment. You had to make sure the skills were there to confront all the local problems and that the problems being considered were broad enough to embrace the palette of skills. Tom brought me onto the board of the Center for Tropical Research to help bring some business-school skills and talents to his initiatives. I recruited a volunteer to work on planning and helped him set up a boundary organization, the Conservation Action Research Network (CARN), to enable his international work in ways UCLA couldn't.

Glen MacDonald and two members of the IoES Advisory Board (Tony Pritzker and Daniel Weiss) set up a lunch discussion that ended in an invitation for me to join the IoES Advisory Board. I accepted, and the board voted me in.

The experience with the AMR projects for CI and my growing awareness of the human resources in the IoES and related parts of campus led me to attempt to expand, formalize, and fund the CI-UCLA partnership and make it the founding partnership in a center for action research. I pitched the idea for the center to the IoES Advisory Board and won their support. Kathryn Atchison, the provost in charge of such things, organized a meeting with Chancellor Gene Block, where I again pitched the idea of the center. He got it immediately and endorsed my efforts. I was specific, however, in not asking for financial support. At that time, I was too sure that the connections with CI and UCLA, in general, and Skip, in particular, would produce someone to name and endow the center. I'm sure Gene was more likely to endorse good ideas that don't cost him discretionary funds. I warned him that decisions would come back to him when development priorities produced conflicts (i.e., the center targeted sources that other parts of UCLA development coveted). Kathryn then briefed Executive Vice Chancellor Scott Waugh on our meeting with the chancellor.

We organized a small dinner with an impressive list of speakers:

- Peter Seligmann, CEO, CI
- Skip Brittenham, senior partner, Ziffren Brittenham, CI Board of Directors
- Niels Crone, COO, CI
- Madeleine Botrill, director, monitoring and evaluation, CI

- Luisa Tam, regional director of development, CI
- Nancy Morgan Ritter, chairman's council, CI
- Jody Menerey, alumna UCLA Anderson, member first Suriname team
- Sue Andres-Brown, president, NetImpact, UCLA Anderson, member Galapagos team
- Mark Gold, associate director, UCLA Institute of the Environment and Sustainability (IoES), co-director, Center for Action Research
- Kathryn Atchison, vice provost, New Collaborative Initiates, UCLA
- Charles Corbett, professor, UCLA Anderson, founder, Leaders in Sustainability, co-director, Center for Action Research
- Lee Cooper, professor emeritus, UCLA Anderson, IoES Advisory Board
- Anand Bodapati, professor, UCLA Anderson
- Tina Quinn, co-founder, Sustainable Development IoES Advisory Board, incoming chair

While the dinner attendees were very impressed, somewhere high in CI, the decision was made not to ask directly for support at that event—a mistake from my point of view. The development team on the CI side consisted solely of Luisa Tam. I don't know what follow-up meetings she set up. If any were set, I was not invited. A hoped-for meeting with Elon Musk never materialized. The UCLA development team was even less responsive.

I should have recognized then that the momentum we had built was fading. People who couldn't make this happen were wildly enthusiastic. People who could make it happen were not available or liked it but had higher priorities for their patronage.

I steamed on in the belief we were on the cusp of funding. I knew I had little personal fundraising power, but nonetheless felt then was the time to ask my friends to join this. That request raised $85k, when I needed at least $300k to hire any staff for even a three-year test.

Since then, I've refined the model and the message and am still waiting for funding.

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Chapter 13

UCLA Center for Action Research

UCLA's core mission can be expressed in just three words: Education, Research, Service.

— UCLA website.

This is the case I made for the center design as it stood in 2016. It emphasized managing multidisciplinary teams that change over time and partnering to get things done in the world. Communications management, project management, and knowledge management are fundamental to being able to learn systematically across a large number of projects.

Part 1: Introduction

The world faces many complex problems and a great public university must be part of the solution. The mission of the center is to transform research and education into service to the world. The goal is to organize, prepare, and support students as they attack real-world problems and to do so on a large scale. UCLA's Sustainable LA Grand Challenge (SLAGC) serves as the test bed for the center's approach. To make LA 100% water and energy independent, with enhanced ecosystems health by 2050, is a challenge on a grand scale. With help from the center and 150 faculty affiliated with the SLAGC, we believe this is achievable.

Mission: Transforming Education and Research into Service to the World

Strategy:

- Form multidisciplinary student teams custom-fit to the needs of each project.
- Use course credit and teaching credit as the internal coins of the realm and include all other variable costs in the project budget.
- Fundraise jointly if the projects that students and faculty demand do not have sufficient support.
- Use information technology to streamline operations, ensure projects can be carried across time and teams, and facilitate access to and utility of the growing knowledge base (KB). Build and adapt knowledge-management, project-management, and communications-management tools to enable this.
- Bring to scale to minimize infrastructure costs relative to value delivered.
- Make the KB publicly available to foster broad adoption and growth of the engagement model by other universities and colleges.

Multidisciplinary Teams

One challenge was the issue of how you manage a multidisciplinary team through the product life cycle (PLC), where the depth of expertise changes with the stages of the PLC. Most MBAs are taught about T-form teams, with depth in one area and lateral connections with other areas. The teams in product-design stages look more like Γ. When the focus shifts to production you get T-form and the after-market support teams look more like 7. Managing this kind of multidisciplinary dynamism is tough. To do it right requires the product manager to let no area remain opaque to him or her. Answers often come from deep expertise, beyond the ken of most managers. The reasoning behind the answers, however, must be understood by at least the product manager. When all members of the management group take on the responsibility of the product managers, strong, multidisciplinary groups are created.

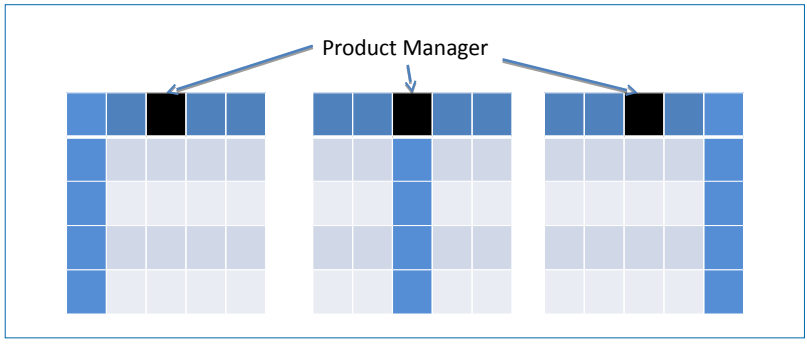


Figure 71. Shifting depth of expertise over time in cross-functional teams.

The next important ingredient concerned time. Real projects often run over larger time spans that quarters or academic years. This is a problem I dealt with as director of the VDP from 2003–2006. My design of that effort had MBA teams do the strategic planning and business due diligence for potential startups mainly out of UCLA labs. The teams bridged the technology gap by having a doctoral student from the lab or sometimes the having the lead researcher join the team to make sure no areas were opaque to the planning process. One year, we had a small group of doctoral students from Cal Tech come over and join any team that aligned with their interests. The teams looked carefully at technology risk, market risk, human risk, and financial risk. They used the Bayesian networks that I developed from the Intel grants to model the likelihood of success and the value of success under a multitude of scenarios. This is a lot of work. Done right, it can have an effect on major business decisions, and it often can't be squeezed into one quarter. Decent project-management discipline and an RA to help ensure continuity from one team to the next handled the issues well on a small scale. The success in carrying out these projects over time translated directly into the efforts of AMR teams on CI projects.

Successes to Date

We have run successful pilot projects merging Anderson MBA students fulfilling their Applied Management Research (AMR) requirement in collaboration with CI and their in-country partners. These projects have the potential to range from large corporate engagements on sustainability to public-sector engagement in considering and appropriately valuing natural capital in economic development. In these studies, we combine a basic management team with expertise from advanced students in the IoES, under active supervision from UCLA faculty and the partners involved.



Figure 72. The project team in Suriname.



Figure 73. The project team in Ecuador.



Figure 74. Surveying fisherman on local markets and practices.



Figure 75. With children from an Ecuadoran fishing village.

Underlying Principle

We are proposing to **let the scope of the problems dictate the scope of the efforts**. We unite student subgroups and individuals from across departments and across degree programs in common purpose to attack a problem. To this effort, we add outside partners with complementary intellectual resources and domain savvy. These professionals become allies in advancing a common agenda. Unite them with the faculty also interested in the agenda and a great deal more force is being brought to bear. This is one way the university can become part of the solution. This is an advanced version of the model for post-secondary education advocated in the 2014 CED Report (Boosting California's Postsecondary Education Performance: A Policy Statement and Call to Action). Project-based learning is a successful and growing trend in education. The center's efforts show the potential of this trend.

Benefits to Students

The freshman experience at UCLA starts with Volunteer Day, engaging teams of incoming students in service projects to aid the local community. The Center for Action Research builds on that spirit of engagement and helpful action. Throughout their academic careers from the earliest days to capstone experiences for senior and advanced-degree candidates, students will have curricular and extracurricular opportunities to engage in team projects that advance valued agendas.

As mentioned earlier, they learn to work in multidisciplinary teams with advanced students, professionals from NGOs, and faculty. What I tell students is as simple as this:

> Study groups will form in almost every class you take. The overall assignment will be divvied up among the group members. What happens next is the key. Don't just do your work and give your answer. Explain the process and/or ra-

tionale. The same goes for the other students' parts. You make a mistake if you accept other peoples' work on faith. You must understand the thinking process that led to a result. If an answer is opaque to you, you lessen your workload, but lose in the process. If you engage in the discussion and questioning that teaches the lesson you've gained two benefits. First, the assignment gets done. Second, you take a major step in learning how to function in a multidisciplinary team. Such teams will characterize most of your work life beyond college.

Real projects get done when multiplicities of talents are pooled into a work group. Think about the leader of such a group. As a project evolves over time, the depth of expertise migrates from design to execution, analysis, synthesis, communication, implementation, and feedback. The leader may not have the depth of expertise to create the answers at any stage but must make the intellectual commitment to understand the thinking behind each piece of the puzzle. "Take my word for it" is the path to sub-optimality or outright failure. Great projects happen when all participants make the intellectual commitment of the leader.

UCLA students are smart, or they wouldn't have gotten in. If they use that strategic asset and make the intellectual commitment to each study group, they will end up as the leaders they want to become.

The center communicates upcoming opportunities, reports the status of ongoing engagements, and helps teams organize and find the student, faculty, and NGO/partner resources needed to advance the projects. Advanced students can use this same infrastructure to gather other students interested in attacking particular projects and attract NGOs and faculty to their efforts. This center creates the opportunity for students to take entrepreneurial initiative. The center provides the infrastructure that helps ensure progress on projects that span across student efforts over time. Real-world problems are not solved in a quarter. That should not preclude students from making progress on addressing important problems. The center will hire student support staff (RAs and TAs) to ensure that projects maintain continuity as they pass from one project team to the next. The needed function involves ensuring, at project uptake, that a record of project milestones, ongoing efforts, and issues not yet addressed is communicated between teams and left as a growing log of the project. This is part of basic project management.

Benefits to Faculty

Faculty get the opportunity to align their teaching and class projects with the agenda of the SLAGC and garner an expanded resource base for addressing important issues. Where there is good reason for the walls around the traditional classroom to stand, these

will remain, but for a growing part of both undergraduate and graduate education, the walls separating disciplines and degree programs are falling, creating opportunities for increasing the relevance and effects of the educational experience. There is also the greater potential for alignment of teaching and research agendas. The UCLA Emeriti Association has endorsed our efforts, and emeritus faculty are eager to participate. Emeriti faculty gain the opportunity to engage with student teams in projects of mutual interest, creating more latitude for matching students and NGOs with interested faculty.

Benefits to Outside Organizations

Nonprofit organizations and other outside partners (all called NGOs here for convenience more than accuracy) gain access to a broad bench of expertise and the ability to customize a team to temporal project needs. Since the center provides the infrastructure for passing projects from one team to the next, partners gain greater flexibility in their manpower planning. Project teams can be scaled up or down in sync with project needs, overcoming one of the major diseconomies of scale NGOs face.

The center will provide project-management tools and an open wiki/KB, communication, and crowd-funding capabilities. Nonprofit organizations are mostly small and medium-size enterprises that face many diseconomies of scale. To the extent that our human resources and information infrastructure can overcome some of the diseconomies they face, the center provides valuable services to the broad NGO communities and all the constituencies they serve.

Systems Redesign

The center is being crafted out of mainly existing pieces within the UCLA system. Similar pieces exist on most campuses. Since over 900,000 student hours per year are dedicated to capstone experiences at UCLA, credit vehicles abound for the kinds of engagements we are creating. No new classes need to be approved before we get established. Beyond the resources the center needs for professional and student staff, the normal curricular budgets fuel the enterprise. We can proceed and grow at our own pace. Scalability is mostly associated with the completion of the data-driven information system. The design is discussed in Part 2.

