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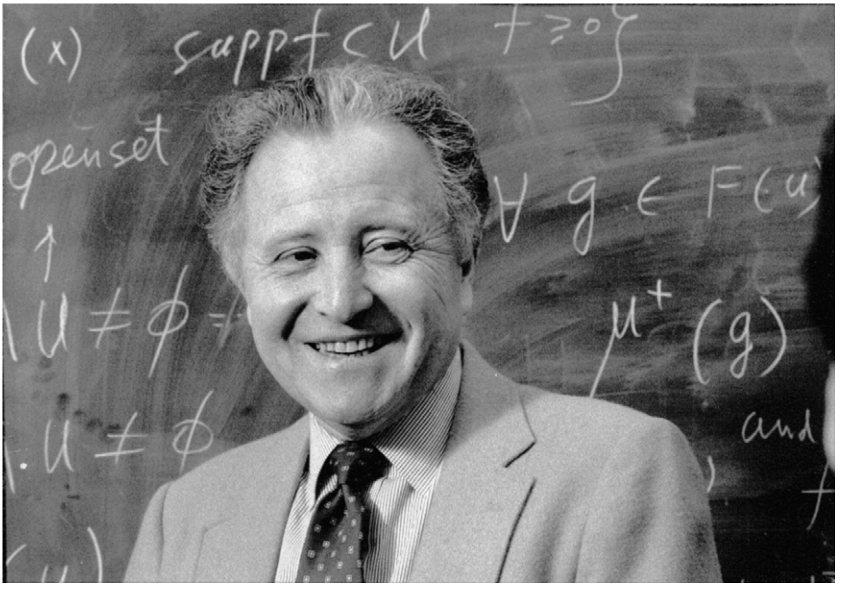
In Memoriam

Donald J. Newman (1930–2007)



Donald Joseph Newman passed away in Philadelphia on March 28, 2007. He was 76 years old. He is survived by his wife, Herta, sons David and Daniel, and three grandchildren.

Newman was born on July 27, 1930, in Brooklyn, New York. He received his undergraduate education at City College of New York and New York University. As an undergraduate, he won the Putnam Competition three times in a row and was awarded a full scholarship to Harvard's Ph.D. program in mathematics, and finished that program successfully in 1958. He had positions on the mathematics faculty at MIT, Brown University, and Yeshiva University, and was a distinguished chair at Bar-Ilan University in Israel. He joined Temple University in 1976 and retired in 1994. He had more than 16 Ph.D. students. [1]

The author of numerous papers and five books, Newman worked in a wide variety of fields, including classical analysis, approximation theory, number theory, combinatorics, functional analysis, and recreational mathematics. He made major contributions in approximation theory. His

[1] The Mathematics Genealogy Project (http://genealogy.math.ndsu.nodak.edu/) contains a partial list.

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1964 paper on rational approximation to $|x|$ was groundbreaking and opened up the field of rational approximation. His work on Müntz–Jackson approximation started a new direction within approximation theory. In number theory, he gave a beautiful truly elementary proof of the Prime Number Theorem. [2] Newman was widely known as a problem solver par excellence. His quick and elegant solutions to difficult problems were (and still are) much admired. He was a frequent contributor to the Problems and Solutions section of the *American Mathematical Monthly*.

Below is a collection of reminiscences from Newman's colleagues and students.

Reminiscences of Donald Newman

Lee Lorch[3]

Donald Newman was an extraordinarily talented mathematician, an inspiring and generous collaborator, a warm friend. I shall miss him greatly in all these capacities. His work bore the deft and strong mark of the master and addressed the heart of the matter.

His undergraduate days at (NY) City College were while I was on the faculty there. He became a legend almost on entry. There were many talented students. It was not surprising when yet another sought courses beyond the beginning. His passion was number theory; he wanted a course on that topic. There was one, based on the quite elementary text by H.N. Wright, College President. Donald didn't know that book and asked in all innocence if it overlapped with one by L.E. Dickson which he had worked through!

The Putnam Competition, restricted to undergraduates, was already in existence. Donald was in the (undifferentiated) top five nationally, in all three of the years, including his freshman year, during which he was eligible to participate.

When I was dismissed (without charges or explanation) from City College, Donald was among the many students and colleagues who protested.

We met again later. He had already started to write notable papers. His first effort to present one to an AMS meeting was accepted and listed in the program, but was thwarted by bad luck hitch-hiking en route. He arrived too late.

Various opportunities to be in the same city (New York, Gothenburg) over the years are reflected in our joint papers. Of course, we talked also about life in general. Here we were not always in agreement.

Early on, he developed MS, a terrible burden which he bore courageously. I remember our walks from where we lived to the nearby Mathematics Institute in Gothenburg. We had to cross a pleasant park where we rested so Donald could recoup his strength.

It was always a great pleasure to be in his company and that of his family. With them, I mourn his passing.

