

Memories of Art Dempster

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Abstract

I first met Art Dempster in the fall of 1970. I last visited with him in the fall of 2025. For these 55 years, I knew him as a steadfast friend, an original and penetrating intellect, and a generous human being.

1 Memories

Early in the fall of 1970, shortly after I arrived as a new graduate student at Harvard's Department of Statistics, Art and Elizabeth Dempster graciously hosted my wife and me at their home in Cambridge — that was before they moved to Lexington. We were amazed by their hospitality. We were charmed by their two young children, especially Becky, with her proper English manners. We learned that Art had spent a sabbatical year at the London School of Economics a couple years earlier.

That spring Art taught a course that used Robert Bartle's little book on integration. His colleagues, he told us, thought we needed to learn about abstract Lebesgue integration as a foundation for probability theory. He was not so sure, but he found this bit of pure mathematics "soothing". The course also dipped into Art's book on multivariate analysis. This felt like an odd combination at the time, pure mathematics paired with a very applied and only remotely connected topic. But when I took a closer look at Art's multivariate book decades later, I felt its mathematics sing. Art knew the joy of mathematics.

That same spring, Art also taught a small seminar on the history and philosophy of statistics. It was the history that captivated me. Bernoulli,

Bayes, Laplace, Poisson, Cournot, Pearson, Fisher, Neyman. I acquired my copy of Isaac Todhunter's 1865 *History of the Theory of Probability* that semester. And I adopted as my own Art's conviction that we cannot understand statistical theory without understanding its history.

After that year at Harvard, as I settled in at Princeton in the summer of 1971, I needed to think about a thesis. Art had merely mentioned his upper and lower probabilities while I was at Harvard, but more than one of his colleagues had told me that they thought it was deep and important and that they planned to try to understand it. Why not try to understand it myself? So then there were trips back to Harvard for Art's encouragement, freely given. A year later he said he thought I had done enough for a thesis.

In the spring of 1973, Art was at my thesis defense in Princeton and at the (vegetable) garden party at the cottage (built for World War II soldiers) that my wife and I rented from the University. My favorite photograph of Art shows him there on the lawn. I wish I could find it.

Another dinner, in Lexington this time, in the spring of 1974. We were celebrating Julie and Persi, who were finishing their Ph.D.s and heading to the west coast. Elizabeth was ever the gracious host, but of course the highlight of the evening was Persi's magic tricks for the children.

By the time my book on "belief functions" appeared in 1976, I was moving on to other projects. If you read the foreword Art wrote to the book, you may conclude that he was also moving on. But we were moving in different directions. He was drifting back to Bayes. To quote E. T. Jaynes, I was "a fanatical anti-Bayesian".

In 1981 my book caught the attention of AI, where its theory was rechristened "Dempster-Shafer". I think this pulled both Art and me back to the topic. By 1984 we were both looking at network computation for Dempster-Shafer, largely inspired by the MYCIN expert system and Judea Pearl's ideas about Bayesian expert systems. It must have been in 1985 that Art and Augie Kong visited me and my colleagues in Kansas to discuss possible collaboration.

From the mid-1980s on, my conversations with Art usually included his interest in bringing Dempster-Shafer into the statistical mainstream. We continued, from time to time, to talk about possible collaboration. Once, in the 2000s, Art, Chuanhai Liu, and I managed to write a joint NSF grant application. Not funded. The program officer saw three different applications, not an application to collaborate.

What I remember best and most fondly about our interactions after the

mid-1980s was our talk about family. I was regularly updated about Becky, Sara, and Ben. Art heard about Rick and Dennis. We began to have those conversations more often after 2000, when my son Dennis began his college education at the Boston Conservatory and I found my way to the area more often. I have lost count of the number of times I was Art's and Elizabeth's guest at their home on Walker Street in Cambridge.

Some of my fondest memories of Art and Elizabeth are the occasions when they attended Dennis's concerts. Dennis later did post-graduate work at the Longy School, just a block from Art's and Elizabeth's Walker Street home, and I think they attended at least one of the concerts Dennis organized at Jewett Hall, at the First Church another block towards Harvard Square.