The Center for Action Research is endorsed by former directors of the UCLA Institute of the Environment and Sustainability (IoES), the IoES Advisory Board, the deans of Physical Sciences and Life Sciences, UCLA's Chief Sustainability Office, the associate vice chancellor for Environment and Sustainability, and the chancellor. We have helped the UC Global Food Initiative and are now working closely with the first UCLA Grand Challenge. We are planning to bring in students from environmental law, public health, and public policy in upcoming projects. With a mature informa-

tion infrastructure, the center could handle hundreds of projects at a time at UCLA and could be mirrored at every UC campus. The designed center can be replicated at every major university; 100,000 projects nationwide are not an unreasonable goal.

Part 2: The Marketplace of Ideas

To my way of thinking, what we are developing is a complex, multifaceted marketplace. On the supply side are the agendas of UCLA's SLAGC and outside partners with project needs and requirements. How are partners attracted to working with UCLA? On the demand side is how these ideas and projects appeal to students and faculty. How do their skills match up? How are donors attracted to the combination? How can we make the resulting knowledge more useful? What innovations can we observe? These are the issues in the marketplace of ideas.

My research for Intel, my reading and teaching about the digital economy, and my own startup experience convinced me of the following:

1. Disruptive innovation is like a long leap across a rugged landscape. You must survive before you can thrive. In business, this means understanding the value you can create, discovering the kernel of the innovation, and finding the reachable first market.
2. To cross the chasm,[54] Geoffrey Moore's valley of death, you needed to provide a whole-product solution and a compelling reason to buy.
3. Employing Moore's bowling alley strategy[55] will create a platform for hypergrowth.

Getting the kernel right is important in understanding both company and industry evolution. Walter Isaacson's (2014) book, *The Innovators*, gets it wrong on video games. He highlights Al Alcorn's hardware-based games and Nolan Bushnell's marketing chops for the explosion of an industry. New game design came out of the advanced engineering group Steve Mayer led. Hardware-based games were each a unique creation. The limits to scale arose when attempting to broaden the product offering. Bushnell's strategy for dealing with the Atari imitators was to out-innovate them, rather than sue. He pushed Atari to produce a new title every other month.

54. The *chasm* is the divide between the nurturing environment in which a disruptive technology incubates and the first real market entry. You have to solve a whole problem for that market and most often need partners to provide a whole solution.

55. The first real market is a beach head. Success in that market knocks over the first pin in the bowling alley. By both building out the capabilities and extending to different market segments, the company or consortium enables commerce in a whole sector, ergo a platform, such as the Wintel platform that dominated PC evolution. These are the basic conditions needed for hypergrowth.

Steve could not meet those demands if each new game was a unique combination of hardware and software. He drew from his fantasy of how the HP35 worked and designed a standard hardware platform from a MOS 6502 chip for the vertical display axis and a display co-processor, Stella, for the horizontal axis. Because of his design, the display memory needed only height-plus-width storage rather than height times width. That was a major innovation when every byte counted. The hardware platform had no native operating system. "Even greater creativity was needed to design the operating system, the game play, and the graphics into the 128 bytes of RAM the original unit contained. (That's bytes, not kilobytes.)" (Cooper 2004, p. 154). At that point, they had a home video game with an arcade game box around it. They had solved the scaling problems in both manufacturing and design. This is an industry ready to take off. Just take off the arcade box.

Being focused as I am on understanding the kernel, what is the kernel of innovation in the Center for Action Research? I say it is project-based learning. I am certainly not the innovator here. Many efforts are proceeding in the K-12 education system. My nephew, David, designed one with the Getty Museum (see Cooper, 2018). As mentioned earlier, project-based learning is the model for post-secondary education advocated in the 2014 CED Report. Speaking after Francis Hesselbein the World Bank dinner, I started with the story of my only teaching award juxtaposed to her Medal of Freedom. In a student roast, called *Cabaret*, when we were still called GSM (Graduate School of Management), I received a GSMmy Award.[56] I deserved the award. When I began teaching, I largely succeeded in becoming my own ideal teacher. I soon discovered that what was ideal for me was seen quite differently by the bulk of the students. I understand why my colleagues thought of students as their customers. I only partially understand the fidelity I felt to the field. I'm a methodologist. We aren't the life of the party. The place where students and I were most aligned was in project-based learning.

What I am trying to add to the project-based-learning movement is a whole-product solution (i.e., let the scope of the problems dictate the scope of the efforts) and a compelling reason to buy (i.e., for a project that an NGO is committed to doing, the partnership model provides the lowest cost way to move forward).

The bowling alley strategy, in this case, involves first expanding to new partners at UCLA and using Net Impact students to help spread the model to other campuses. The information system becomes an important part of shared infrastructure for all participants in the alliance.

The system can grow to hundreds of projects at UCLA and proportional numbers at hundreds of other colleges. My goal is for 100,000 projects across colleges, universities, and their NGO partners. It's enough that this should happen. Further expansion is hampered by several unsolved issues.

56. As said earlier, for "the best translation of an English language course into a foreign language."

We are starting with student teams ready to enter the workforce— finished products as far as the knowledge factory is concerned. Expanding the team structures to include apprentice personnel will be problematic. Starting with teams in the IoES Senior Practicum should help lead the way.

We are starting by partnering with nonprofit organizations. The students are drawn to projects by what they value. Possible expansion to the for-profit sector has a different set of problems. NGOs are used to establishing partnerships on the basis of fair trades. For-profit firms often look for advantages that can drain the resources of a university.

We have witnessed the phenomenal growth and development of new marketplaces in the gig economy. Over 40% of the US labor market is now in contingent employment. Uber, Lyft, Airbnb, TaskRabbit, HelloTech, and the LendingClub are often-discussed examples. All of these have advanced by transforming the players in disorganized and small-scale arenas into data-driven organizations. Information technology is the key to scalability. The same is true for the marketplace of ideas.

Information System Needs

As the number of projects grows, the matching of students' skills and interests with UCLA's and/or outside partners' project needs requires an information system that could be used strategically (e.g., communicating project needs and goals, tracking project progress and milestones, and archiving and mining project results and knowledge). UCLA is a network of students, faculty, and resources. Providing a common platform for project advancement is the key. Major tools, such as #Slack, Asana, and Zapier, are already highly developed and amendable to our needs.

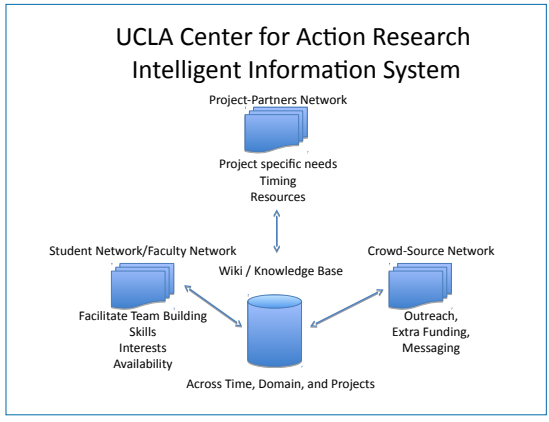


Figure 76. Early version of the info-systems design.

The Project-Partners Network

The success path for the center involves attracting a diverse portfolio of projects. We start with the many projects forecast for the SLAGC but envision scaling far beyond these. We have a deep and broad bench at UCLA. The diversity helps ensure that student interests are engaged with one or more of the available projects. The Project-Partners Network needs a record of the project specifications useful in team selection. Rich tagging of the information should facilitate the mining of the KB described below. We need the kind of information that enhances communication to the Crowd-Source Network, also discussed below.

The Student Network and Faculty Network

The students need to be characterized by skills, abilities, interests, and affiliations. Teams could be pre-affiliated, in search of projects, and/or in search of other components for the team. Regular and emeriti faculty need information on upcoming projects of potential interest. Much of the functionality of the system is basic to social networks. There may be an existing social network we could use that could partition this effort off from their larger audience.

The Crowd-Source Network

If incremental resources are needed, the combined UCLA project-partners team could appeal to a donor community for any additional resources needed to complete the project. Expanding the information system to include donors presents interesting prospects in crowd sourcing and other such community-building efforts. This is also a public outlet for center communications, and a natural connection point for other media outlets.

The Wiki/Knowledge Base

All project results, including outcome measures, are maintained in the KB. Since we have the infrastructure to extend projects over time and teams, progress can be tracked. The report structure must be robust enough to facilitate handing projects off to future teams. Accessibility to future teams facilitates knowledge transfer across geographies, content areas, and time. One of the goals of the center is to build community and common knowledge among the project partners and the UCLA teams working with them. Knowledge sharing is the default, although exceptions could be granted in specific circumstances. The KB can be mined for best practices. At a more general level, just as medicine is a translational science linking knowledge in the lab-

oratory with clinical evidence, center projects contribute to the evidentiary base for sciences including the environment, sustainability, and all allied areas.

The Alliance for Action Research

The information-infrastructure needs of the Center for Action Research are similar to the needs of the action-research components of many other research centers and projects. One of the functions of the Center for Action Research is managing an alliance among such centers. There is a small immediate benefit of understanding that we have a lot of issues in common. The real benefit of helping to redress some of those issues is off in the future. In addition, J. R. DeShazo and Colleen Callahan have brought the Luskin Center for Innovation into this alliance, as has Tom Smith with the Center for Tropical Research and the Congo Basin Institute. We will be reaching out to other centers in the near future. Hundreds of other projects based on campus could benefit from the information infrastructure we are trying to build. This is also a natural way to extend the benefits to other campuses.

The Revolution Will Be Bottom-Up, Not Top-Down

As in the Cambrian explosion, a great number of local efforts have begun to redress problems in social, political, and environmental justice. The SLAGC is one umbrella for perhaps 150 such projects. Each of these must find the human and financial resources to survive or they simply die. The information infrastructure described here makes it easier and less costly for such small and local efforts to find partners and resources to help overcome the diseconomies of scale such projects must confront. Universities are hosts to legions of bright, young, idealistic students who want to make a difference with their lives. The multidisciplinary, project-based-learning model and information infrastructure to ease partnership building and project execution are two key elements for fostering the radical change that is so needed.

What Silicon Valley has taught us about radically new products is that, for a cool idea/product to achieve hypergrowth, you need a *whole-product solution* and a *compelling reason to buy*. The Wintel became a platform by uniting hardware and operating systems with applications and peripherals—a whole-product solution. Mostly business needs provided a compelling reason to buy. Apple, with a few peripherals, provides whole-product solutions. Design and/or opening of new-product classes makes Apple products *must-buys*.

The pilot projects between AMRs and CI are cool efforts that the participants and the stakeholders loved. The Center for Action Research is the attempt to drive this model into hypergrowth. It is fundamentally designed to provide a whole-prod-

uct solution by building teams that are fit to the needs of the project and changing them as needs change. Given the natural fit of these projects to capstone efforts and other curricular initiatives, much of the expense associated with personnel costs are shifted onto normal course budgets. The lowered total-project cost is a compelling reason to buy. This is a revolution with a solid business model to back it up.

I brought the Emeriti Association on board as faculty available and interested in mentoring and/or leading teams and recruited the first two members of the Alliance for Action Research. Then, I waited for CI to get me on Elon Musk's calendar, whom they had hoped would fund the first three years of effort by both UCLA and CI. And I waited. Much more has happened, but 18 months later, we trashed that plan.

The IoES hired a new director as of July 1, 2015. Conservation International has reshuffled its top echelons, although major players inside CI are still advocates and supporters of the partnership.

We have made progress on the Intelligent Information System while waiting for progress in funding areas. Conservation International worked on the knowledge-management component with collaborators at the National Center for Ecological Analysis and Synthesis. There are decent public-domain tools available for project management, and the IoES is redesigning its communications-management component to be much more robust. We've since learned that everything we need exists in the Slack APIs and the apps that connect to them.

I wrote my 2004 book before I knew whether my startup would ever succeed, and I write this before I know what will become of my efforts with the Center for Action Research. I'm hoping to be able to write a happy epilogue.

The *valley of death* is the much discussed period in the technology-adoption-life cycle (TALC) literature when the nascent organization with disruptive technology tries to transform cool prototypes to beachhead products. Like the explorer crossing the dessert, you can only go as far as your water allows. For young tech companies, it turns into the burn rate. You are betting the company on the ability to raise the next tranche of capital.

An analogous valley of death period is transited by aspiring actors and screenwriters. More often these are solo ventures. What substitutes for water as the relative abundance of resources in the local environment? Living at home, waiting tables, or teaching part-time are frequent examples. When do aspirants give up trying for an elusive goal? It obviously depends on the nature of the feedback and the available resources. Extreme, variable-schedule, partial reinforcement builds the strongest habits. That's one of the few things I remember from psychology—it's one rave review or good personal feedback and on rare occasions another. It's like one of Don Morrison's mixture models. There's one distribution of talent, probably normal. There's another skewed distribution of resources. You have to shuffle them together to get a sense of

how long you can last in the valley of death. My resources are fortunately not an issue. At the current burn rate, I could go on a lifetime, although the opportunity costs increase as I approach an age of diminished physical capacity.

