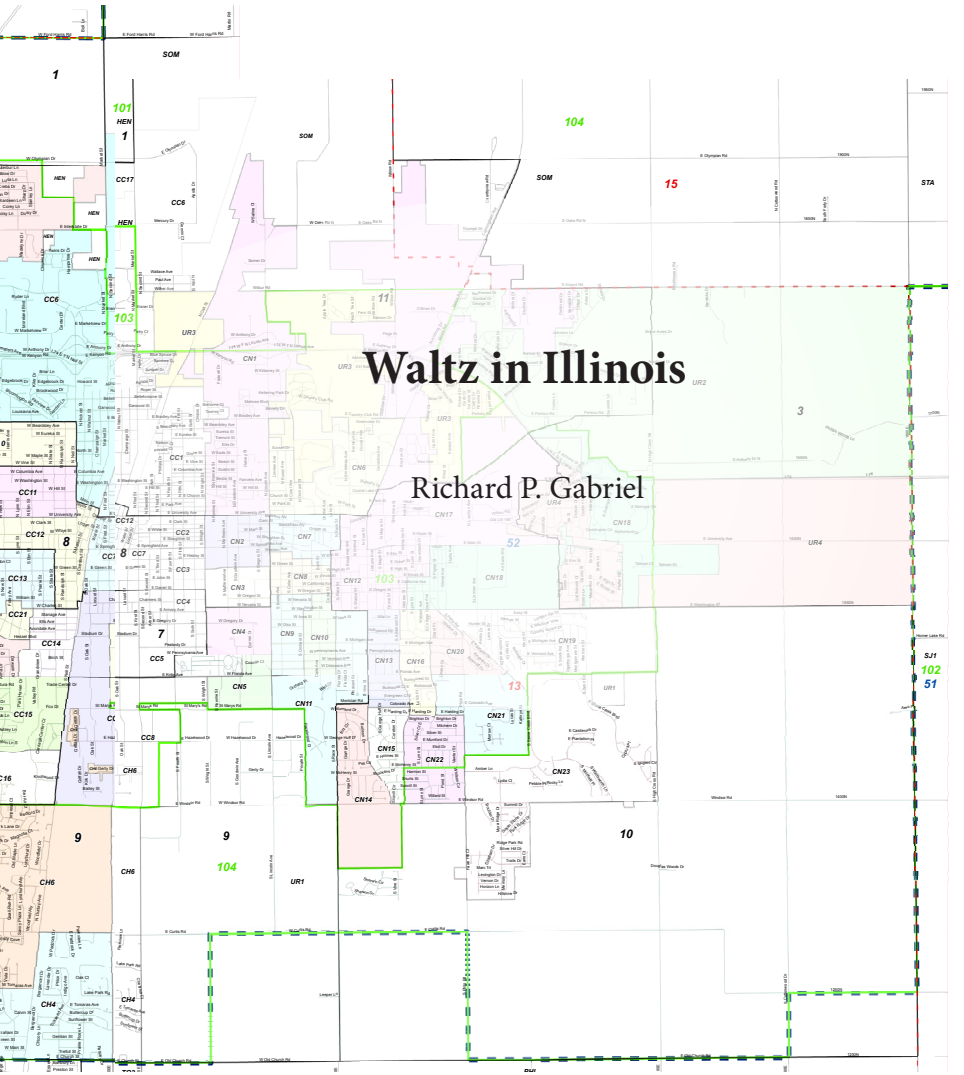

Waltz in Illinois

Richard P. Gabriel

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Harriet Fell joined Northeastern from MIT and while sitting with me in the Math Department lounge in 1972 my senior year she asked what interested me and my inept answer prompted her to say *ah, you're into AI; you should talk to my friend Pat Winston who directs the MIT AI Lab*, and I did and he let me sit in an office at MIT for a year and when money for that ran out, he said *you should talk to Dave Waltz who just graduated and has taken a job at the University of Illinois and maybe you can go with him*, and I did and Dave said *let's go to the corn fields and soybean fields of Illinois and build an AI lab—what do you say?*, and that's how David Waltz and I ended up in the corn and soybean fields in the flat state of Illinois bewildered but dreaming and eager and scared and starting an adventure together that ended separate.

Sadly ended separate.

I arrived with Kathy, Yuri, and our Volksie; Dave with Bonnie, Vanessa, and the White Whale. Kathy and I settled on the western side of Champaign three blocks from the cornfields separating us from the eastern front of the Rockies; Dave and Bonnie settled on the eastern edge of Urbana—his brand new house in a new neighborhood backing up on a field of soybeans that he and I and Bonnie and Kathy with Vanessa close by would look out on from their living room the nights we ate supper there.

