

Remembering R. Duncan Luce

September 30, 2013



R. Duncan Luce died on August 11, 2012. He was one of the most prominent mathematical psychologists of the 20th century, one who was very good at experiments as well. Luce was born May 16, 1925, in Scranton, Pennsylvania. He received a bachelor of science degree in 1945 from the Massachusetts Institute of Technology (MIT) in Aeronautical Engineering and a PhD in 1950 from the same institution in mathematics.

During his lifetime he held a large number of academic positions. From 1950 to 1953 he continued to be at MIT as director of the Group Network Laboratory, which was a research laboratory of electronics. From 1954 to 1957 he was assistant professor of mathematical statistics and sociology at Columbia University. From 1957 to 1959 he was a lecturer in social relations at Harvard University and from 1959 to 1968 professor of psychology at the University of Pennsylvania. He spent three years at the Institute for Advanced Study in Princeton. In 1972 he was appointed professor of social science at the University of California, Irvine. In 1976 he then moved back to Harvard University, where he held various positions until 1988 when he became the Victor S. Thomas Professor of Psychology, Emeritus. From 1988 to 1994 he was Distinguished Professor of Cognitive Sciences at the University of California, Irvine, and remained at Irvine until his death.

He will be missed by many, but his work will remain as one of the great bodies of research in mathematical and experimental psychology, taken together in all of 20th-century and early 21st-century psychology.

During his lifetime, Luce received many awards and prizes for his distinguished work in psychology. In 1954 he was appointed a Fellow at the Center for Advanced Study in the Behavioral Sciences, located at Stanford but not part of the university. The center became very prominent in the behavioral and social

sciences after that time. In 1963 he was elected to the Society for Experimental Psychologists, and in 1966 to the American Academy of Arts and Sciences. In 1970 he was given a distinguished scientific contribution award by the American Psychological Association. In 1972 he was elected to the National Academy of Sciences, and in 1994 to the American Philosophical Society. In 2003 he received the National Medal of Science. In 2007, he was awarded an Honorary Doctorate of Mathematics at the University of Waterloo. I emphasize that I have only listed a small number of the awards and prizes he received.

Luce published a number of important books. His first was *Games and Decisions*, written jointly with Howard Raiffa, published in 1957, and reprinted in 1989 by Dover Publications. This is one of the early books on game theory and received a lot of attention. In 1959 he published *Individual Choice Behavior: A Theoretical Analysis*, which I consider in many ways his most original work. I comment on it in more detail later. In 1971 he published, with Dave Krantz, Amos Tversky and myself, a three-volume treatise, *Foundations of Measurement*. Volume II appeared in 1989 and Volume III in 1990. In 1993 he published *Sound and Hearing*, a subject on which he was an expert and wrote a great deal about.

The general subject of measurement was one of the most prominent features of Duncan's scientific work. In 2000 he was sole author of *Utility of Gains and Losses*, which was a book of applications of measurement theory and clever experimental approaches to testing theoretical ideas. In this survey of his publications, I have not mentioned here the articles he wrote (often with collaborators) or books he edited and co-edited with others.

In 1949 he published his first journal article with Albert D. Perry, "A Method of Matrix Analysis of Group Structure" in *Psychometrika*, Volume 14, pages 95–116. He was just 24 when this first article was published. In the years that followed, he was too prolific for me to try to describe his many scientific papers in detail. Indeed, at the time of his death, he had a rather large number of manuscripts nearly ready to go to press.

An important feature of Duncan's work is the large number of areas of psychology about which he wrote a serious collection of papers, often with co-authors. In my experience it is hard to think of anyone who has had a wider scope and a wider collection of co-authors than Duncan. For example, in the earlier years he wrote many papers with David Green and A.A.J. Marley. The many papers with Green had an impact that almost amounted to a change in research on the nature of sound from a psychological standpoint.

I was fortunate to collaborate with Duncan over many years on work in the theory of measurement. In some ways this collaboration had a rocky beginning. The original version of Duncan's 1957 book, *Individual Choice Behavior*, was widely circulated several years earlier with a red cover, and was referred to as the "Redbook." He has, in this book, what seemed to be unusually simple axioms about behavior. Initially, I thought the axioms were too simple and clearly must be wrong. Duncan and I had vigorous arguments about this over an extended period of time. But he finally convinced me that he was right and I was wrong. I am glad he persuaded me, because I would feel pretty silly now to have had such an opinion of such an important work. His interaction with me on this matter was typical of his patient and careful explanation of what he believed about some area of psychology, and his corresponding sharp critical remarks on the work of others that he felt represented either errors or misjudgments.

He also had perhaps the most efficient habits of working of anyone in the academic world I have known. Given a deadline he was always well on time and usually early. I can remember well when we were writing the multivolume work on foundations of measurement. He and I had agreed to finish one of the chapters by a certain date. He was quite dissatisfied by my slowness in completing my part. So, he came from Irvine to Stanford and moved in my house with the assertion that he was not leaving until I had finished. Of course, he did not mean this literally, but we were the kind of friends that could talk this way to each other.