Equally memorable was Art's and Elizabeth's presence at the 2007 ceremony in Cambridge where my wife Nell was inducted into the American Academy of Arts and Sciences. Art was already a member of the Academy. But he and Elizabeth were there to support me and my family.

In 2009, Elizabeth and Nell were in Prague to witness a ceremony where Art and I were jointly awarded an honorary degree. The following year, Art and I were together for the first conference of the Belief Functions and Applications Society in Brest. We visited Quimper, tried to hike to the Pointe de Raz. Didn't quite make it.

The last time I saw Art and Elizabeth was in October of this past year, just a few months before their deaths. Art was still talking about making progress on Dempster-Shafer. We were still talking about family. For some reason, I asked Art about his acquaintance with Jerzy Neyman, and he talked about the conversation they once had on an airplane flight.



Elizabeth and Nell in Prague in 2009



Glenn and Art in Quimper, France, in 2010

2 My tribute at Art's retirement dinner

As I thought about what I should say today, I stumbled on the tribute I offered more than 20 years ago, at Art's retirement dinner on May 20, 2005. I can do no better than to quote it.

"I met Art and Elizabeth 35 years ago, when I came to Harvard as a graduate student. Art was 40. I was 17 years younger. Just back from the Peace Corps. Recently married. Eager to do well and do right.

"Today Art is 75, and 17 years younger no longer looks so young to the outside world. But it is only to others that we look our age. To ourselves, we are a composite age, for we carry within the voices and experiences that have shaped us. For these 35 years, Art has been one of the most powerful of the voices inside me, as I am sure he has also been for many others here.

"I speak now not of his steadying and reassuring influence for these 35 years, but of his lasting example during my year at Harvard in 1970–1971.

"I speak of his quiet questions, which demanded no immediate answer but could command decades of thought. Ten years after that year at Harvard, Mike Sutherland explained to me how he interpreted Art's thoughtful silences. Art would think, he said, not only about what he should say but about what you would say then, and then what he would say next and what you would say then, and so on and so on. And soon the conversation would be over. I laughed and acknowledged the truth in Mike's picture, but 25 years later I realize that it was only a partial truth. For my often silent

conversation with Art is not over yet.

“I speak also of Art’s broad view of his subject, critical but never dismissive, engaged but never opinionated, generous but never gullible. Art’s seminar in the Spring of 1971 has defined my intellectual interests for these 35 years, not merely in the topics we examined but in the respect and engagement that he brought to them. Where else would I have seen mathematics so in service of philosophy, history so in service of understanding, philosophy so in service of practice, with so few axes to grind?

“I speak also of Art the man, a man who values his family and his students over abstractions. When he looks at you thoughtfully, it is you he is seeing.”

3 Art’s philosophy of statistics

Art’s 1967–1968 sabbatical in London was partly supported by a John Simon Guggenheim fellowship. The title of the project he proposed to the Guggenheim Foundation was *Concepts and reasoning processes of statistical inference*. He had intended to write a book, he told me at that dinner in the fall of 1970. “But nothing happened.”

There are a million reasons why a book you are going to write doesn’t happen. To begin with, all those other things you need to finish. In the preface to his multivariate book, dated July 1968, Art writes, “The final touches were added to this book while I was a Fellow of the John Simon Guggenheim Foundation.” At the end of the paper on upper and lower probabilities that he read to the Royal Statistical Society on February 14, 1968, he again acknowledges support from Guggenheim.

But wait. By the end of the summer of 1968, he had made a decent start on the book. I find in my files more than 180 double-spaced typewritten pages, some mimeographed, some dittoed, that Art had distributed in that seminar course in 1971. It presents itself as a book, *The Theory of Statistical Inference: A Critical Analysis*.