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The prospect of going to Illinois with Dave seemed like bad luck to me. I didn't know him aside from reputation which was for all I knew a construct of the AI Lab which seemed to make out like the only real research being done in AI was being done right there. I had been loathe to leave New England in the past, and in fact, I was a Special Student at MIT because I didn't want to move to Minnesota or Wisconsin where I had been accepted into PhD programs. But now I had Kathy to come-with so it seemed safer. It was hard, back then, for me to label the cause for not wanting to leave home, but now it seems pointless to hide it—fear; fear of change, fear of making bad mistakes, fear of falling into an unrecoverable decline. But I had no alternative. Dave was friendly but imposing in stature, plain spoken, overly accomplished, confident. I was really none of those things.

And we weren't moving to the promised land of AI research—we were going to start one. I had never started anything before. Plus to go there I had to be a grad student…in mathematics; and what

I learned at MIT taking grad classes in math was that I wasn't very good at it. And how did Dave decide I was worthy of being taken along? The strange, math-like / math-light paper I wrote that year at MIT? A discussion with Pat Winston?

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Dave was in the EE department and I in the math department. Somehow someone arranged for an impromptu application process for me at the beginning of summer 1972. I think it was Dave. At that time the University of Illinois was at least in the top twenty for math departments, and maybe better. I recall hearing that some of the math faculty claimed they were in the top five. To get me into that program for real was a triumph. Or took a very big dog.

Our tasks—Dave's and mine—were simply laid out but hard to achieve: build a computing infrastructure for AI work; establish a first-rate AI program; find and attract great students; teach AI and all that goes with it; obtain research grants; adopt current AI students who don't really have proper advisers; do work that will always be remembered.

What did we start with? A PDP-10 with 192k words of memory—almost a megabyte; a slow connection to the ARPANet poached off of CAC next door. We got MacLisp running on the machine, and then later Logo, Conniver, MicroPlanner, and SHRDLU; for high quality typesetting we got TJ6 working and acquired a Type 37 Teletype along with a set of special type balls, including the important MAC Kludge Ball. I wrote a structural Lisp programming environment modeled loosely on Interlisp's.

Dave tried to lure faculty and visitors; he tried to recreate the intellectual excitement he experienced at MIT. But as Paul Rutter told me once while walking back to CSL after lunch at Papa Del's, Illinois is an engineering school based on plug and chug / not concepts.

Dave taught AI and I taught Lisp. We met some odd people. One was Gene Lewis, who was a math prodigy, getting a PhD in math from the University of Chicago in his early twenties. He wore a straw hat everywhere, and often a foil nose protector to keep UV off. (Some said the straw hat was lined with foil.) He took one of Dave's AI classes, and he had an odd behavioral tick: he kept at least 6' of distance between himself and every other person. When he talked to Dave and me after class, we'd try to corner him by slowly backing him up into one—just a few steps every couple of minutes, casual like we

just wanted to hear him better. We tried to coordinate our stalking, but Gene always got away. He was a prodigy after all.

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Dave was physically imposing: he walked like a giant—long leaning and swaying steps. You could recognize him from blocks away. When he laughed there was no doubt he found it funny. His laugh resounded and he'd look at us one by one to see whether we had the same joy. His beard was red—or so it seemed. The gap between his front teeth spoke of passion, his deep love which seemed the only kind he felt. How clear was it that he loved Bonnie and Vanessa when I first met him?—his love resounded like his laugh; he held them; he laughed with joy over them; there was never a stranger pair than Dave and Bonnie, but they were like a couple you'd imagine from the purest fairy tale of 1960's hippie love but lasting and lasting. Dave was straightforward but always spouting jokes and puns. Bonnie was skeptical of the whole Illinois experience, and she seemed urban and urbane. She especially, but both of them, loved excellent food. I recall she cooked well, but it could have been how terrible Kathy and I were by comparison.

Kathy and I babysat Vanessa it seems scores or maybe hundreds of times over the two years we lived in Champaign-Urbana. We ate at Dave's house dozens of times. We celebrated many holidays with them. When Kathy and I needed a big car to move stuff, Dave lent us the White Whale; when Dave and Bonnie needed muscle, Kathy and I did all we could. This was a foreign land to us. We came from New England; the flatness and apparent uniformity of the land and people made it seem like we had transported to another planet.

First the land: flat to every horizon line, wind sweeping across with hardly a hindrance. Sky filled our sightlines to much more than half so that even a bright blue autumn day filled us with a tickling dread. When bad weather hit, it came from all directions. When tornadoes encroached, the clouds grew green from debris picked up by funnel clouds. The first day in our house in Champaign, Kathy and I watched Mr Roberts, the WCIA (Channel 3) weatherman, tell us at 6:15pm that there was no chance a tornado would touch down in the Champaign-Urbana area, and at that very moment—6:15pm—a tornado was tearing the roof off a store about one mile away from our place.

For relaxation we drove out into the fields—row and row and row of corn; row and row and row of soybeans. Flat. I mean we drove out

on the roads leaving town which were on both sides and to a great distance surrounded by corn or soybeans. Looking out the side windows it seemed like we *were* in the fields.