In his later years, Duncan was especially good at generating from the theory of measurement clever new axioms for unusual behavior in making choices, for example, by gamblers or other compulsive types. And he was very good at testing such new axioms by designing experiments put together to focus on just the right things.

He will be missed by many, but his work will remain as one of the great bodies of research in mathematical and experimental psychology in all of 20th-century and early 21st-century psychology.

-Patrick Suppes

*Lucie Stern Professor of Philosophy Emeritus
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A Celebration of R. Duncan Luce

By Richard C. Atkinson, former president and regent of the University of California system, and former chancellor of UC San Diego

Duncan was a friend and colleague for more than 50 years, and I believe I have read every scientific paper that he has ever written. There is much that I could talk about, but I am going to focus my remarks on the summer of 1957 when I first met Duncan. That summer was a defining moment in psychology and set the stage for Duncan's remarkable career. Pat Suppes, who would become one of Duncan's closest friends, had organized a summer institute at Stanford University on "formal theory" in the behavioral and social sciences. It was a six-week retreat involving a small cadre of seminar leaders and about 40 attendees who were recently-minted PhDs or advanced graduate students. All of the students had a strong background in mathematics, and this was an opportunity for them to learn about the role of formal theory in their disciplines. The seminar leaders in psychology were Duncan Luce, Bob Bush, Bill Estes, George Miller, and Noam Chomsky — Duncan was the youngest of the group, all of whom were already quite famous.

Several weeks before the start of the seminar, Duncan sent me a manuscript of a book that he was writing. At that time, I had not met Duncan but had some correspondence with him on his work in game theory. Once I started reading the manuscript I could not put it down. To this day I have a clear memory of the exhilaration of reading, studying and repeatedly rereading the manuscript. I had never experienced anything quite like it. It was so important that I had copies made to be distributed at the summer institute. By chance, the secretary who made the copies placed them in a red binder.

The manuscript was titled "Individual Choice Behavior: A Theoretical Analysis." I had loved Euclidian

geometry in high school and Duncan's manuscript read like Euclid; a set of definitions, some axioms, and then a series of theorems and proofs — followed by examples of how the theory was applicable to psychology and economics. It was a thin manuscript but its elegance and implications for research were staggering. That summer, everyone at the institute studied and debated the work which quickly was dubbed "the little red book." When Duncan published the book about a year later, there could be no question that its binding had to be the color red.

The Red Book is as important today as it was 50 years ago. It, along with Duncan's subsequent papers and books, set the standard for theory in psychology and cognitive science. He has been recognized for his scientific contributions by election to the National Academy of Sciences at a very early age, as a recipient of the National Medal of Science awarded by the President of the United States, and by many other honors.

Duncan was a totally dedicated scientist. But that is not the whole story. He had a remarkable genius for understanding the social, political, and organizational forces impacting science and academia. He could not be persuaded to accept an administrative job even though he was offered several high-level government and university positions. Although he would not consider day-to-day administration, he did serve as a valued and much sought-after advisor. His high standards, advice, and guidance at UC Irvine both in the early 1970s and when he returned in the 1980s were critical to the success of this institution. For psychology, he had the foresight to establish a new journal, a new society, and a series of boards all of which shaped the field as we know it today. At the National Science Foundation and the National Research Council he provided expert advice on a wide range of scientific and technical issues. When I served as president of the University of California, I often sought his counsel, and when he detected problems at the university he was quick to alert me. Many institutions have been shaped by Duncan's counsel and advice.

Duncan was a giant in modern science who left an indelible imprint on the behavioral and social sciences. As no one knows better than his wife, Carolyn, he had a gentle nature and a wry sense of humor. He will be greatly missed, but his work will be studied by generations to come.

My Years With Duncan

By Elizabeth F. Loftus, University of California, Irvine

(With apologies to Abraham Lincoln)...Four score and seven years ago, a dentist and his wife brought forth, upon this continent, a new baby, conceived in Scranton and dedicated...no not dedicated, but...proof of the proposition that all men do not grow up to be equal. That new baby boy would one day grow up to become Professor R. Duncan Luce.

So began a short talk that I delivered at the University of California, Irvine (UCI), at which our campus celebrated the life and career of one of the most important faculty members in the history of our campus, and one of the most important psychological scientists in our field.

I first met Duncan in 1974. I can't recall exactly where it was, but most likely at a conference like the Psychonomics meeting, or serving on some committee for the American Psychological Association.

(Remember, APS didn't exist back then.) He would have been 49 years old, and I was just a few years out of graduate school. I was one of a number of then-young cognitive scientists (although we didn't call us that back then) whose work he showed an interest in, and whom he would help along the way. That was one of the special things about Duncan; he was not only interested in his own work, but everyone else's too. I would receive these amazingly thoughtful formal communications about my work from Duncan, like this one from February 25, 1975, where he crisply laid out my research "Problem," the "Hypothesis," "A possible experimental design," and later in the letter his thoughts on data analysis and interpretation.