- Chapter 1, Introduction, dated August 26, 1968.
- Chapter 2, Probability, dated September 27, 1968.
- Chapter 3, The history of statistical inference, undated, clearly unfinished. In the introduction, he explained that Chapter 3 would trace the interaction between the Bayesian and Bernoullian paradigms over 200 years.

- A promised final chapter would explain how his generalization of Bayesian inference to upper and lower probabilities could “relieve the pressure to use Bernoullian inference in contexts where it is less appropriate”.

Why could this book never finish itself? Where did Art’s dissatisfaction with it lie? What was missing? What was awry or unpersuasive?

Let me pause over Art’s use of the word “Bernoullian”. He noted in his introduction that the alternative to the Bayesian paradigm...

... has no widely accepted name. One hears terms like frequency approach, Neyman–Pearson theory or sample distribution school, all of which are somewhat narrowly conceived.

Bernoullian, he argued, is the appropriate name. Jacob Bernoulli’s *Ars conjectandi* initiated this type of inference just as Thomas Bayes’s *Essay* initiated Bayesian inference.

Art used *Bernoullian/Bayesian* in several articles in the late 1960s. I urge you to adopt it. It should be one of Art’s legacies. Unlike the now prevailing *frequentist/Bayesian*, it names the two traditional methodologies without seeming to align them with different meanings for probability.

As for the meaning of probability, Art again distinguished two broad traditions: *epistemological* and *mechanistic*. Nowadays they are more often labeled *subjective* and *frequentist*. He was firmly on the epistemological side. And for him, epistemological did not mean subjective. It was about knowledge and certainty. As he wrote, “reluctance to accept the very notion of probability as a numerical degree of certainty has produced a plethora of discordant views of probability which are awkward, confusing, and unnecessary.”

Art was a Scot from Toronto. His family had been in the bakery business there. The name “Dempster’s” still appears on Canadian bakery products. Back in Scotland the name had derived from the Middle English *demester(e)*, meaning “judge” or “one who deems”. Art would not have traced his thinking about statistics so far back, but his views did hark back to before Neyman–Pearson and the neo-Bayesians. He believed, with some justice, that his concept of probability was close to that of Bernoulli, Bayes, Laplace, and Fisher. He bridled when the neo-Bayesians began calling Fisher and Neyman’s work “classical”. For him, Bayes was as classical as Bernoulli.

Like his predecessors from Bernoulli to Fisher, Art combined his epistemological concept of probability with the mechanistic metaphor. The ball drawn

from Bernoulli's urn. From Laplace's "infinite urn". From Fisher's "infinite population". He saw the contradiction and embraced it, in a way that isolated him from those who chose a side. It isolated him from the free-wheeling users of Dempster-Shafer outside the statistical tradition, who often followed my book in dropping the metaphor of random sampling. It isolated him from those, like Chuanhai Liu, who wanted to reconcile Dempster-Shafer with Neyman's combination of Bernoullian methodology and frequentist probability. It kept driving him back to the simplicial models of his 1968 Royal Statistical Society paper, which offered a way of combining epistemology with drawing from the infinite population.

When Art was a Guggenheim Fellow, I was a senior in college. I remember my course on the American novel. Melville, James, Faulkner, Hemingway, Dreiser, Steinbeck. Everyone wanted, we were told, to write the Great American Novel. In the early 1970s, as I got acquainted with other statisticians and philosophers who were debating the philosophy of probability and statistics, I saw in many of us the ambition to write the Great American Probability Book. I have not yet seen the Great American Novel or the Great American Probability Book.

There cannot be a Great American Novel. Our country's contradictions are too intense, too tightly packed. Trying to unravel it all can produce only chaos. The Great American Probability Book was similarly impossible, I think. The very identity of statistics as a field was a bundle of contradictions. Objective judgement, random mechanism, probability as both fact and opinion. Too many contradictions for Art or any of us to make coherent.

As we have buried Art, I think we have also buried the Great American Probability Book. The knot of contradictions that was the identity of statistics has in fact exploded. New ways of thinking about prediction and inference are pushing its debris to the side. The next generations will struggle with different contradictions.