The roads aligned on a grid; the towns at grid intersections. A good plan for a Sunday drive was pick a direction, drive *n* miles; turn right, drive *n* miles; turn right, drive *n* miles; turn right, drive *n* miles. Or drive to Arthur, the closest Amish town, and grab a shoo-fly pie.

Dave and the rest of us would sit in his family room on what was then the eastern edge of Urbana and look out over the soybeans. That first autumn unbearable heat was shriveling and dropping their leaves. At dusk we'd step outside and watch an eggshell blue sky turn dark and the horizon line push past orange to blood red. An ill-formed line of clouds sometimes sat pewter blue/black between, and con-trails divided the sky. Dave would say something like *well, there you have it—another fantastic, Illinois soybean moment*. Bonnie would tell again the story of lifting the corner of the blankets with her foot to let escape the gaseous emanations from an overly carbohydrated Illinois meal, trying to keep her ladyishness firmly in Dave's mind—even as he listened to the story and laughed his insatiable laugh.

Next the place names: Farmer City, Rantoul, Lake of the Woods, Philo, Tolono, White Heath, Tuscola, Mahomet, Arcola, Olney ("Home of the White Squirrels"), Mattoon, Pesotum, and not to be forgotten, Foosland. And some places with familiar looking names had odd local pronunciations: Marseilles (pronounced Mar-Sáles). We lived in a place called "Centroi Illinois." We spent months trying to understand this.

Next the strangeness: Nearby Allerton Park in Montecello is part of the University of Illinois; I gave my first-ever public talk there in 1974. They had a maze, a sunken garden, fake ancient Greek ruins, a fake Roman arena, and nude / bizarre statues—many on a forested trail along the Sangamon River. Statues ranged from the quaint (Fu dogs, Chinese musicians, koi) to the strange (Last of the Centaurs, the Sun Singer) to the weird (Gorilla Carrying Off a Woman (Dave called it Statutory Ape), Bear and Man of the Stone Age—a bear death-hugging a hunter who had stabbed the bear in the neck, the hunter still holding a rope attached to a bear cub).

Driving around Urbana late one night I remember hearing an interview of Grace Slick, singer for the Jefferson Airplane, and she was saying that she was never really sure where the band was playing,

and one time they drove her out to a venue that looked like *a fucking flying saucer*—this being the Assembly Hall at the University.

Morrow Plots—the oldest continual corn-field experimental plot in the US, begun in 1876. Some say the University built the three-story undergraduate library underground to keep it from shading Morrow Plots. We called it the "Undergrounduate Library."

We would drive out to the University teaching farm where they had 500–600lb hogs and cows with portholes in their sides so students and researchers could understand and probe bovine stomachs. I grew up on a dairy farm and the smells were familiar but still overwhelming in the heat and humidity of Centroi Illinois summers.

Deep-dish pizza, which neither Kathy nor I had heard of before. Papa Del's was our favorite, and Dave was part of our CSL Thursday Noon Pizza Club. *How many slices for you, today?* Kathy and I dissected the pizzas to understand how they were made.

The McDonald's on the north side of Urbana used local beef and so the burgers tasted good.

In February 1974 the winter turned warm and the national collegiate passion of streaking hit the University, and we went to the Quad one night to watch thousands of students run naked, several on their hands. Of note was the ParaStreaker who came down on the Quad that day—ParaStreaker: all he wore was a parachute and a para-sneakers.

The soil was thick and black. In town it was 6' deep; in a valley to the north it was 300'. Farm land around Champaign-Urbana was the most expensive in the world, we heard. Kathy's tomatoes grew to 6' in 1974.

Next the strange plants: On radio and TV we heard about weeds that would destroy crops: *Foxtail, velvetleaf, lambsquarters, thistle, mallow, ladysthumb, pokeweed, purslane*, and the appropriately and maniacally named *fall panicum*. We heard also about the weed killers that would solve these problems, and specifications about their dispersal: *broadcast* versus *incorporation*. It took us many months to sort out what these meant. Broadcast: the herbicide was cast on the surface using a special device; incorporation: the herbicide was shot into the ground using injectors dragged beneath the soil behind a tractor.

The morning crop and stock reports—corn futures, soybean futures, prices per bushel, wheat middlings, No. 1 soft white wheat, dressed broilers, choice white grease, edible tallow, hog bellies. It was

not simply that this was farmland and the terms and rhythms were different—I grew up on a working dairy farm. This farmland was different: different scale, different raw materials, different kinds of distributions, commoditization, foreign and exotic.

Cicadas: We arrived during a summer when the cicadas were about. Every night and many days we'd hear the welling building and overwhelming throbbing of the leg squeaks of these insects, and we'd see their left-behind casings still clinging to trunks—with nothing inside them.

We didn't know that to the south in Philo a great writer was growing up—David Foster Wallace. He wrote "this was in my home of Philo, Illinois, a tiny collection of corn silos and war-era Levittown homes whose native residents did little but sell crop insurance and nitrogen fertilizer and herbicide and collect property taxes from the young academics at nearby Champaign-Urbana's university, whose ranks swelled enough in the flush 1960s to make outlying *non sequiturs* like 'farm and bedroom community' lucid." What we couldn't imagine we couldn't know.