Yet another source of resistance is the "crying wolf" syndrome. You can only sing the same song of promise so long. There is an unknown expiry date on even good ideas. In another local environment, they might flourish. Locked in a particular locale, they die.

In 2011, the first project with CI was completed, and I saw the power in the combination and started completing the model in my mind. I completed the design and sketched the information system by September 2013. That fall we had a big push on the center and the CI-UCLA partnership. I assumed the endowment would flow from the dinner announcing the partnership. It was a long process of reduced expectations from CI. I started fundraising from my small circle before I sensed how little was happening on the CI side. In the end, I raised something over $85k, which is not enough to hire staff. Spring 2014 was when it was all supposed to happen.

It's only been a couple of years that I've wandered in this chasm. I kept receiving occasional positive feedback as some friends and colleagues got the concept.

What series of events led to the renewed push? Mark Gold, who years earlier agreed to be the co-director of the center, lost his bid to become the director of the IoES. Peter Karieva, the victor, thought the center was a cool idea but not on his critical path to success in his job. Mark, partly at my urging, designed the dream job he needed to be created for him to stay at UCLA as head of the SLAGC. I asked the chancellor to move the center under Mark's new office, with its campus-wide mandate, and fund it. He did the former, not the later. When two friends separately urged me to get an updated message out there and see if there was renewed interest, I jumped back in.

Two years of effort have produced too little progress. Projects keep happening at a slow pace using more or less the existing infrastructure: AMR and CI continuing a project-by-project partnership. I reviewed another AMR team project on Ecuador on March 17, 2017. Academic year 2017-18, CI has five AMR teams some new and some sequential projects. Two more blockchain applications are on deck for teams from the Executive MBA Program.

I resigned from the advisory board of the IoES in December 2016. Strike one was when Peter placed the center off his critical path. Strike two was when he told the president of CI to put a million dollars on the table if they wanted to do any partnering with the IoES. Strike three was when Peter nixed the plan to take my information-systems design to a major funder who was left alone just wandering at the gala. Staff agreed it was a perfect fit. Strike four was when they terminated a staff member as she approached the end of her probationary period. Wait any longer and IoES would have to come up with a reason for firing her. She was the only one helping me bring in information technology to the IoES operations.

I funded her through CARN for four months in the hope we could get an alpha demonstration of our technological vision out there for possible funding. We learned everything we needed was available, in #Slack and the ecosystem around Slack APIs but couldn't get something worth showing. We lacked a technical lead. I've learned from helping expensive and short-lived startups, KlickSports and Ultra-Live TV, that this doesn't work.

In spring 2017, SLAGC came back into the picture. The UCLA Library hired a data-systems person to support funneling project knowledge into the archives. I proposed using the $85k we raised for the center to hire apprentice personnel to help all parties use Slack for communication and work on bundling the apps that automated those project processes that are amenable. The Leadership Council has chosen to use Slack for their communications. That's leadership. Conservation International has bought into the need for more formal project management, so we can learn across projects. We'll see where it leads.

Chapter 14

Answers and the Questions They Imply

"If I am not for others, what am I? And if not now, when? "

— Hillel

Remember that extreme, variable-schedule, partial reinforcement leads to the highest habit strength. So, I persist. These are the essays that summarize the foundations for attacking world problems at scale. They cover incubating disruptive innovation and project-based learning, building centers for action research, the huge entrepreneurial opportunity in moving to the new-energy economy, redressing the crisis in the American workforce, matrix pedagogy, and fostering large-scale systems change.

I failed to get adequate resources within UCLA, but the structures and advantages are there for all. I decided I had to cast the message of action research to a broader audience. At around the same time, I ran across the original project reports from Rajiv Kulkarni of 3-D Systems. I contacted him anew about sharing his story with a broader audience. He deserves the credit. He was very willing to cooperate, had little time, and hadn't a clue how to proceed.

The two motivations came together, when seeking an outlet for the 3D printing story, I ran into a lead story in the *California Management Review* on how the third industrial revolution is driven by the transformation of 3D printing into distributed or additive manufacturing. That's what Rajiv did in the VDP.

I thought of a trilogy of short pieces that went from the real history of incubating this revolution to the issues in project-based learning, then to action research and the model for enabling university students to be part of broad coalitions attacking important problems. The capstone sketched the tremendous entrepreneurial op-

portunity moving to a sustainable energy future. For that, I had the help of Michael Totten who is much more broadly read in these areas than I am. Then, I saw an *elephant curve*, which describes the growth in wealth over the 1988–2008 period for each sector from the poorest of the poor to the global elite and highlights the decline in wealth in the developed world middle class. I decided a fourth piece needed to spell out the implications of manufacturing innovations, the sustainable energy economy for redressing the problems in the American middle class.

At the end of each essay, I ask who is taking these issues on in a systematic way? And if no one, why not? I added a fifth piece that looks at large-scale systems change and the need for systems entrepreneurs. I present these five pieces here so that, at the end of the day, I'm saying I did the best I could to find ways for us all to work together to tackle the future.

Some of the material naturally recapitulates parts discussed earlier in the book. Think of these as what I think is most worth remembering from this 50-year saga.

Incubating the Third Industrial Revolution

Lee G Cooper[57]

June 2017

Ben-Ner and Siemsen (2017) lay out a compelling case for the vast potential effects of 3D printing (additive manufacturing, AM), calling it the technology that ushers in the third industrial revolution. They go in considerable detail to support their initial claim that "AM is poised to transform many aspects of production, distribution, the supply chain, organizations, and the global economy." Of the almost 9,000 words in this broad vision, only 85 words vaguely describe the origins of this disruptive technology. The authors later describe the industry as *nascent*.

> "The adoption of 3D printing will arrive in stages. In the current, nascent, and evolving stage, 3D printing is confined to industrial applications, such as spare parts inventory." p. 17.

It was much more nascent 13 years earlier when I encountered 3D printing in the UCLA Venture Development Project (VDP) in early 2004. We all would gain from a better understanding of the real incubation of this disruptive technology.

57. Professor Emeritus, UCLA Anderson: I want to thank Michael Totten for his comments. I also want to thank Rajeev Kulkarni for his cooperation and permission to release his original analyses and supporting materials. The original analyses are available on the *California Management Review* online site. Edited for consistency.

3-D Systems and the UCLA Venture Development Project

The Venture Development Project (2002–2005) at UCLA Anderson did the business due diligence and strategic planning for 18 companies, mostly startups out of UCLA labs with some projects from Cal Tech and UC Berkeley. The methods were developed in under three years of grants from Intel Corp.[58] specifically focused on strategic planning for disruptive innovations or radically new products. Seventeen of the companies engaged in team projects—typically four MBA students augmented with graduate students from the lab or other bridge people and the faculty member heading the lab. I led the VDP through a course called Strategic Marketing Planning for New Ventures.

The 18th project was different. An MBA student, Rajeev Kulkarni, was a product manager at 3D Systems when he took the course in early 2004. He wanted to do a solo, confidential project on his own company. I told him I would expect a team's worth of effort, not a solo act. I insisted because these analyses are laborious to do comprehensively. You had to find the kernel of the innovation and the best first market for building out the innovation and fill out the critical-issues grid by investigating political, behavioral, economic, sociological, and technological issues from the perspective not only of the company, but also how these same factors affect the business ecosystem, and the general infrastructure. All these had to be mapped into Bayesian networks (Pearl 1986 & 2000), like a dynamic, quantitative, scenario analysis for assessing the likelihood for success (*cf*. Schwartz 1996). The analyses combined Geoffrey Moore's (1995) *technology-adoption life cycle*, Christensen's (1997) writings on the *innovator's dilemma*, a little Slywotzky (1996) on *value migration*, and my own work (Cooper 2000) on *strategic planning for radically new products*.[59]

The 3D Systems Corporation at the time was oriented toward the tool and dye sector with the new selective laser sintering (SLS) system for metal 3D printing. Rajeev saw the complex risk analysis at the heart of the VDP as an opportunity to assess the best course forward. He developed Bayesian networks based on his customer and in-company surveys and used the results to support shifting away from tools and dyes and pivoting to direct manufacture. Their successful pivot to

58. Intel Corporation, 1996–1997, Project Action: Planning for Radically New Products. Intel Corporation, 1997–1998, Planning for Radically New Products (renewed 1998–1999). Intel equipment provided under the grants was accompanied by software grants from Microsoft.

59. Cooper (2000) won the Marketing Science Institute H. Paul Root Award for 2000, given by the American Marketing Association to honor the *Journal of Marketing* article that has made the most significant contribution to the advancement of the *practice* of marketing. I would like to thank David Stewart, then editor of *JM*, and the editorial board of *JM* for selecting this article as the lead for the January 2000 issue and supporting the article for the MSI award.

Team project: Strategic marketing planning for a new venture.

- Kernel analysis.
- Market screening:
  - Market definition.
  - Value network.
  - Business-design summary.
  - Competitor analysis.
  - Opportunity analysis.
- Value-recapture analysis (pricing strategy).
- Marketing research.
- Organization chart.
- Financial spreadsheet (along with a guide to its use).
- Scenario Analysis.

Figure 77. Team assignment from January 2004.

a market that fueled their expansion helped Rajeev be promoted to chief product officer, VP at 3-D Systems.

I had helped an earlier student team working on rapid prototyping in a market-assessment or marketing-research class project in the mid-1990s but can't find any record of that effort. When the VDP came into the picture, 3D Systems made objects like those seen in Figure 78.

The putter reflected the new SLA process for metal 3D printing, which became publicly available two months before this VDP project started in January 2004. The shift from photopolymers to metal powders reflects a key point in the evolution of this technology as a basis for something more than rapid prototyping.



Figure 78. 3D Systems example products circa 2004 with mouse for scale.

The *kernel analysis* thinks of disruptive innovations as long leaps across rugged organizational landscapes (Emery and Trist 1965 and Kauffman 1995). The innovation must find enough resources in its local environment to take root and grow, or it dies. Kulkarni's Bayesian network analysis showed a very low (6%) chance of success in the tooling market and a 70% chance of success in the direct manufacturing market, sticking first to the production of small (< 8") metal parts. The analysis supporting the pivot was strong enough to convince top management to get behind the young product manager. This is like extending kernel analysis to second-market selection. It also provides strong support against those that would oust the founder. With radical innovation, you need to keep the creators central to top decision-making. Some CEOs are brought in because of their first-market savvy. Managing the path of disruption benefits from a deeper understanding of the technology/innovation.

So What? Project-Based Learning, Action Research, and Scaling Impact

Recognizing the thoughtful analysis needed to foster disruptive innovation is important in itself. Cooper (2000) affected at least 17 companies in addition to 3D printing industry, my own startup,[60] and served as Travis Kalanick's introduction to the literature on disruptive innovation—a story for another time. Intel's support bore fruit. Some of it has just taken a long time to sprout. All of the development is in the public domain.[61]

The VDP is an example of project-based learning—using students' commitment to a project to put context, meaning, and motivation behind their learning efforts. Teaching kernel analysis, critical-issues analysis, and Bayesian networks is practically impossible without the extra engagement that real projects engender. As an important byproduct, students learn to work in multidisciplinary teams toward common goals.

Project-based learning has been seen as a major vehicle for closing the skills gap—aligning curricula with the needs of a modern workforce. The Committee for Economic Development (CED 2013) focused mainly on California community colleges and the state university system. The VDP (*cf.* Cooper 2004) shows that the benefits of project-based learning also accrue at the highest levels of the post-secondary system. Perhaps highlighting the benefits at the highest levels will help spread the practice.

60. Strategic Data Corp. was founded in January 2000 and sold to Fox Interactive Media in 2007, *cf.* Cooper 2004.

61. The Bayesian networks were developed in Hugin LT 5.6. I have no idea what has replaced this. The original report and supporting documents are available from the California Management Review website.

Action research is another example of project-based learning. Since 2010, I've been involved with encouraging collaborations between NGOs such as CI and MBA teams embarking on capstone projects. These projects supplement the professional staffs of NGOs with the ready-for-market, grad-student talent that would be very difficult to maintain on permanent staff. The enormous opportunity provided by the action-research model is a topic for a future post. Here, I'll just underscore the main issue involved in scaling such efforts.

Big businesses today have transformed themselves into data-driven enterprises partly through the use of enterprise-resource-planning (ERP) systems. ERPs open up the silos that often sub-optimize corporate performance. Seeing all parts of an enterprise as *us* is beneficial, while seeing all outside parties as *them* doesn't fit well with the broad coalitions of small organizations engaged in action-research projects. For action-research efforts the need is for help in forming coalitions, managing projects over time and over changes in personnel, and recording the process and result in a way that we can learn from history. The result of our investigation[62] is that any information system interoperability with #Slack will enable small organizations to overcome some of the diseconomies of scale they face. I was one of five gatekeepers that all had to cooperate to connect a project from the Congo Basin Institute[63] to student help in sustainable finance. The right communication channels disintermediate the gatekeepers. It is a marketplace of ideas, interests, and skills. The outputs are projects that, if responsibly managed over time, can have traceable impacts on outcomes. Best practices and evidentiary science come from mining such histories.