February 25, 1975

TO: E. F. Loftus

FROM: R. D. Luce

Problem:

Does the verbalization of a memory of an event shortly after the event occurs inhibit the nonverbal memory of the event?

Hypothesis:

This appears to be a special case of a more general hypothesis: We recall better what is said about an event than we do the event itself.

A Possible Experimental Design:

Each of three groups see an event. The control group is asked at a much later time (say one month) to describe what happened as fully as possible. Right after the event occurs, Experimental Group 1 is provided with an incomplete verbal report of the event that includes only factually correct statements, but omits a number of statements that are equally true. Experimental Group 2 is provided with a similar incomplete verbal report that includes some of the correct items of E1 and some plausibly incorrect ones (for the same total number). Both E1 and E2 are asked at the same later time as C to describe what happened as fully as possible.

And then every so often, he sent me something personal, in his own handwriting, often showing an interest in what was going on in my life, as in this one from December 1974 where he commented on my father's health situation as Dad had just been diagnosed with melanoma.

December 3, 1974

I trust the trip back was uneventful and that all is well at home. And I also hope the news from your father is satisfactory.

Or this one where he talked about spending time with his young daughter, Aurora, whom he called “Zuzu.”

My afternoon with Zuzu was most bittersweet — so good to see her and talk to her, but so heart breaking to leave so quickly. I slept very badly.

In my talk to the UCI community, I recounted a bit about Duncan’s move from UCI to Harvard — when he was in his 50s, and it was there that he met Carolyn Scheer who would become his wife and later my friend. I fondly remember being with Duncan and Carolyn one evening, in December 1982, when my ex-husband and I were in Boston. It was quite special for me, still a relatively young psychologist, to go with them to a Christmas party at the home of mathematical psychologist Bill Estes, a home formerly owned by William James.

Years later, Duncan returned to UCI. Never in my wildest dreams did I imagine that one day I would take a job at UCI, a job that Duncan most certainly helped me obtain. And never in my wildest dreams did I anticipate the terrific friendship that I would have a chance to develop with Carolyn and Duncan after I became a colleague, their neighbor, and a family friend.

In 2003, I would get a chance to repay some of his kindness when I happily accepted an invitation to write a letter in support of the nomination of Duncan for a big campus award. A small portion of the letter expressed my personal views:

Since so many can speak about his scientific contributions (and his contributions in founding the Institute), let me focus on one activity that I can best address, namely his involvement in my own recruitment to UCI. To say that Duncan extended himself in a meaningful and hugely significant way would be a vast understatement. I’m told that Duncan played a major role in the development of the search committee report that went to the Executive Vice Chancellor nominating me for a Distinguished Professorship. Once I was offered the job, he emailed me periodically to strongly encourage acceptance. Once I arrived at the University, he and his wife, Carolyn, offered me their home for a few days since construction on mine was not quite complete (I just had to feed the cat, Heidi). They helped me get settled, providing champagne and all. They hosted a reception for me so that I could meet other faculty. They went out of their way to invite me to professional and social events so that I would be stimulated and not lonely.

After Duncan won the award, the letters were bundled together and given to him. Soon thereafter I got a short note from Duncan, thanking me for one thing — mentioning Carolyn in my letter.

I wrote a few other letters over the next few years that concerned Duncan in one way or another. But none was as hard as the short letter that I wrote to him a few days before he died in August, 2012. We’ve all had the experience of sending sympathy notes to people who have lost a spouse, or a parent, or a close friend or loved one....It’s never easy to know what to say. But never before had I written directly to the friend who was dying..... and here’s what I said.

Dear Duncan,

How do you say goodbye to someone special whom you've known for nearly 40 years? Back in the early 1970s, you read the pre-publication manuscript of one of my initial papers on eyewitness testimony, and you made it better. I thanked you in a footnote, and at that time, I of course had no idea how many more times, over many decades, that I would be grateful for your help. You were instrumental in getting me the job I love at UCI, which was a huge rescue from a difficult past. You and Carolyn generously gave me a place to stay when my house wasn't yet ready for me, and you both included me in many holiday gatherings with Aurora and family. You wrote to the President of APA to complain about the "McCarthyism" involved in the organization's reaction to complaints from my enemies after APA gave me an award. I'm sure it is because of (your efforts) ... that I was elected to the NAS. You wrote me an apology email after you pulled my hair in response to my once again engaging in one of my typical "laudatory introductions" of you. I'm sorry if those introductions were "somewhat unnecessarily laudatory"; You are so special, I just wanted to be sure that everyone knows it. These are just a few of the many many things that I remember about our 40 year friendship.

With love and affection,
Beth