And how were we, exactly, to transform a place like this into one of the great centers in the world for doing AI? How could we lure people here, where the TV stations mostly shut down at 10pm, where the funniest things were names of weeds, where at any moment in tornado season a nearby trailer park would be transformed back into a slight and unfarmable hollow, where one of the best restaurants really was McDonald's, where it was not considered strange to know that a *hank* of hog casing was 100 yards (and where to buy same), and where the steepest hill on a bike ride was a headwind. We joked about the place, we struggled to understand the local accents, and we felt that we were visitors from another planet bringing knowledge and common sense to a society reduced to shambles by an overdose of big sky.

Dave and I told jokes all the time; we punned. He was an older brother not a distant mentor. We played jokes on each other ceaselessly. We tried to tell each other the wildest stories to see how far we could go before they were obviously impossible. We mixed in bizarre truths to keep the game murky. The brown recluse spider and its terrible bite was one of mine; Dave and Bonnie refused to believe it—poisonous bite but as shy as something *really shy*—until Bonnie's friend (was it "my friend Berry"?) was diagnosed with a recluse bite and stayed in the hospital for days. The best was when Dave called

us saying Bonnie had gone into labor early—it was April 1, 1975 or thereabouts—and could we come over and babysit Vanessa? *Yeah, right,* I said. *I'm sure Bonnie went into labor a little early today on April first, Dave.* I think I told him that Kathy had decided to catch out on the freight bound for Foosland via Mahomet and wasn't available. Took him 15 minutes to convince me he was serious—Kathy and I spent a couple of days babysitting while Jeremy was born.

Dave's work to build up AI went slow. Sometime during the first year he decided to work toward natural language processing, combined with database retrieval. He asked me to help him write up a paper as part of a formal proposal process. I don't remember exactly how we split up the work or where each idea came from—particularly since I don't have the paper we wrote—but the main ideas were to limit narrowly the domain of discourse to queries on a particular database or set of closely related databases; to limit understanding of the input text to just what was needed to construct a database query; to validate the program's understanding of the query by playing back a canonical fair copy; and to present the results of the database query in natural language based on template filling. Understanding natural language queries was not accomplished by a sophisticated dictionary / parsing process, but by matching word sequences to stored queries and to patterns of qualifier phrases. That is, essentially all possible queries were stored as sentences or sentence skeletons, qualifiers were similarly stored (e.g. "on <date>") and opportunistically matched; matching proceeded by a gradual weakening of the exactness of match. The extent to which the system *understood* any particular word or concept was the extent to which the network of stored queries cross-referenced it.

An important feature of the program was its set of "context registers," which were filled out by qualifiers (such as the dates referenced), noun phrases which formed the targets of pronouns and other referring words (such as "that," "it"), the previous query ("how many unscheduled maintenances did it have?"), and the results of database retrievals ("of those,…"). The domain of discourse was dictated by the funding opportunity, which was the US Navy, and the databases in question were maintenance records for Naval aircraft. The idea of the proposal was to put within reach of non-programmers the ability to understand and query those databases.

Eventually this was called an "engineering approach" because it didn't (necessarily) shed light on understanding human intelligence—

one purported goal of AI—but it created a capability that was human-like and perhaps of some interest to *real* AI researchers. Interestingly, the idea of maintaining a corpus of real utterances and sentences is a common technique today for all sorts of natural language systems.

This early work led to the creation of the Planes system—a question-answering system focused on airplane maintenance—which was Dave's first major post-doctoral scientific achievement. For me, this early work led to my first published paper and conference presentation.

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My funniest Dave story has to do with a meal Kathy and I made for him once when Bonnie and Vanessa had traveled back home for a bit and our instructions were to take care of him. It was when we lived in the modest mansion in Champaign, blocks from the in-town golf course. We rented from an odd couple: Nellie and Freddie—he was emeritus in the chemistry department, as I recall. Instead of sending us letters, Nellie would write notes on the back of our rent checks, so we would get them when the canceled checks were delivered to us—remember that?

The house was brick Tudor style with an imposing front door. Entering the house, to the left was a large, sunken living room with archway cutouts all around, providing a muffled kind of privacy. The dining room was behind the living room, and then to the right was the strange kitchen—it had a commercial look and feel to it, a commercial refrigerator with double doors, an electric stove, multiple sinks, and a kitchen booth for breakfasts. Upstairs the master bedroom was locked, and Kathy and I used the very large guest bedroom with a bathroom across the hall. In the basement were a variety of female mannequins and paraphernalia from their former pet, Jocko the capuchin monkey.