Ben-Ner and Siemsen (2017) argue that additive manufacturing (AM) will reduce the minimum efficient scale of a company. This is a continuation of a trend that transformed the computer industry in the last century. Enterprise, in general, will move toward broad collaborations of relatively small organizations, mainly tightly centered on a specialization and collectively covering the whole project needs across organizational boundaries and time. Coase (1937/1952) asserts that firms grow until it costs more to do a transaction inside than outside. Information networks, the gig economy, and AM signal that *smaller* is the direction we are going. The NGOs are already there. The issue is how to scale these efforts.

Now, more than ever, we need to make it easier for bottom-up coalitions to get things done. Does anyone know of agents or agencies taking on the central problem of building this fundamental infrastructure? If not, why not?

My next post will be about the university's role in action research (i.e., project-based learning). The third post will look at an entrepreneur's guide to saving the world.

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62. Natalie Garrett was an active collaborator evaluating #Slack and the Slack APIs.

63. https://www.cbi.ucla.edu.



Figure 79.

Building Centers for Action Research

Lee Cooper, Professor Emeritus, UCLA[64]
July 5, 2017

Introduction

The world faces many complex problems, and great universities should be part of the solution. In the long-term, universities accrue enormous demonstrated societal benefits. But what about today? If we want universities to have an immediate effect, we need to engage today's students in hands-on projects that confront real problems. That's the premise of *action research*. The generic mission of a university *action research center* is to transform research and education into service to the world. The goal is to organize, prepare, and support students as they attack real-world problems—and to do so on a large scale.

Origins

After over 40 years at UCLA, I'd seen many excellent student projects. But when I read one 2010 MBA team's final report and listened to their presentation analyzing the infrastructure for ecotourism in Suriname, I knew that this project was different: someone had finally gotten the balance of collaboration just right. In the past, similar projects were often the result of Herculean efforts by either the team or the client—never both. This time, a talented team was attracted to working with CI. The department chair was their faculty advisor for this AMR[65] project. I served as an extra advisor to help both inside and outside UCLA.

64. I want to thank Michael Totten for his comments and Jae Park for his editorial and publishing help. This post appears on LinkedIn as well as the *California Management Review*. Edited for consistency.

65. Applied Management Research (AMR) is a two-quarter team project that is an MBA graduation requirement. The assistance of the AMR Office on all of these projects is gratefully acknowledged.

The normal capstone-team dynamic was laid inside an ongoing project stream within CI. Hari Balasubramanian, then CI project manager, actively managed the overall process to ease coordination with the Suriname-based CI staff, energy experts, and staff economists.[66] The Suriname staff established the connections to government, trade and industry, and educational establishments that the Anderson team needed. The team conducted one-on-one interviews with personnel in all the key sectors. UCLA designed an exit survey for the Paramaribo Airport and CI connected them with local university students to administer the survey. The UCLA team combined CI research with their own primary and secondary research, analysis, and modeling to provide a thoughtful assessment of the infrastructure for ecotourism, with feasible options and recommendations for action.

I was intrigued that it worked so well. The structure of support pulled the best out of the student team. Everyone benefited from the process. Russ Mittermeier (then CI president) and Jennifer Morris (then CI EVP) presented the results of the UCLA-CI collaboration to the parliament of Suriname, leading the parliament to call for a five-year sequence of collaborative efforts to do green-economy studies in other major sectors of Suriname. The project report is being used within Suriname to reshape the tourism industry. Subsequent projects included analyzing how to use that country's fresh-water surplus in ways that help sustain the resource while aiding in the country's development.

The CI partnership with AMR has produced a steady stream of successes:

- We have completed two sequential studies furthering shade-coffee development in the San Martin province of Peru.
- We ran two parallel studies for sustainable fisheries in Ecuador, showing how solutions depend on identifiable patterns of local-market conditions and ran a third follow-up study in harvesting while maintaining mangrove ecological.
- We worked with CI's Center for Environmental Leadership in Business to assess the need for an internal consultancy to assist extractive industries with reducing, minimizing, and offsetting their environmental impacts.
- We developed an effective collaborative strategy that combines a basic management team with expertise from advanced students possibly from any campus department, under active supervision from UCLA faculty and the partners involved.

66. The CI team also included Aaron Bruner, Annetter Tjonsiefat, Lisa Famolare, Eduard Niesten, and Michael Totten. The Anderson team included Jody Menerey, Hiromasa Ebihara, William Tang, John Kinney, and Deborah Yim. Charles Corbett was the faculty advisor. I thank Hari and all the rest for helping me see what could be accomplished.

Building on the successes of these AMR projects, the question became: How could we scale such collaborations both horizontally and vertically? The answer was simple. *Let the scope of the problem shape the scope of the effort.* We sought to develop the infrastructure that allows student and faculty expertise to aid such projects as they progress and change over time.

Centers for Action Research

The model of effective collaboration that led to success in Suriname can be replicated in any coalition. Universities should seek to have greater effect by creating new centers dedicated to providing students with opportunities to actively apply new knowledge to real-world problems.

Strategy:

- Form multidisciplinary student teams custom-fit to the needs of each project.
- Use course credit and teaching credit as the internal coins of the realm and include all other variable costs in the project budget.
- Fundraise jointly if the projects that students and faculty demand do not have sufficient support.
- Use Internet-based tools and technology to streamline operations, ensure that projects can be carried across time and teams and facilitate access to and utility of the growing knowledge base. Design, build, and adapt knowledge-management, project-management, and communications-management tools to enable this.
- Bring to scale to minimize infrastructure costs relative to the value delivered. It takes a small staff to get started. With the right tools that staff can support a lot of projects.
- Where possible, make the knowledge base open source and publicly accessible to foster broad adoption and growth of the engagement model by other universities and colleges. We need to share and learn from history.

Underlying Principle

We are proposing to **let the scope of the problems dictate the scope of the efforts**. Centers seek to unite student subgroups and individuals from across departments and across degree programs in a common purpose to attack a problem. To this effort are added outside partners with supplementary intellectual and financial resources and domain savvy. These professionals become allies in advancing common agendas. When students and professionals unite with faculty also interested in the

agenda, a great deal more force is being brought to bear. This is one way the universities can become part of the solution today. It is an advanced version of the model for post-secondary education advocated in the 2014 CED Report ("Boosting California's Postsecondary Education Performance: A Policy Statement and Call to Action"). Project-based learning is a successful and growing trend in education. The successes so far show some of the potential of this trend. It is a model that can be imitated or adapted to any university, college, and grades K-12.

My goals with this post are to use the UCLA cases I cited so far as exemplars of the realizable benefits of each such collaboration, to take an aspirational look at how such centers are designed to operate at scale, and to propose a business model that should allow this engagement model to spread.

Benefits to Students

The freshman experience at UCLA starts with Volunteer Day, engaging teams of incoming students in service projects to aid the local community. A center for action research can build on that spirit of engagement and helpful action. Throughout their academic careers from the earliest days to capstone experiences for seniors and advanced-degree candidates, students can have curricular and extracurricular opportunities to engage in team projects that advance valued agendas. Students learn to work in multidisciplinary teams with advanced students, professionals from outside partners, and faculty.

Internet-based collaboration, sharing, and communication tools enable greater depth and breadth for action research and project-based learning. For example, students now arrive at college as sophisticated users of their "pocket supercomputers," ubiquitously connected to innumerable other pocket supercomputers. They have access to inestimable library resources and use of a range of apps that once required scores of costly devices and services (camera, video, audio recorder, phone, calculator, GIS maps, "suitcases" of books and publications, travel and lodging planning, postal email, and countless specialized apps).

Benefits to Faculty

Faculty get the opportunity to align their teaching and class projects with valued agendas. Where there is good reason for the walls around the traditional classroom to stand, these will remain. For a growing part of both undergraduate and graduate education, the walls separating disciplines and degree programs are falling, creating opportunities for increasing the relevance and effect of the educational experience, while achieving the same pedagogic goals. There is also the greater potential for alignment of teaching and research agendas. Emeriti faculty gain the opportunity to engage with

student teams in projects of mutual interest—creating more latitude for matching students and outside partners with interested faculty. Emeriti are eager to participate.

Benefits to Outside Organizations

Core to the conceit that we can make real change and advance what we value is that projects are the collaborative efforts of multiple partners. Outside partners gain access to a broad and deep bench of expertise and the ability to customize a team to temporal project needs. Since a center provides the information infrastructure for passing projects from one team to the next, partners gain greater flexibility in their personnel planning. Project teams can be scaled up or down over time in sync with project needs—overcoming one of the major diseconomies of scale that small organizations face. Synchronizing with academic calendars is a known and manageable issue.

Systems Redesign

A center can be crafted out of mainly existing pieces. At UCLA, over 900,000 student hours per year are dedicated to capstone experiences. Credit vehicles abound for the kinds of engagements a center facilitates. Typically, no new classes need to be approved before a center is established. Beyond the resources a center needs for professional and student staff, the normal curricular budgets fuel the enterprise. This is a major savings compared to the overhead on research projects. Support can come in as donations, rather than contracts and grants. Similar pieces exist on most campuses. Centers can proceed and grow at their own pace. Scalability is mostly associated with the completion of the data-driven information system.

The Marketplace of Ideas

To my way of thinking, in developing this collaborative model, we are creating a complex, multifaceted marketplace. On the supply side are internal university agendas, such as UCLA's Sustainable LA Grand Challenge (SLAGC),[67] and the external agendas of outside partners with their project needs and requirements. Market dynamics reveal how partners are attracted to working with UCLA, for example. On the demand side, market dynamics show how these ideas and projects appeal to students and faculty. How do their skills match up? How are sufficient resources attracted to the combination? How can we make the resulting knowledge more useful? What innovations can we observe? These are the issues in understanding the dynamics of the *marketplace of ideas*.

67. The goals of the SLAGC are to make LA 100% water and energy independent, with enhanced ecosystems health by 2050.

We have witnessed the phenomenal growth and development of new marketplaces in the *gig economy*. Over 40% of the US labor market is now in contingent employment. Uber, Lyft, Airbnb, TaskRabbit, HelloTech, and the LendingClub are often-discussed examples. All of these have advanced by transforming the players in disorganized and small-scale arenas into data-driven organizations. *Information technology* is the key to creating that level of scalability. The same is true for the *marketplace of ideas*. The 900,000 capstone-hours per year represent a disorganized and underdeveloped market.

Information System Needs

While project ideas and initial coalitions may well form in broader social media, project management needs to be an early focus. Teams need the basic discipline to set benchmarks and goals and record the process and results of projects. Communications reflect part of the process of each project, and the relevant aspects need to be tracked. As the number of projects grows, the matching of students' skills and interests with internal and/or outside partners' project needs requires an information system that could be used strategically (e.g., communicating project needs and goals, tracking project communications, project progress and milestones, and archiving and mining project results and knowledge). Major tools, such as #Slack, Asana, Hootsuite, Workbot, and Zapier, are already highly developed and amendable to the needs. Anything connecting to the Slack APIs could help.[68] Projects that require more confidentiality can opt out or require multi-factor authentication for access, but long-term benefits accrue to coalitions of the willing. Conservation International (CI) has come to see this kind of discipline is needed if they are to learn best from prior projects. The next generation of best practices comes from accumulating, sharing, and communicating open-source knowledge. The saying I've heard is that PDFs are where knowledge goes to die.[69]

The Revolution will be Bottom-Up, Not Top-Down

As in the Cambrian explosion of speciation, a profusion of local efforts has begun to redress problems in social, political, and environmental justice. The SLAGC

68. Many Anderson students come into the MBA program with experience using #Slack, especially those from technology backgrounds. Once in the school with the motto "Think in the Next," they revert to using email for project communications and Excel spreadsheets for project management—25+ year-old tools that don't fit easily into data-driven enterprises.

69. New parsing tools and natural language processors are changing this for the better.

is one umbrella for perhaps 150 such projects at UCLA. Each of these must find the human and financial resources to survive or it simply dies—the basis of *kernel analysis* discussed in my prior post. The information infrastructure described here makes it easier and less costly for such small and local efforts to find partners and resources to help overcome the diseconomies of scale such projects typically confront. Universities are hosts to legions of bright, young, idealistic students who want to make a difference in the world. The multidisciplinary, project-based-learning model and information infrastructure to ease partnership building and project execution are two key elements for fostering the radical change that is so needed.

What Silicon Valley has taught us about radically new products is that for a cool idea/product to achieve hypergrowth you need a *whole-product solution* and a *compelling reason to buy* (Moore 1995). The Wintel became a platform by uniting hardware and operating systems with applications and peripherals—a whole-product solution. Mostly business needs provided the compelling reason to buy. Apple, with a few peripherals, provides whole-product solutions. Design and/or opening of new-product classes makes Apple products *must-buys* for some segments.