[I can't resist. Because of a severe ankle injury and Kathy not being ready to move, my parents drove me to Illinois. After we found the house and had arranged the rental, my parents, Nellie, Freddie, Yuri (our husky), and I were sitting in Nellie and Freddie's side yard one evening. The conversation took a weird intertwined twist when my mother thought the topic was Yuri's temperament, and Nellie thought the question on the table was my wife's name. When my mother replied *the dog is friendly*, Nellie heard *his wife's name is*

Frendi. Nothing ever convinced Nellie otherwise, so we were *Richard and Frendi Gabriel with their temperamental dog, Yuri*.]

The garage behind the house had been transformed into a large studio apartment, and our new friend Francis Lensky lived there (Nellie called him "Lee Lenstra"). This was his second year affiliated with the law school doing something to become an environmental lawyer. He was short, bearded, balding, athletic, and a good cheerful friend to Kathy and me. And to Yuri too. When we invited him to a meal at our place with Dave while Bonnie was away, he suggested that he teach Kathy how to make chicken cacciatore. It was not hard, he said, and he volunteered to put the ingredients together the night before, so all she had to do the next day—the day of the big meal—was cook it over highish heat for three or four hours, make the pasta, and serve. I volunteered to make my mother's favorite cake recipe, which was a heavy white cake with a very rich and sweet butter frosting. I don't have the recipe any more, but I remember that the frosting was made from a pound of butter, a box of powdered sugar, and a can of evaporated milk.

Kathy and I bought all the ingredients at Kroger's and delivered them to Fran the night before. He had a project to do or a major test to study for. He said he would leave his door unlocked and the pot with the ready-to-cook meal on his stove. When I went downstairs the next morning into our very commercial looking kitchen, the pot was on our stove cooking—Kathy liked to get up early. I don't recall the day, but later that day I came home from something and Kathy was in tears, sitting with Fran in our kitchen. Fran had decided to do the three to four hours of cooking the night before and figured that Kathy would realize it when she found the pot hot on his stove. Instead, Kathy just followed directions. The chicken was still edible, but instead of resting on good strong bones easy to pull the meat away from, most of the bones and cartilage had separated from the meat and were floating in / covered with tomato sauce. There was no time to make another batch. We didn't want to disappoint Dave whom we had told of this feast.

We made a plan. First, I was to finish the cake. I had already made the cake part and had only the frosting left to do. Meanwhile, Fran would make the vegetables over at his place. Finally, Kathy would recover the usable parts of the original chicken cacciatore. What did this mean, exactly? The bones were mixed in with the glop made from overcooking by a factor of two, as was the cartilage. The only way to

find the bony parts to eliminate was to transfer the glop from one pot to another by grabbing a handful, squeezing hard to feel what to remove, removing it, then putting the good stuff in the good pot. Squeezing tomato-y stuff like this, though, meant that red streams would sometimes go squirting in random directions. The counters, walls, and floors of the kitchen were all of some sort of tile, so cleaning that up was easy. This left Kathy. That day turned out to be one of the days I learned that she was a lot less shy than I had imagined. She immediately stripped completely and dove in, as it were, into the chickeny tomato-y soup-like stuff. When Fran was done with the veggies he came back to our place, sat at the boothlike kitchen table, and enjoyed a humorous chat about the cooking mess-up while Kathy strained away—turning red…from tomato-glop squirts.

We reconstituted the chicken cacciatore a bit with some fresh tomato fixings and spices, boiled up a load of pasta, cleaned up the walls, counters, and floors, hosed off Kathy, vacuumed the dining room—a quite formal and old-European specimen—set the table, and waited for Dave.

Things started well: chit-chat was fine; salad was fine; fresh bread was fine. Dave talked a long monologue as usual—serious mixed with hilarious. Then the main course: the veggies were fine—Kathy, Fran, and I piled on the veggies. We grabbed a lot of pasta, too. Dave piled everything on his plate, same as we did, but when it came time to ladle on the chicken cacciatore, he laid it on thick while we kind of put a couple of tablespoons of it on the side. *Late lunch,* we said. We mixed the pasta with the veggies and tried to keep up a lively conversation. Dave was floored by the flavor of it and how well mixed-together it all seemed. The three of us just stared at each other. *Do you mind if I have seconds*, he asked. *Sure, take as much as you want. This is really wonderful, Kathy*, Dave said. The three of us just stared at each other. Kathy was a fine looking young woman—tall, long dark hair, a nice figure—and I'm sure Fran enjoyed gazing upon her kitchen labors in ways similar to how I did. But both of us remembered the red squirts landing all over her. And I suspected she also found that and the squeezing a little too intimate an encounter with the preparation details of the meal. So we passed up the opportunity to really taste how it came out.

But Dave kept up the conversation; he laughed at our stories and during his own. Finally after thirds, he was ready for the cake. Kathy and I loved that recipe—it was the recipe we used for our wedding

cake. But we just weren't hungry. Neither was Fran. We took polite slices. Dave cut about 1/4 of the cake for himself. *Go right ahead*, Kathy said. Dave marveled at the cake, especially the frosting. He took another 1/4. When it was over, Dave took all the leftovers. Next day he said the meal was superb. I watched him carefully for a few days, and he never fell ill.

We told that story many times and to many people. But never to Dave, nor to Bonnie as I remember. To have kept it from him was my small gift to him.

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Dave and I tried to put together a multidisciplinary degree program for AI, but stalled when we found out that the people and organizations holding approval rights included department chairs, deans, the University President, the trustees, and the Illinois Legislature (for funding). We were surprised how parochial and disjointed the departments were when we arrived. There was a decent computer science department, but it wasn't where AI was done—I recall the areas of study were something like hardware (the physics behind transistors etc), digital design (making digital devices, such as flip-flops and CPUs, out of transistors), algorithms, numerical analysis, and software. Electrical engineering is where Dave was, and they had nothing really related to computers except for design, queuing theory, and the like. Mathematics was theoretical and pure. There were related departments like linguistics and psychology, but it would take years for Dave to get them aligned to AI.

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We all arrived in the summer of 1973, and that October the 1973 oil crisis hit. In retaliation for the US supplying the Israeli military during the Yom Kippur war, OPEC declared an oil embargo. For a lot of people in Champaign-Urbana this was an inconvenience for driving, but for Kathy and me it had another effect: heating. The rules were set as follows: Every home in the area would be provided with about 80% of the heating oil it used the same month of the previous year. Because Nellie and Freddie were in Honolulu the previous year and set the heating at a minimum level—50°—that winter we ran out of heating oil about 2.5 weeks into each month. And because heat and electricity were included in the rent, we were not considered new occupants—no exemptions. We tried a couple

of things, like suffering through it, spending evenings in the kitchen with the stove's heating elements on, eating at Dave and Bonnie's as much as we could, but the thing that finally worked was finding a heating oil dealer willing to sell us oil from the black market—at about twice the usual cost. Dave and Bonnie had plenty of heating oil, but the White Whale cost them plenty for gas.

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In my second year, Tim Finin, George Hadden, and some of Dave's eventual long-term grad students began to arrive. Tim had spent a lot more time at the MIT AI Lab than I had, and he helped with even more of the computational infrastructure. He was also a more seasoned researcher than I was, and so I think Dave started to feel like progress was being made. Tim and his wife Janet were quite refined in their tastes and especially for food, so Champaign-Urbana was a wasteland for them. There were neither great restaurants nor great stores to buy ingredients to make good food. Everything seemed targeted to the native population of simple but good farmers and merchants.

The natives made things hard for us easterners in lots of ways. The twin cities were governed by folks elected by permanent residents and not by the students, but the total population during the school year was more than half students. I remember the second summer we were there the local TV station did a poll to see whether to keep Saturday Night Live on Saturday nights or replace it with movies. Naturally the permanent locals preferred movies to the counter-culture SNL, and off the air it went. When the students returned, the station was flooded by complaints and the decision was reversed.

Tim and Janet tried hard to make the place livable for themselves, and also for us. They had a friend who had a friend in New York whose family had a deli or something, and they arranged for a couple of New York cheesecakes to be sent in dry ice containers to Urbana every couple of weeks, and Dave, Bonnie, Kathy, and I were happily side-effected by this.

Tim and Janet's place was out on the Western edge of town—the side close to Denver. Kathy and I had to move because Nellie and Freddie decided to stay in Champaign the next winter. We needed to keep the rent down, and so we found a place for $100 a month in Urbana—the smallest house one can imagine living in north of boxes. It had two rooms, really: a living room about 8' wide and 15'

long, but the last 4' was a tiny kitchen. The ceiling was about 7'. The back room was the same size and was our "work" room. Its small closed-off end was just big enough for a full-sized mattress laying on the floor (full-size meaning larger than a twin bed but smaller than a queen). There was maybe 18" to spare on one side, which was where we put some books and an alarm clock. When it rained hard, the bottom of the mattress got wet. The house was around 1' from the property line, so when the next door neighbor went out and started his car—warming it up for 15 minutes each morning—the gas fumes came into our "bedroom." But, as Kathy always said, the yard was huge, and we planted a tomato garden with 20 or 30 plants, and I built a small bike shed big enough to store also some of our other stuff.

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After our attempt to build a multi-disciplinary AI degree failed, we decided to focus on how exactly to graduate me. I had helped with a lot of the infrastructure so that CSL felt a little like an AI Lab once you sat down in front of the computer. My own computer vision research was a failure, and the exploration of natural language with Dave was working better.

We had three obvious approaches to graduating me: stay in the math department, move to the computer science department, or move to the electrical engineering department where Dave was.

The computer science department seemed to me to be out of the question: I would have to learn an entire field—after being in grad school for a few years already—and the department appeared to be focused on designing and building computer-like machines. All I really knew about computer science was what I knew about AI (from an MIT-centric point of view) and a little about programming.