The pilot projects between AMRs and CI are cool efforts that the participants and the stakeholders loved. Designing a center for action research is the attempt to drive this model into hypergrowth. It is fundamentally designed to provide a whole-product solution by building teams that are fit to the needs of their projects and changing the teams as needs change. Given the natural fit of these projects to capstone efforts and other curricular initiatives, much of the expense associated with personnel costs are shifted onto normal course budgets. Gaining customized teams at lowered total-project cost is a compelling reason to buy. Some of that lowered cost has to be funneled into helping all project partners move onto the more structured and project-team-centric communications systems such as #Slack. The balancing benefit is the transformation of these collaborative efforts into data-driven enterprises that can learn from history, build best practices, and provide the evidentiary base for translational sciences.

This is a revolution with a solid business model to back it up. Does anyone know of any other agent or agency that is trying to build this infrastructure? If not, why not?

The next post explains why being able to duplicate and scale this infrastructure matters. There is an expected $74 trillion in net operating profits to be had in switching from *business as usual* (BAU) to new industries that could move beyond a zero-carbon-footprint to actually drawing down atmospheric CO_2 levels beginning in 2043. The entrepreneurial opportunity associated with Paul Hawken's (2017) *Drawdown* and related efforts is the topic of the next post. Michael Totten is co-authoring that one. I've drafted a fourth post in this promised trilogy entitled "Addressing the Crisis in the American Workforce."

The $47 Trillion Upside to Saving the World

Lee Cooper, Professor Emeritus, UCLA
Michael Totten, Principal, AssetsforLife.net

July 18, 2017

Paul Hawken's new book *Drawdown* describes and totals the 100 most impactful and optimal solutions to reversing humanity's massive carbon emissions footprint. The *Drawdown*-identified actions would prevent the release of 1.6 trillion tons of carbon dioxide-equivalent (CO_2-e) emissions between 2020 and 2050. Hawken and his team estimate the total cost of implementation ("first cost") at $129 trillion over the next 30 years. This is roughly $27 trillion of additional investment ("net cost") above and beyond the $102 trillion required for *business as usual*. However, the "drawdown" investments would reap $74 trillion in net operating savings over 30 years, resulting in global accrued gains of $47 trillion.[70] This is very positive news: on average, the global economy would accumulate one dollar of savings for every 34 tons of CO_2 reductions! This is an economic and ecological win-win outcome par excellence.

Moreover, finding the extra $27 trillion isn't the barrier it seems. World Bank President Jim Kim recently indicated $40 trillion is available toward this end:

> For decades, the rich have used sophisticated tools—swaps, derivatives, debt—to get richer. We need to put those tools to work in creative ways on behalf of the poor. At the World Bank Group, we think of ourselves as strategic advisors and honest brokers who link capital looking for greater returns to countries looking to achieve their highest aspirations.
>
> We believe that everyone in the development community can be an honest broker who helps find win-win outcomes—where owners of capital get a reasonable return, and developing countries maximize sustainable investments.
>
> There's never been a better time to find those win-win solutions. Right now, there's $8.5 trillion sitting in negative interest rate bonds, $24.4 trillion in low-yield government securities, and an estimated $8 trillion in cash, waiting for better investment

70. "How much would it cost to reverse global warming? The first cost (total cost to implement) of all the modeled solutions is $129 trillion over thirty years. [...] A more illuminating number, however, is the net cost—how much more money would be required to implement climate solutions compared to the cost of repeating business as usual. [...] Spurred forward by the decreasing cost of renewable energy, net zero buildings, LEDs, heat pumps, batteries, electric vehicles, and so on, the net cost to implement all solutions modeled here is $27 trillion over thirty years. [...] The net operating savings is $74 trillion over thirty years." Hawken (2017, p. 220).

> opportunities. We can mobilize this capital to help meet the exploding aspirations of people all over the world.
>
> Aspirations are rising all around us; let's see if we can raise our own to meet them.[71]

This amounts to a pledge from the head of the World Bank that the extra capital for such a broad transformation is available. Neither accruing the funding nor achieving the drawdown actions is a *fait accompli*, but the *Drawdow*n roadmap is extraordinarily clear for where citizens worldwide need to drive public policies, financing, and regulations, combined with private investments and market innovations, to avert catastrophic climate destabilization while spurring economic prosperity.

We admire the spirit of Hawken and his team to prepare an easy-to-read book for the public based on very substantial research. Parallel independent assessments corroborate the reasonableness of the emission-free energy opportunities.

Most notably, there is the fine-grained assessment by Stanford Professor Mark Jacobson and UC Berkeley Research Scientist Mark Delucchi (2017) and their 20 colleagues. What this report uniquely does is to focus on eliminating all fossil fuels and biofuels, nuclear power, and any new hydrodams, achievable by 2050. This is based on a multi-criterion matrix analysis comprising upwards of a dozen attributes sought in energy services: safe, secure, clean, economically attractive, and ecologically sustainable; minimizing land, water, emissions, air pollutants, water contaminants, toxic wastes, and failing gracefully, not catastrophically. These are used to determine the preferential least-cost-and-risk life-cycle options for delivering energy services. Efficiency, solar photovoltaic power (PV), and wind power rank at the top three. Shifting from combustion to electrification garners an intrinsic 40% efficiency gain.

After performing state-by-state and nation-by-nation analyses (with specifics on how many solar panels, wind turbines, costs, health benefits, avoided emissions benefits, and net job gains), they determined $50 trillion *per year* of direct savings and avoided costs would accrue by 2050.

Stanford business-school instructor on disruptive technologies, Tony Seba (2014), arrives at comparably immense positive economic outcomes with deep emission and pollution reductions, described in his book *Clean Disruption of Energy and Transportation*, resulting from the technology transformation to fleets of autonomous electric vehicles on-demand and a solar- and wind-powered society. Other analysts around the world have done half-a-dozen global energy assessments similar to the one performed by Jacobson *et al*.

The energy sector constitutes 70% of global greenhouse gas emissions, and *Drawdown* also tackles the other 30% of global CO_2-e emissions as well as including

71. Jim Kim (2017).LinkedIn post.

negative emission technologies (NETs) that draw emissions out of the atmosphere. These include very lofty ambitious goals and will require ongoing monitoring, evaluation, verification, and continuous adaptive management to ensure success. This is particularly the case with land-based initiatives involving the prevention of deforestation, restoration of degraded ecosystems, and ensuring very long-term storage of captured carbon from biomass crops.

The scientific literature includes cautions about unintended consequences that may thwart and, in some cases, negatively amplify outcomes from what turn out to be ill-conceived land-based initiatives. This has most to do with the complexities of restoring carbon in soils that may be overwhelmed by the release of nitrous oxide, which is a 300 times more potent greenhouse gas than CO_2. This is particularly problematic when fertilizers are inappropriately applied in some cropping systems or the mutualistic role of mycorrhizal fungi networks is neglected. A half-century of reforestation initiatives is littered with large-scale failures due, for example, to planting monoculture species vulnerable to pests, droughts, and wildfires as well as planting the wrong species on the wrong soils (e.g., afforesting grasslands, wetlands, and peatlands). Considerably more research is essential on such complex interactions in order to design landscape restorations that prevent big problems when projects are scaled up too rapidly.

The same cautions have been raised about NET options by a number of notable climate scientists. Again, it is the rapid scaling over immense areas that raises concerns. For example, promotion of bio-energy with carbon capture and storage (BECCS) could require a land area equivalent to one to three Indias and permanent storage with no leakage for a millennium or more. In the case of high emissions from livestock production, the rotational grazing system of Meat Naturally Pty., which came out of a joint CI-UCLA project, shows great promise on a local scale.[72] One hopes these challenges can be resolved, but the current research offers no high degree of certainty or surety.

Carbon Upcycling UCLA

We use the UCLA XPrize project as an example in what *Drawdown* calls the category *Materials: Alternative Cement* and ranks it #36. "The production savings of $274 billion are largely a result of longer cement life span (p. 161ff)."

This version of the XPrize theme is Reimagine CO_2: Inspiring the Brightest Minds Around the World to Help Solve Climate Change.

A $20 million global competition to develop breakthrough technologies that will convert CO_2 emissions from power plants and industrial facilities into valuable

72. The UCLA team included Andy Howard, Tom Jackson, Dani Koo, Kaitlyn Peale, and Alex Was. Sarah Frazee headed up the effort on the CI side.

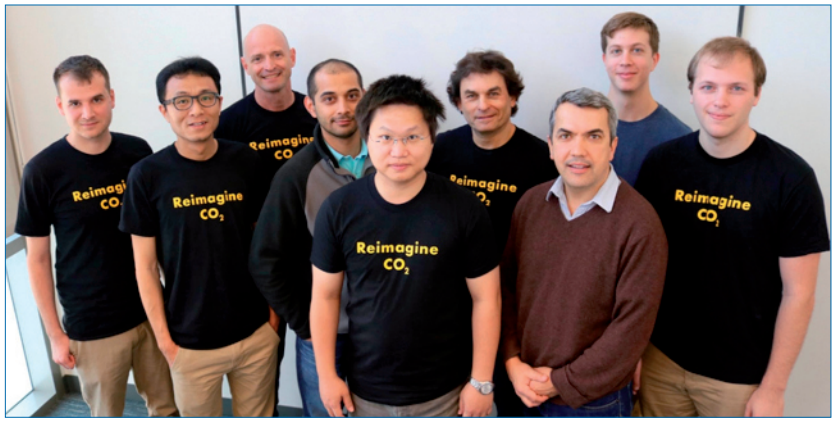


Figure 80. The Carbon Upcycling UCLA Team.

products, such as building materials, alternative fuels, and other items that we use every day. Teams will be scored on how much CO_2 they convert and the net value of their products (http://carbon.xprize.org).

The Carbon Upcycling team is a prime example of a multidisciplinary team bringing together researchers from chemistry and biochemistry, materials science and engineering, mechanical engineering, civil and environmental engineering, and economics. "The team includes UCLA faculty, staff, and students. Five distinguished professors lead the team. Dr. Gaurav Sant is the Principal Investigator on the project and is developing the technology to combine the pressurized CO_2 with hydrated lime to create CO2NCRETE: a carbonated building material. Dr. J. R. DeShazo is providing the economic and market analysis for the work. Dr. Richard Kaner is developing the membrane technology to separate/capture the CO_2 from flue gas. Dr. Laurent Pilon is focusing on waste-heat recovery and on the overall energy efficiency of the process. Finally, Dr. Mathieu Bauchy is working on optimization of the material properties and CO_2 uptake." (http://carbon.xprize.org/teams/carbon-upcycling-ucla)[73]

The technological breakthroughs involve sucking CO_2 out of smokestacks using advance membranes at scale in power plants and casting it into concrete blocks, Lego-style (called CO2NCRETE), that are 3D printed for shape stabilization—showing yet another direction 3D printing has gone.

We haven't seen a business plan for this effort. Still, it illustrates some basic principles of disruption. As with Foster's (1986) classic position that attackers have the advantage that incumbent players don't appreciate until it's too late, the major

73. The UCLA team has advanced to the XPrize final round.

players in this industry probably look on CO2NCRETE as an inferior product. Cooper (2004) summarizes Foster's argument by pointing out that the sailing-ship companies that dominated Atlantic trade in the early 1800s considered steamships inferior goods:

> Steamships, for example, initially seemed no threat to the clipper-ship franchise on trans-Atlantic freight. Steamships were more expensive per ton, delivered smaller payloads, and were initially less reliable. So the freight companies listened to the voices of their best customers and increased cost efficiency by allocating corporate resources to craft clipper ships with more masts, sails and cargo capacity. Of course, these freight companies perished when the steamers emerged from the more protected environment of river shipping, which fundamentally valued the steamship's core advantage (the ability to navigate regardless of the prevailing winds) and did not need what steamers couldn't initially provide (the large payload capacity and reliability required for trans-Atlantic efficiency). (Cooper 2004, p.16)

This is more than one technology replacing another. Established businesses will fail when they don't see disruptive innovations creeping up behind them. Cement, the fossil-fuel business network, and major parts of agri-business are due to be disrupted between now and 2050. As we move to the next generation of production systems, $47 trillion on the table means thousands of new billion-dollar businesses are coming.

Bottom Line

What is clear is that the faster humanity ends dependence on fossil fuels, combined with the faster it ends deforestation and severe land degradation (annually amounting to the size of England), the faster it will dramatically reduce the need for riskier NETs later this century.

Jacobson *et al.* (2017) conservatively estimate higher costs than Hawken's analysis for the global energy transition. The total upfront capital cost is estimated at $125 trillion, with a 2.5-year simple payback if one includes the avoided damage costs from air pollution and CO_2-e emissions. Orthodox economists would exclude the avoided damage costs, but a growing number of well-respected economists (e.g., Lord Nicholas Stern, Martin Weitzman, and Nobel laureates Kenneth Arrow and Paul Krugman) argue for inclusion of these very real economic costs.

Tony Seba (2014) presents substantial evidence of learning curves that, he argues, point to a technology transformation underway that will net exponential profits. He's very optimistic for good reason. There is ample evidence to indicate the entrepreneurial opportunity is even larger that Hawken outlines.

Yes, there are many efforts to grow the companies in the third industrial revolution: clean-tech incubators, accelerators, and skunk-work efforts. It is easier now than back in 2002–2005 when the UCLA Venture Development Project was helping incubate direct manufacturing via 3D printing. Impact@Anderson, the business-creation option (BCO) in AMR, and the incubators both in Anderson and the California NanoSystems Institute (CNSI) are ways Anderson and UCLA are making progress in isolation. Even on a single campus, one incubator doesn't connect systematically with another—no shared learning from prior projects except what passed verbally. There are many other efforts elsewhere that are disconnected from each other. Given the scale of the opportunity, we need many more. What is also missing is the ability to share the learning across efforts. These are very profitable opportunities. Circles tend to be drawn tightly. Someone needs to figure out how to share what can be shared. The XPrize sharing is a step in the right direction. Is anyone else taking on the effort to share learning across incubators? If not, why not?

The next post looks at what this extraordinary opportunity in clean-tech growth means for addressing the problems in the stagnant American workforce.

Addressing the Crisis in the American Workforce

Lee Cooper, Professor Emeritus, UCLA
July 31, 2017

The Elephant Curve – Visualizing the Problem



Figure 81. The elephant curve.

"The 'elephant curve' began life in 2012, hidden in the middle of a World Bank working paper by Branko Milanovic, an authority on global inequality." (*The Economist* 11-30-2016).

The elephant curve is a great visualization of the impact of *business as usual* over that recent 20-year period. The last nine years haven't been much better for folks sitting on the *base of the trunk* (BoT). This post sketches what we can do about this over the next equivalent bunch of years. The year 2050 was the target date for the discussion of *Drawdown* in the last post. Over that period, $129 trillion could be spent to implement the next generation of production systems. They'll be clean by design and collectively turn back the clock on atmospheric CO_2.

As an example of new production systems, I'll use a company that was founded to help the "Very Poorest Locked Out of Growth" the left-most tail of the elephant curve, better known as *the base of the pyramid* (BoP). The elephant curve conveys a much more dynamic look at the shift in real income growth than thinking in BoP terms. This company, SunStream Technology, Inc., will show us the way to employ the domestic US workforce left behind at the base of the elephant's trunk on the right side. With the spread of automation and additive manufacturing, production is freer to compete in urban, suburban, or more rural settings. Workforces can be spread over networks of smaller production hubs and scaled to local needs. And, of course, there will be a role for project-based learning, as we remember some of the basics of systems design and redesign. We start with the basics of management.

Understanding the Leadership of Multidisciplinary Teams

It takes a team to get work done. The most fundamental skill any good manager must have is the ability to lead a multidisciplinary team. Teaching product management in the 1980s and 1990s helped me understand the process of multidisciplinary team leadership much better. The old saw about needing to teach a subject to really learn it didn't quite hold in this case. I'd taught management of mature products for years based on real data and market-share models I co-developed. I developed CASPER as a tactical simulation game with MBA teams for three competing brands and MBA teams for three competing grocery chains in a promotion planning game that was scored against 26 weeks of real data. The competitive challenge was great enough that at least one person on each team willingly learned about high-parameter, asymmetric market-share models and the like (Cooper and Nakanishi 1988). The graphics and table generators and the ability to simulate across ranges pushed students to share a deeper understanding of what the models were telling them.

I shied away from teaching new-product management because it was decades before I saw how the exotic techniques I knew could benefit MBAs. When I finally stepped in, I aligned my thinking with the technology-adoption life cycle (*cf.* Moore

1995); diffusion-of-innovation thinking well fit to explain hypergrowth of technology platforms. I swapped arcane tools, such as multidimensional scaling (*cf.* Cooper 1983) for arcane tools, such as Bayesian networks (Pearl 1986 and 2000). The new tools were much better suited for strategic planning and risk analysis for disruptive enterprises, such as the ones that will shape the new-economy (Cooper 2000). The simulation ability of Bayesian networks help people understand the complex risks in launching new ventures.

With the numbers side under control (as seen in the first post, Incubating the Third Industrial Revolution), problems on the human side became more obvious. The challenge was how to manage a multidisciplinary team through the product life cycle (PLC), where the depth of expertise changes with the stages of the PLC. Most MBAs are taught about T-form teams, with depth in one area and lateral connections with other areas. The teams in product-design stages look more like Γ. When the focus shifts to production you get T-form and the after-market support teams look more like 7. Managing this kind of multidisciplinary dynamism is tough. To do it right requires the product manager to let no area remain opaque to him or her. Answers often come from deep expertise—beyond the ken of many managers. The reasoning behind the answers, however, must be understood by at least the product manager. When all members of the management group take on the responsibility of the product managers, strong, multidisciplinary groups are created. The lesson harkens back to good study-group practice. It's a mistake to divvy up the load and turn in your part. *Free riding* is worse. Like the product manager, you need to understand the reasoning. You learn new content, different problem-solving styles, and communication styles. The successful teams in my product-management games followed this process.

A star basketball player will understand his or her role and execute it to perfection. A star floor leader understands the role of everyone on the team and executes the leadership role to perfection. A little less than perfection will still make you rich. Teams of stars can struggle, while teams of real leaders rarely do.

Taking leadership responsibility involves this intellectual commitment—really a prerequisite for leadership. Once this is mastered, I would turn you over to Marshall, who over the 40 years I've known him has grown from very smart to very wise. Bob Tannenbaum, one of the wisest men or women I've met in the academy and a mentor for both of us, would have been impressed. Marshall's 100-Coaches gift is an inspiration for all of us at my stage of life and career to find ways to pay it forward.

New Production Systems (SunStream Technologies)

Inventor-entrepreneur John Anderson evinces such leadership. Repeated visits to off-grid South Africa convinced John Anderson, an engineer with a strong background in photonics, that what these villagers wanted most was a reliable and cheap way to

charge their cell phones. In Sub-Saharan Africa 600 million people do not have access to electricity. Cell-phone charging is the number one electrification need—rated above cooking and lighting.[74] Can you serve this market where the average per-capita income is $762 a year?[75] The median is much lower—half the population lives on less than $1.25 per day. This reality led to a price target for the base unit of $20-25 retail. John was convinced that figuring out how to specialize panels for charging USB (five-volt) devices without a chip set was the key to building reliable, durable, and cheap pico-solar panels. The piles of burned out cell phones in his garage attest to the difficulties. Ultimately, John figured out how to do solar-cell power-conditioning (through optimized design and manufacturing) rather than electrical power-conditioning (through circuitry, inverters, etc.) in traditional PV arrays. He was issued a utility patent over the resulting process. Other patents have followed.



Figure 82. John Anderson with SunStream panels in an African village.

A mutual associate connected John with Skip Brittenham while still in the early garage stage. While Skip's day job is as an entertainment attorney, he has guided numerous technology companies large and small over the years, including my start up, Strategic Data Corp., which he oversaw from the board of directors from first funding

74. Some of the research is by Brian Wasige, Shane Malott, Yu Chen, and Matteo Bastreghi who created excellent business plans for the Hult Prize and Knapp competitions. The Hult-Prize criteria included doubling the income of 10million people in seven years. Shiven Vikram helped recruit and was on was on the Hult-Prize team. I want to thank Howard Wolin for our discussions about SunStream production processes and Michael Totten for his comments and insight.

75. www.economist.com/blogs/freeexchange/2014/01/incomes-sub-saharan-africa

to its $150 million exit to News Corp. seven years later. Skip loved the SunStream mission and saw enormous potential in this technology. He decided to guide SunStream from the board. He worked with John and team to design more market-ready products from the early prototypes. He brought in Mark Feldman as an investor and advisor on the manufacturing side. Mark, his long-time friend and fishing buddy, was on the Conservation International (CI) board with Skip and was drawn to the mission. Mark headed one of Walmart's biggest clothing suppliers with over 13,000 employees before retiring.

Mark lured his former head of manufacturing, Howard Wolin (now SunStream COO), out of retirement to take on this worthy effort. Mark didn't survive to see the new manufacturing process assembled in the new facility. I have seen it, and I know Mark would have been proud.

The first two lines have been installed with three more designed into this new space. Each line is highly automated: producing around 2.2 million of the most basic product or 1.6 million of all the current products proportionally, per year during normal operations. The lines eliminate the original manual method of production during the early development stage, de-skilling the operation from approximately 20 trained solderers, to two machine operators. A single line runs with 30 people at full capacity producing 3,200 units per shift per line of the most basic product for the BoP market. That doesn't put people out of work; these are totally new jobs.

> "What is equally exciting is that these are jobs that have left the American middle class. As more and more jobs have become service jobs (trading wealth) where we trade a dollar of our time for a dollar of someone else's time, these jobs are manufacturing jobs (creating wealth) by using $5 worth of materials to make $20+ of product. Furthermore, these are jobs in the U.S., another rare commodity. By de-skilling the process (to save labor) and controlling the entire quality control in-house (to assure performance), we can become competitive with Pacific Rim manufacturing and creating a new generation of job opportunities back in the U.S. When built out, the factory will have a maximum capacity of 600+ new jobs: 150 jobs (30 per line X 5 lines) X 4 shifts, plus support jobs in this new facility." Howard Wolin (personal communication)

By SunStream's engineering of the processes to save time and effort and engineering the machinery to be more task-friendly, they can create more value, which can translate into higher profits and higher wages in the future.

When I first saw the early prototypes, I ran the numbers on a network of BoP micro-businesses that charged cell phones for their friends and neighbors. Even at the current average $0.25 per charge, a $20-$25 investment earns $364 per year for some entrepreneur in off-grid Africa, with zero marginal cost and saving 227 grams (½ pound) of CO_2–e emissions per charge. Adding a dollar a day to people

who get by on $1.25 a day, that's a good business. The South-African market alone could sustain 4.2 million such micro-entrepreneurs. I invested as soon as I could. An MBA team developed the idea for the Hult-Prize and Knapp Competitions[76] —another example of action research.

This isn't small stuff when you realize serving only the off-grid, African, addressable market with this first product would require 6,000 person years and save 13 million metric tons of CO_2–e emissions per year compared to the diesel generators typically used for charging cell phones off-grid. That is 1.5 times the employment boost that petroleum lobbyists used to push the XL Pipeline. And the solar jobs are permanent jobs rather than 1,950 construction workers a year for two years of construction of the XL Pipeline. The off-grid and under-grid markets in India, Mexico, or the rest of the world assures job tenure—servicing an estimated market size of 1.2 billion people, or 16% of the global population.

This is a for-profit American company based on innovations protected by utility patents (in the US, China, and other major parts of the world), design patents, and trade secrets. Regardless of the protections, there are other advantages in keeping production here. I'm confident Howard's design is domestically scalable. At 600+ jobs per facility, there are many communities that would benefit from that kind of employment bump from clean production systems of the new-economy. With this smaller efficient scale, even the former manufacturing centers of the Midwest benefit. Replacing the 13,000 jobs at GM's Lordstown plant with 20 smaller, new-economy facilities provides the same level of employment and is much more robust against single-industry cycles, such as automotive. Portfolio theory in jobs and production helps remove the risk of single point, large-scale failure for companies and communities.

Pacific-Rim countries can adopt the new distributed-production systems. The same middle-class jobs and entrepreneurial opportunities can be created anywhere. They can coexist and compete with manufacturing based on cheap labor and lax environmental oversight. Educating the workforce and fostering innovation are the basic ingredients.

Remembering the Basics of Systems Design: Function and Task Analysis

Training for the SunStream example is pretty straightforward. From laser cutting the 6" X 6" stock solar-cell sheets into the right-sized sub-panel units for each product to arraying, soldering, connecting the USB, sealing, encasing, QA, and product

76. The Hult Prize is a Clinton Foundation new-venture competition with criteria that change every year. The MBA team came up with a solid business plan to achieve that year's goal. The Knapp Competition is the premier venture competition at the UCLA Anderson School.

testing—skills are required for handling the components and running the automated equipment. You break the workflow into the functions and tasks with special focus on those that are human run. Working closely on mission exercises produces the most realistic analysis. You train on those functions, tasks, and the teamwork to get the whole mission done. According to Howard Wolin, SunStream trains in three areas. "One, we train the crew on how to use the machines. Two, we train the mechanics on how to fix the equipment. And three, I train the managers on awareness training, floor balance, logistics, etc." (personal communication). This could be in-house training or cooperative projects with community colleges. The advanced engineering skills needed for product development are available in most of our top universities. Our universities are strategic assets in many ways.