Because I was in the math department and had an extensive background there, it seemed the best bet so Dave and I visited the department head to see how this would work. He took it under advisement, and a few weeks later he called us back in. *Here's how it will work*, he said. *First, you take all the math courses required and pass our qualifying test. Then, you write a dissertation with Dave. He must approve it as valid AI work. Your math department adviser must approve it as valid mathematical research. And since Dave is a junior faculty member in EE, we will ask Marvin Minsky and Seymour Papert to approve it as an AI dissertation.*

This seemed somewhere between completely and totally impossible to me.

I hadn't originally put the electrical engineering department as a possibility, but Dave suggested it and asked me to go with him to Ed Davidson's office. Ed was a full professor and quite a power in the EE department. He sat us down and said *you can switch to EE*. At that time, EE required extensive knowledge of physics, antenna theory, and all sorts of things whose names I didn't even know. I mentioned I thought this was crazy. Ed said *not at all. First, you take the qualifying test. Let's say you flunk it—get a zero. At the faculty meeting where we review the results of the qual, someone will read your name and score (zero); Dave will stand up and say I move Dick Gabriel passes. I'll stand up and second the motion as a full professor, and that's it. You pass. Then you go on to do your thesis work.*

For a few minutes I sat there, stunned. Finally I said *so, let's suppose we do all that. Then I look for a faculty position, and with a degree in EE I apply to an EE department, and I don't know the first thing—not any thing—about EE. That's crazy. And I'll never get a job.* Ed said *it won't work that way.*

Well, I considered it for a few days and concluded it was not right, not moral, not ethical. This meant I had to leave Illinois.

Don't forget Kathy. Kathy was working as an occupational therapist at a nursing home on the East side of Urbana on East Main. She had done a year at the Boston University occupational therapy program when the diversion to Illinois began. The idea had been for me to finish my PhD and then she could resume her career, but in physical therapy. With part one of this plan down the drain, we decided to apply to schools in the same regions so that we could both resume our educations. We picked two regions: Boston and the Bay Area in California; the schools were Boston University for her in PT and MIT for me in Boston, and Stanford for both of us in California. I had failed to get into MIT as an undergraduate before, and Stanford had the top computer science department in the world at the time, so neither seemed likely to me. But there were two things that I figured could help. First was that one of the last things I did in the math department at Illinois was to prove a theorem that Dana Scott had failed to prove—on a challenge by a professor. Moreover, my proof was

novel, and in coming up with my proof, I had uncovered a weakness in the existing proof—a counterexample to an important step in it.

The backstory was that I was in a decision theory class and the professor liked to give oral exams, and he gave us two choices: prove in front of him without notes Hilbert's Tenth Problem, or prove on your own the Scott-Tseitin Theorem. I decided to do the latter since I hated oral exams. It took me a few weeks, and the final proof was close to 100 pages of handwritten material. On top of that, the professor asked me to prove the theorem to him on a blackboard—an oral exam, but using my notes. It took two days to go through the proof, partly because when he asked me why I didn't approach it the way Tseitin did, I showed him my idea for a counterexample to the key step that was not proven but claimed obvious. Later he asked if he could use my proof in one of his books, and I agreed. He said he was sorry to see me leave the department and the school.

The second thing I thought could help was that Dave had good contacts at MIT and he said he had friends at Stanford too, including Tom Binford, who had been at MIT.

I made it onto the waiting list at MIT, and Kathy was turned down at BU. Kathy got into the Stanford PT program, and a little later Don Knuth called me inviting me to come to Stanford. Later I found out I had been whiteballed into the program based on Dave's influence.

~

But that wasn't the last thing that Dave did to move my career along. After I was at Stanford for a while, I connected with Terry Winograd—one of the three big Ws from MIT in the early 1970s: Patrick Winston, David Waltz, and Terry Winograd. He became my thesis adviser, and my thesis was about how a particular sort of general-purpose planning system that was not of a pure logical nature could solve lots of interesting problems, including doing natural language generation with good writing style. Dave agreed to be on my thesis committee, so the circle could be closed. Terry didn't like the "not of a pure logical nature" part of it, and the night before my orals he called up to warn me that he planned to vote against me. I had honed and practiced my orals presentation to a ridiculous degree, so despite being discouraged, I gave a good talk. Normally there was a private session after the public talk so the committee

can grill the candidate, but I didn't have one: instead they walked out and congratulated me on passing.

I believe when Terry started talking about failing me, Dave intervened. I imagine he said something like *the system was a good engineering approach, and the talk was a* tour de force. There were lots of comments to address in the dissertation, but I passed.

~

After Dave died I started to recall the adventure we had those two years in Illinois. I was not a full-time student at MIT, I was taking classes. I was not part of the AI Lab, I had an office while Pat Winston watched what I might achieve. I was what they called a "hanger on." Dave didn't need to take me with him to CSL. He didn't need to arrange for a late admissions process for me. He didn't have to include me in his administrative and strategic planning for his AI Lab and program at the U of I. He didn't have to entrust the computing infrastructure to me, he didn't need to ask me to teach Lisp. He didn't need to pull me into the proposal process for the Planes project, and he didn't need to let me be first author on my first real publication. He didn't need to let me make a fool of myself giving my first talk in front of a real audience at Allerton. And he definitely did not need to make the phone calls to Stanford calling in favors that enabled me to go to school there. And years later he didn't need to agree to be on my PhD committee and argue against my adviser that I deserved to pass.