Tom Smith, director of the Center for Tropical Research at UCLA and the Congo Basin Institute in Cameroon presented a tougher design/training challenge. One of Tom's many initiatives was to bring UCLA caliber, master's level training to the Congo Basin. He wanted to develop a network of International Research and Training Centers in Central Africa. The goal was to establish a series of in-country centers of excellence focused on higher education and scientific research to help meet the environmental, health, and economic challenges facing Central Africa. UCLA first established a modest facility in Yaoundé (http://www.irtc.ucla.edu/ https://www.cbi.ucla.edu/). It has attracted researchers from around the world. What attracted me to the idea was the framework of a matrix pedagogy. The rows are the skills to be developed by a graduate program, while the columns are the problems in the local environment. The projects you design to address local issues tap a pattern of cells in this matrix. You have to make sure the skills are there to confront all the local problems and the problems being considered are broad enough to embrace the palette of skills. A function and task analysis of current UCLA training, a thorough survey of local issues, the design of projects to address these issues, and a function and task analysis of proposed projects are the basic ingredients in a matrix pedagogy. Run the design through multiple mission scenarios, such as setting up field clinics for service delivery and record keeping, to complete the matrix. You can add projects until all the skills are covered and add skills training until all the projects can be advanced. Good project planning would allow you to dial in the level of redundancy on training deemed sufficient for mastery.

Conclusion

I started this trilogy, now a quartet, with a note on how project-based learning helped incubate the third industrial revolution. The second post focused on how universities could be reorganized to partner on action projects helping advance the third industrial revolution. In the third post, I joined with Michael Totten to

outline the enormous entrepreneurial opportunity associated with going beyond *business as usual* (BAU) to a new, economically attractive, sustainable future. This post shows how you can do it with domestic production, distributing the benefits more fairly to those who have sat on the elephant's trunk too long.

Again, I ask if any agent or agency is tackling these problems in a systematic way. If not, why not?

Systems Entrepreneurship: Walker's Keys to Successful Systems Changes

Lee Cooper
August 4, 2017

The Skoll Forum commentary that led me to Walker's article introduced the topic by saying:

> The systems-related term that seems most on the upswing at the moment is "systems entrepreneur:"—usually an organization that can herd many different types of groups around a common, ambitious cause. At the 2017 Skoll World Forum, a panel on systems entrepreneurship described the topic as follows: "The problems we seek to solve—from failed school systems to infectious disease—are too big and tangled for any single organization to address, no matter how innovative or well-funded. We need 'systems entrepreneurs' who see large-scale problems require close collaborations across sectors—including governments, nonprofits, and businesses. One of the panelists was Jeff Walker, a leading thinker on systems entrepreneurship, who has argued that it is time to focus "more on solving problems through creative collaboration, and less on [creating] new institutions." Skoll.org 2017/07/05

I recent viewed the 2017 Skoll World Forum panel on systems entrepreneurship and read the companion article by Jeffrey C. Walker (2017). Both are excellent discussions of the issues in using systems thinking to attack large-scale problems. I'm going to comment on Walker's five keys to successful systems change, with most of my commentary reserved for the one place we differ a bit.

1. **Think in systems. Having a great idea for solving a social problem is just the beginning. You also need to identify the collaborators who can help you translate your innovation into real solutions for the real world.**

   Of course. Work gets done by broad coalitions of specialized firms. Team membership changes over the life cycle of the project, program, or other or-

ganized effort. Transorganizational management is the rule, rather than the exception. Sometimes it's done well and sometimes badly. Not understanding the *system* makes "badly" more likely.

2. **Engage in research and analysis to hone your strategy. Figure out what's really needed—and what works.**

   I'd suggest the critical-issues grid is a good guide to when your research is broad enough. It's just old systems thinking applied to radically new products. For new products or projects, you spell out the political, behavioral, economical, sociological, and technological issues from the perspective of the target company or project, from the perspective of the surrounding business ecosystem, and from the perspective of the broader infrastructure. I think of strategy as comprehensive problem solving. Lay out the pattern of issues, map their interactions, and seek a simultaneous solution. See Cooper (2000) and Cooper (2017 a, b, c, d).

3. **Understand that effective communication is the lifeblood of any systems-change campaign. Maintain transparent and compelling communications both internally with collaborative partners and externally with public audiences.**

   I would emphasize that the fifth key starts here. Having a communication/project-management system that can tie the process to result is fundamental to learning and transforming the coalitions into data-driven enterprises.

4. **Embrace your inner policy wonk—and your inner politico. If you seek to change a complex system, you will often need to change the laws, administrative rules, and official practices governing that system.**

   I would put something else in this spot. The political/legislative/legal issues that impact the project, the ecosystem surrounding the project, and/or the general infrastructure should have been identified by the research in Key 2. These issues are but one row of the critical-issues grid. All of the critical issues have to be considered to develop a strategic agenda. I believe in bottom-up efforts. It all starts with the social entrepreneur who figures out a way to get things started in the world as it is. The more experience in that world, the more able you are to articulate the friction points. Even costly success builds the coalition that could ultimately influence legislation.

   Walker said, "Systems thinking emphasizes the importance of understanding how the different parts of a system interact, rather than focusing on the parts themselves." Consequently, I would propose that the fourth key be that system entrepreneurs should build the information infrastructure that eases the interaction across organizations—helping to form coalitions, transform coalitions into project efforts, helping transform the coalition personnel over time, and helping to move to Key 5. Systems entrepreneurs should develop

this multifaceted marketplace where different agents in the overall system interact. It is the marketplace of ideas and values. The marketplace should try to disintermediate the gatekeepers between social entrepreneurs with a compelling project and the potential partners in that effort. The system should ease running projects and learning from them.

5. **Measure and evaluate. Then, measure and evaluate again. The most successful systems-change campaigns create consistent and ongoing data assessments and rely upon those findings to guide strategy and ensure accountability.**

   Yes. Yes. Yes. My root discipline is psychometrics. Measurement and evaluation are the bases for any translational or evidentiary science, and the finding of best practices. Connecting process with result can be done with managed communications channels (e.g., #Slack) and basic project-management tools (e.g., Asana). That transforms the coalition into a network that can learn from history.

   Thanks to Jeffrey Walker and the Skoll Foundation for highlighting the importance of systems thinking to addressing the big problems in the world. I hope the Skoll Foundation, or some other agent or agency, takes on the task of building the infrastructure that these transorganizational efforts require.

My Keys to Systems Entrepreneurship

My turn to provide a different summary. These are the take-aways from my book—the lessons for systems entrepreneurs.

The innovations that will change the world are being worked on in labs inside and outside the university. The first lesson is on how to incubate disruptive innovations. You have to find the kernel of the innovation from a business perspective and the most nurturing first market for building out the innovation and fill out the critical-issues grid by investigating political, behavioral, economic, sociological, and technological issues from the perspective not only of the company or technology but also how these same factors impact the business ecosystem and the general infrastructure. All these had to be mapped into Bayesian networks (Pearl 1986 and 2000), like a dynamic, quantitative, risk-scenario analysis for assessing the likelihood for success (*cf.* Schwartz 1996). The analyses combined Geoffrey Moore's (1995) *technology-adoption life cycle*, Christensen's (1997) writings on the *innovator's dilemma*, a little Slywotzky (1996) on *value migration*, and my own work (Cooper 2000) on *strategic planning for radically new products*. Go back to the original sources for more depth.

Part of this planning and every other planning scenario is understanding how work gets done in the modern world. I find it easiest to think of everything as proj-

ects. Real projects get done when multiplicities of talents are pooled into a workgroup. Firms are getting smaller and more clearly focused on core competencies. Coalitions across organizational boundaries are the real workgroups. This makes managing a multidisciplinary team the most fundamental management skill. *Take-my-word-for-it* is the path to sub-optimality or outright failure. Managers must accept the intellectual challenge to understand the reasoning behind a choice. Great projects happen when all participants make the intellectual commitment of the leader. The same holds for teams that span across organizations.

Let the scope of the problems dictate the scope of the efforts. It's a general issue that arose in thinking about how to best use the broad talents of university students to help the things they care about. Universities have broad and deep reservoirs of talent that change with regularity. Custom building a team to project needs and student interests is an efficient solution given overall project costs. To pull this off at scale takes infrastructure.

Information technology is the key to scalability. Having a communication/project-management system that can tie the process to the result is fundamental to systems learning and transforming the coalitions into data-driven enterprises. System entrepreneurs should build the information infrastructure that eases the interaction across organizations—helping to form coalitions, helping to transform coalitions into project efforts, and helping to transform the coalition personnel over time.

When you have such an information system in place, *matrix pedagogy* is easier to develop. Teams can subcontract particular tasks to use as classroom problems. Whole curricula can be designed by these principles. One of Tom Smith's many initiatives was to bring UCLA caliber, master's level training to the Congo Basin. He wanted to develop a network of International Research and Training Centers in Central Africa. The goal was to establish a series of in-country centers of excellence focused on higher education and scientific research to help meet the environmental, health, and economic challenges facing Central Africa. UCLA first established a modest facility in Yaoundé (http://www.irtc.ucla.edu/ https://www.cbi.ucla.edu/). It has attracted researchers from around the world. What attracted me to the idea was the framework of a matrix pedagogy. The rows are the skills to be developed by a graduate program, while the columns are the problems in the local environment. The projects you design to address local issues tap a pattern of cells in this matrix. You have to make sure the skills are there to confront all the local problems and that the problems being considered are broad enough to embrace the palette of skills. A function and task analysis of current UCLA training, a thorough survey of local issues, the design of projects to address these issues, and a function and task analysis of proposed projects are the basic ingredients in a matrix pedagogy. Run the design through multiple mission scenarios, such as setting up field clinics for service delivery and record keeping. You can add projects until all the skills are

covered and add skills training until all the projects can be advanced. Good project planning would allow you to dial in the level of redundancy on training deemed sufficient for mastery.

The revolution will be bottom-up, not top-down. It's up to the systems entrepreneurs to build the infrastructure for the revolution.

Chapter 15

My 75th Year and 50th at UCLA

"Do not go gentle into that good night, Old age should burn and rave at close of day; Rage, rage against the dying of the light."

— Dylan Thomas

It's still the summer of 2017 when I'm beginning this last chapter. I'm holding out that by 2019, coalitions will exist to tackle the big stuff. If not, I will have made my contributions and stated my case. It's for the next generation to take the lead.

It's not that I'm pulling back and saying, "Hands off." I'm still engaged with the CI-UCLA partnership, still helping the SLAGC a bit—pushing both the use managed communication systems (i.e., #Slack). Through CARN, I'm helping the Congo Basin Institute. I'm sometimes pulled in to help with tech transfer from the great material-sciences group, and I'm a sounding board for strategic issues with SunStream.

Someone outside might think I've led an extraordinary life. I assure you I have not. This is sort of the floor for full professors at a place such as UCLA. Excellence is a multidimensional construct. My path was unusual, not extraordinary. Many simpler paths have had more extraordinary results. This one was right for me.

Looking back, does it make sense? Kierkegaard doesn't promise.

To me, it does. I came at 25 with enough skills to get tenured in six years. Rather than be a psychometrician in a business school, I tried to see what my historical discipline had to say in a new environment. I let the business-school environment affect my agenda. It led to a five-year walkabout that benefited my later career. I

couldn't have made the shift from developing analytical models to driving strategic planning without the perspectives I gained. The tools I built are all in the public domain for anyone to use. The books and writings are also available free. This book will also have a free, open-access version. All the pieces are there to assemble as needed. I never spent the time promoting—just enough to smooth my career. Once it was published, I was pretty much done and on to the next project. I was having too much fun creating.

It seems to matter to me more now. The tools are all there to attack major problems with university students taking important roles. I don't understand the inertia.

The surprise is that I've been able to do so much without leaving UCLA. This isn't the likeliest of endings.

I find myself now, as emeritus, writing when I want to write, playing tennis four or so times a week, walking with my wife on non-tennis days, visiting our Chicago family as often as distance and schedules allow, and helping push the other things forward. This is a good life.

If my larger vision isn't advanced, I have to document for my grandchildren that I tried. It might not happen, but I'm not grieving. I know what grief is like and that's not what I'm feeling. This is more like letting go. It's more like walking up a windy country hill with a hand full of helium balloons and letting them drift away. Will anyone get the message? Apparently, the answer is "Yes." I released the five balloons between June 21, 2017 and August 4. I put out a small explanatory piece on kernel analysis, and basically, I waited. I acknowledged the "Likes," responded to the comments, and waited. I got to the point of acceptance without having to re-experience denial, anger, bargaining, and depression.

A mutual acquaintance pointed Henry Elkus to my writings.[77] Henry founded The Helena Group in his Yale dorm room in 2015. It's grown in short order to be a "think tank of global leaders focused on executing projects that improve the world." He and fellow Yale dormie Sam Feinburg are executing their ambitious agenda to gather annually 30-person cohorts of global leaders, half of whom must be 25 or under and combine them with brain-trust members and university fellows to gestate ideas in private meetings and find ways to form the coalitions needed to execute the project. That is spot on the principle I wrote about concerning action research, **letting the scope of the problems dictate the scope of the efforts.**

So far, I've learned about their effort to enhance grid security, help incubate direct carbon capture, develop financing mechanisms for new applications for

77. My writing in response to Jeffrey Walker's piece led Gillian Wynn, whom I know through Conservation International, to share Walker's piece with Elaine Wynn, who chairs the National Board of Communities in Schools (CIS). The CIS used the Walker piece as a prelude to its new strategic business plan. Gillian shared that news with me and included Henry Elkus in our subsequent exchanges. Our subsequent discussions led them to invite me to join the Helena Brain Trust.

off-patent drugs, design optimal food systems, foster efforts to rebuild schools after disasters, and many more. I hope to help them scale toward 100,000 projects. I'll try to help craft a replicable fellows program in general, with a more detailed focus on UCLA first—just adding to a working model. Their current fellows are the best young minds in each area of study. Take a look at http://helena.co.

In the spring of 2018, as my deadline with the publisher nears, I still persist. With help from the Luskin Center for Innovation and the Center for Action Research funding, we are working on bringing some automation to the matching of Masters of Public Policy (MPP) students to Helena projects, a prototype for a mediated coalition-formation tool. We are discussing the same process with the AMR Office. We are helping move the half-century of field-study and AMR reports into an open archive, starting with over a decade of project reports in electronic form. We are working on a way to text mine the archive using the critical-issues grid for categories. This KB will be connected with many others in the Helena Multivac project.

Multivac, Asimov's (1956) computer that figures out in 2061 how to deliver free solar energy to all people in the world, must be capable of *strong AI*. Pearl and Mackenzie (2018) argues there are three levels of AI and *strong AI* cannot be created without causal reasoning. He presents a sufficient graphical algebra for causal reasoning—a monumental achievement. He talks about the kinds of AI achievable with each level. The causal ladder has Bayesian networks and machine-learning algorithms at the base observational level. As powerful as the current machine-learning algorithms are, they reflect only entry-level AI. Next up, he describes the intervention level. What happens to Y if I do X? This level was mostly about experimental results and the issues of external validity or *transportability* for Pearl. When can experimental results in one situation be causally predictive of field results in another context? When can observational data substitute for randomized, controlled trials (RCTs)? The breakthroughs in transportability have vastly increased the ability to learn across projects. Pearl and Mackenzie (2018, p. 334) now believes that RCTs are but one of the many ways to gain legitimacy for causal inferences. In our case, with each project, you have a record of how people worked together toward common goals and what they achieved—multidisciplinary teams in action. Each project is a small piece of an increasingly causal record of what works and what doesn't. That's an empirical base of support for best practices. These are very strong tools in supporting systems change.

The top level, strong AI, concerns counterfactuals. I'll use an example of counterfactuals that came up in my granddaughter's class. I asked my son, the neuropsychiatrist, where the brain processes counterfactuals. He answered:

> The prefrontal cortex [PFC] generally is where we can plan out things. We use our PFC to imagine swimming and, even if we're not swimming, it lights up the motor

> planning parts of our brain used to swim. So we can think abstractly. An example of this was given in the intro to the 9 to 12-year-old class for Rosalía last week. At this age they begin to be able to handle questions like "what would have happened if Lincoln wasn't assassinated." Whereas a kid in 6-9 range is most likely to get stuck on the premise and argue "but he WAS assassinated."

Strong AI starts with being as conceptually capable as my granddaughter. It would be a great place to start. We are a long way short so far. From there to the capabilities of Multivac is a currently unrealistic goal. I'm in no hurry for strong AI to develop. Currently, we supply the intelligence, the judgment, and the insight behind the plans—aided by enormously powerful allies from Levels 1 and 2 AI. I expect help in coalition formation, project and communications management, and knowledge management. The record of what we do and how we get things done will be a training set for a more mature, strong AI.

I hope you see why I'm enthusiastic about the Multivac project; 100,000 projects are a beginning. What I have found about projects is that the people who want to get a project done care less about political or cultural differences and put in more effort working toward a common goal. Students work harder and more interdependently when engaged in a project of their choosing. Free riding is at a minimum. Toward the other end of the age spectrum, I'm one of many emeritus professors who are still enthusiastic about helping, in part-time capacity, advance projects of concern to them. Many are in the enviable position of being able to be skilled volunteers on projects. Even more broadly, it is a grand opportunity for seniors who are looking for meaningful engagements advancing valued goals.

Caring less about differences is deceptively important. Ken Hammond came up with the daunting principle that, "when rational men of good will sit down at a table to resolve their differences, they can't."[78] I've long held my unpublished corollary, "If you care enough, nothing can be divided equally." Ask any divorce lawyer.

It may seem a bit melodramatic, but I'm very glad I let go as I did. It freed me of a burden. The load must be carried forward by a generation younger than I. To continue to be part of the solution is just an extra dessert. Whatever effect I've had in my half-century at UCLA, the best chance I have on affecting the next half-century is by helping leaders in their 20s achieve their ambitious goals. The next best chance is by leaving a record for my grandchildren to read when they are ready. All indications are that they and their parents will outshine me.

78. This quote comes from a symposium Hammond gave at the University of Illinois in 1967 or 1968.

This seems like a much more upbeat place to end. I ended my last book on a much less optimistic "we'll see" attitude. The epilogues in Chapter 11 were a pleasant surprise. I expect any epilogues to this tale to bring good news, too.



Figure 83. Halloween 2017.

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To all those who helped review, I thank you for your kind words and insights. They more than compensated for the effort put into this book. I thank Zac Rolnik, publisher, and Alet Heezemans, production editor, for their help in publishing this book.

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Carpenter, G.S. and K. Nakamoto (1989). Consumer Preference Formation and Pioneering Advantage. *Journal of Marketing Research* 26: 285–298. [A collaboration between marketing science and behavioral perspectives that bore great fruit.]

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Christensen, C.M. (1997). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*, Boston: Harvard Business School Press. [Shaped some of my thinking on planning for disruptive innovations.]

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Collins, J. and J.I. Porras (1994). *Built to Last: Successful Habits of Visionary Companies*, New York: HarperCollins Publishers.

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Cooper, L.G. (1994). "Tracking the Components of Customer Satisfaction," Marketing Study Center Working Paper No. 240, (April). [The almost forgotten parts of factor analysis.]

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Cooper, L.G. and H.G. Levine (1985). "Guerilla Science: An Epistemology for the Applied Behavioral Sciences," in *Human Systems Development*, Tannenbaum, R., N. Margulies, F. Massarik, and associates, New York: Jossey-Bass, 489–519. [This is the epistemology I laid out in the 1980s that now has been sanctioned by Pearl as causal modeling for an applied science. Except for the application section written by Harold, this piece is the most turgid prose I've ever written.]

Cooper, L.G. and M. Nakanishi, (1983). "Two Logit Models for External Analysis of Preferences," *Psychometrika* 48 (December): 607–620. [The last article I ever sent to *Psychometrika*. It's about how to imbed preference vectors or ideal points into pre-existing brand maps.]

Cooper, L.G. and M. Nakanishi (1988). *Market Share Analysis: Evaluating Competitive Marketing Effectiveness*, Boston: Kluwer Academic Publishers. [This book summarized the first 18 years of the research Masao and I did together.]

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Cooper, L.G. and T. Noble (1998). "Barriers to Digital Convergence," Center for Marketing Studies and Center for Digital Media, Anderson School at UCLA, 88 pp. [This summarized over 40 interviews that Troy conducted with leaders in the digital space. The issues were organized into the categories of the critical-issues grid.]

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Dunderjerski, M. (2011). *UCLA: The First Century*. Third Millennium Publishing Ltd., London. [A great introduction to the first half-century I missed.]

The Economist 11-30-2016. [The first report of the elephant curve.]

Emery, F.E. and E.L. Trist (1965). "The Causal Texture of Organizational Environments," *Human Relations* 18 (1): 21–32. [Classic reading that influenced my understanding of turbulent fields and disruptive change.]

Ferguson, C.H. (1999). *High Stakes, No Prisoners: A Winner's Tale of Greed and Glory in the Internet Wars*, New York: Times Business – Random House. [A cautionary tale that helped me understand what I faced at SDC.]

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Ivins, M. (2003). *Bushwacked: Life in George W. Bush's America.* New York: Vintage Books.

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Jim Kim (2017). "Rethinking development finance to meet rising aspirations," May 1, https://www.linkedin.com/pulse/rethinking-development-finance-meet-rising-aspirations-jim-kim/ [On the availability of the trillions needed to fund the transition to the new-energy economy.]

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Moore, G.A. (1991). *Crossing the Chasm: Marketing and Selling Technology Products to Mainstream Customers*, New York: Harper Business. [Moore's first book.]

Moore, G.A. (1995). *Inside the Tornado: Marketing Strategies from Silicon Valley's Cutting Edge*, New York: Harper Business. [While the first Moore book is better known, this one has a more complete strategy for disruptive technology.]

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Nakanishi, M. and L.G. Cooper, (1982). "Simplified Estimation Procedures for MCI Models," *Marketing Science* 1 (Summer): 314–322. [Simpler yet.]

Pearl, J. (1986). "Fusion, Propagation and Structure in Bayesian Networks," Cognitive Systems Laboratory Technical Report CSD-850022 R-42, Department of Computer Science, UCLA (revised March 1986). [This is the first reference to Pearl's development of Bayesian networks.]

Pearl, J. (2000). *Causality: Models, Reasoning, and Inference*, Cambridge, UK: Cambridge University Press. [Pearl's book on the *how* of causal modeling.]

Pearl, J. and D. Mackenzie (2018). *The Book of Why: The New Science of Cause and Effect*. New York: Basic Books. [The distillation of 30+ years of Pearl's developments in causal modeling and AI.]

Perloff, H.S., P. Bullock, L.G. Cooper, S. Eisner, and H.R. Faine (1979). *Arts in the Economic Life of the City*, New York: American Council for the Arts. [My part was a financial model that set goals for each segment that supports an arts organization.]

Rhim, H. and L.G. Cooper (2005). "Assessing potential threats to incumbent brands: New product positioning under price competition in a multisegmented market," *International Journal of Research in Marketing* 22: 159–182. [This piece integrated our MCI models and our models of external analysis of preferences with economic models for introducing new brands into existing markets.]

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Schwartz, P. (1996). *The Art of the Long View*, New York: Currency Doubleday. [This is the analog alternative to Bayesian networks.]

Seba, T. (2014). *Clean Disruption of Energy and Transportation: How Silicon Valley Will Make Oil, Nuclear, Natural Gas, Coal, Electric Utilities and Conventional Cars Obsolete by 2030*. Silicon Valley: Clean Planet Ventures. [Another take on the upside to shifting to the new-energy economy.]

Shapiro, C. and H.R. Varian (1999). *Information Rules: A Strategic Guide to the Network Economy*, Boston: Harvard Business School Press. [A great pun on the rules that drive the information economy and the dominance of information in the economies of the future.]

Schumpeter, J.A. (1934). *The Theory of Economic Development*, Cambridge, Mass.: Harvard University Press. [A classic that I've never read.]

Slywotzky, A.J. (1996). *Value Migration: How to Think Several Moves Ahead of the Competition,* Boston: Harvard Business School Press. [This was once required reading for all entering MBA students at UCLA. It still should be.]

Stouffer, S.A., L. Guttman, E.A. Suchman, P.F. Lazarsfeld, S.A. Star, and J.A. Clausen (1949). The American Soldier: *Studies in Social Psychology in World War II. Vol. IV, Measurement and Prediction*. Princeton, NJ: Princeton University Press. [A classic study that laid the foundation for much of quantitative social science.]

Stormer, J.A. (1964). *None Dare Call It Treason*, Florissant, Mo.: Liberty Bell Press. [One of the propaganda pieces behind the John Birch Society.]

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Timmons J.A. (1999). *New Venture Creation: Entrepreneurship for the 21st Century, Fifth Edition*. Boston: Irwin-McGraw-Hill.

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Tversky, A. (1977). "Features of similarity." *Psychological Review* 84 (4): 327. [Tversky on perceptual mapping.]

Tversky, A. (1972). "Elimination by aspects: A theory of choice." *Psychological Review 79* (4): 281. [Tversky on choice modeling.]

Tversky, A. and D. Kahneman (1981). "The Framing of Decisions and the Psychology of Choice," *Science* 211: 453–458. [One of the foundations of behavioral decision theory.]

von Bertalanffy, L. and A. Rapoport (1956). *General Systems: Yearbook of the Society for the Advancement of General Systems Theory, Volume 1*, Ann Arbor, MI: Society for General Systems Research. [Influences from my early years.]

Walker, J.C. (2017). "Solving the World's Biggest Problems: Better Philanthropy Through Systems Change." *Stanford Social Innovation Review,* Apr. 5.

Welsh, R. (1958). The Blue Book of The John Birch Society. Spiral bound fourth printing 1961. [The primary propaganda piece behind the John Birch Society.]

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Wolpert, R. (2017, draft). *Soul of a Deal.* [A valuable history of the deals Richard crafted and deals from the industry leaders he interviewed.]

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