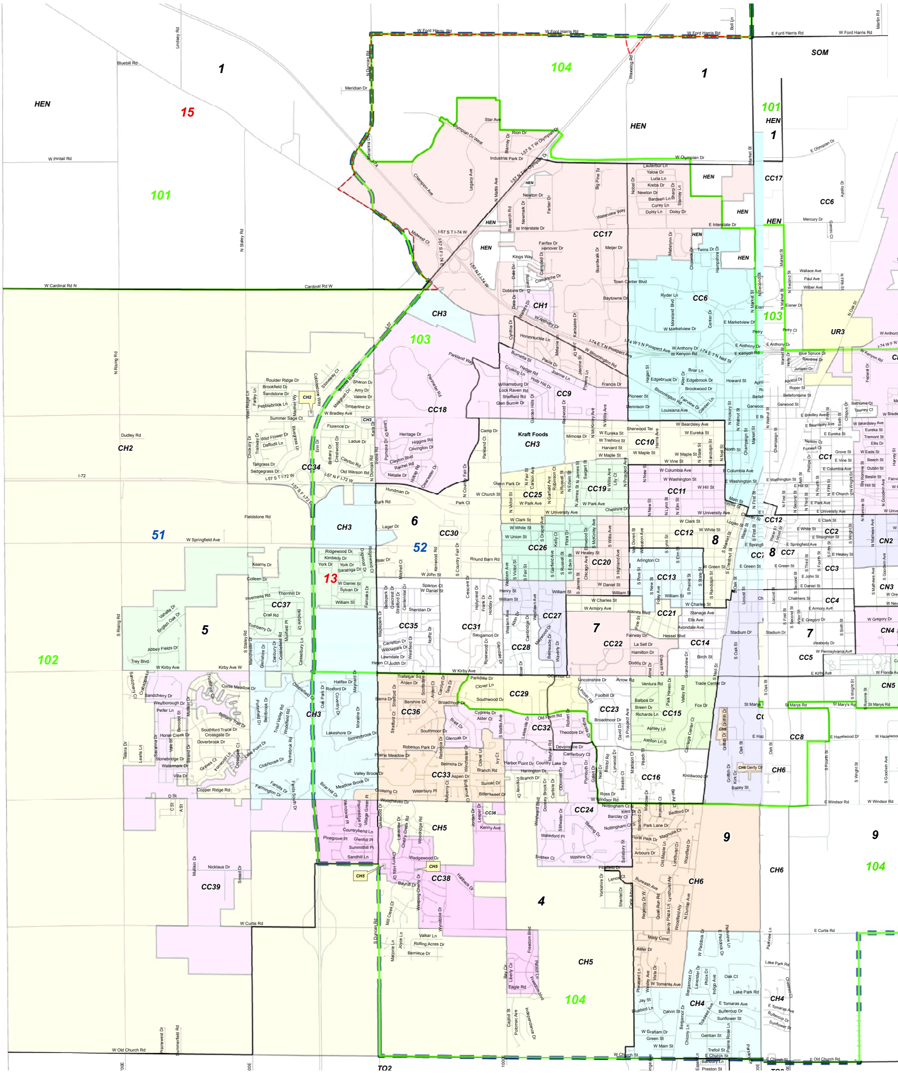
Those were the professional things. He didn't need to ask Kathy and me over several nights a week (it seemed like), he didn't need to take care of us on holidays. He didn't need to show me how to navigate the hard world of science. He didn't have to be a role model.

As I sorted through all this I realized that he was the last mentor I ever had. Perhaps he was the only true mentor. If you look at me and believe at all that I have made any contribution to computer science or to the world as a whole, it's because of Dave. If it weren't for him, I would be as nobody a nobody that anybody can be.

Thank you, Dave. I wish I had said this sooner. Thank you for the life you prepared me to carve out and live.

Lament Representing Ongoing Work

At the edge of a field filled
with round balls of lavender clover
a crew is dismantling an oak,
starting at the top with the long branches
that trace the bottom of wind, and after each branch
falls more trunk is taken down. The men
stop every thirty minutes to sit under the diminishing shade
and sip from jars of lemonade filled from one
of five big buckets, and when the shade is gone
they move their drinks and tools to the rim
of shade around the field. They climb like arboreals
or use ladders on the flat beds of a pair of trucks
to reach the limbs that go next. Later
the field is filled with limbs and leaves
losing their lives while the wind finds
the way less obstructed and the lemonade
buckets grow emptier and less able to comfort
the sweating work of the wearying men.



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W University Ave
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