Leon Ehrenpreis[4]

When I saw the movie "The Fastest Gun in the West," I said: This is a movie about DJN. Amongst all the mathematicians I have met, no one could compare in speed and brilliance. Whenever I had

[2] J. Korevaar, *On Newman's quick way to the prime number theorem*, Math. Intelligencer 4 (1982), no. 3, 108–115. D. Zagier, *Newman's short proof of the prime number theorem*. Amer. Math. Monthly 104 (1997), no. 8, 705–708.

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a difficulty in my work that could be translated into "Newmanian terms," he always came up with a quick fantastic idea. My own work has suffered greatly since his illness.

I met Donald for the first time in my first day at Stuyvesant High School. I had been a reasonably good math student in elementary school, but I was totally overwhelmed by the thought of meeting the geniuses in Stuyvesant. Fortunately, Donald happened to be in the seat next to me in my first math class. He was writing on a clipboard, as he always did. He handed me the clipboard and said SIERPNERHE, DO THIS PROBLEM. It took me a long time to realize that "sierpnerhe" is "Ehrenpreis" spelled backwards. I thought "Wow, I must be a mathematician if the great DJN is asking me to do a problem." This is how I got my start, and there are many others whose mathematical beginnings were inspired by Donald.

Soon after that encounter I moved to the Bronx, around the corner from Donald. We used to go to school together, and we became great friends. We played handball and lifted weights.

Donald was very prone to helping people. He taught me how to drive. One day, my mother cut her hand badly. I called Donald and he arrived immediately and drove us to the hospital. I must say, as a sideline, that he enjoyed the ride. He drove as fast as he could and went through all the red lights. There was that impish streak in him. The first time that we went to Princeton he drove his white convertible Cadillac at 100 mph. He finally was caught for speeding and we ended up in jail, since we didn't have the money to pay the fine; Anatole Beck finally bailed us out. What do you think we did in jail? We played dice! Donald was not one to let anyone put him down.

Once Donald saved my life. We went for a walk in Crotona Park with Louis Nidus. Some kids met us and took a dislike to me. They told Donald and Louis to go and they would "take care of me"—but they refused to leave, even though they then were in danger.

Let me say something about Donald's mathematics. When we were about 18, the American Math Society had a meeting at Columbia University. The main speaker was Chowla; he discussed various error terms in the prime number theorem and ramifications to arithmetic progressions. It was the first time that I had ever encountered high-level mathematicians. I was amazed that Donald could discuss the intimate details of Chowla's talk with him and even suggest some improvements. Then he introduced me to Erdős, whom he described as "the greatest mathematician since Euler." I was even more taken aback when he explained to Erdős how to solve some of Erdős' problems.

A little later we went to Princeton, as I mentioned above. We went to see Selberg (certainly one of the greatest mathematicians in the world) because Donald wanted to discuss his new ideas on the sieve method and explain that, in its usual form, it could only prove the prime number theorem up to a factor of 2. I remember that Selberg looked startled, because he had worked on the same idea for many years and had come to the same conclusion.

One time we were working together on a problem which involved showing that only few points (lattice points, which you can think of as the corner points of squares on a graph) lie on certain curves. We were having great difficulty proving the result we needed. Early one morning (this was unusual since Donald did not like to get up in the morning) he came bursting into my house: "I got it." Then he explained how he solved it.

" I had a dream. In the dream I was driving my car. I found myself in a bus stop. I got out of the bus stop and found myself in another bus stop. This went on for quite a while. Finally I was getting disgusted, so I asked someone: 'Why am I getting into so many bus stops?' He said to me 'You idiot! Don't you realize that there are so many bus stops because you are in the plane? If you go to the Riemann surface then there wouldn't be so many bus stops.' " "Go to the Riemann surface" saved the day.

As a problem solver Donald had no peers, except for Erdős. His score in high school math team competition was far above anyone else's. He won the Putnam exam several times. But this was not his only ability. He gave the most beautiful and simple proof of the prime number theorem, and of the asymptotic formula for the partition function.

I should like to comment about the latter: I met him in the hospital about 2 months before he died. I told him that I was giving a course on analytic number theory, using his new (beautiful) book. He was very pleased. I then asked him if it was possible to use his method for proving the asymptotic formula to prove the complete formula (of Rademacher). He thought about it for a while. At this point I felt that we were back in the old days, working together. We came up with an idea which I later worked out to give the result. To see him in this state of awareness was a great thrill.

He did a lot of work on approximation theory, which revolutionized the subject. But his most profound work was on the “corona problem.” At the time he worked on it, it was one of the main problems in analysis. He thought that he had solved it and I told him to show the solution to Beurling, who was the acknowledged master of that branch of mathematics. Beurling found that his argument was brilliant, but there was a gap in the proof, which Beurling assumed that Donald could fill in. Unfortunately, Beurling showed Donald’s manuscript to Carleson, who was able to complete the proof before Donald. Carleson then published the paper with only a tangential reference to Donald even though Donald’s contribution (the short curve theorem) was the key ingredient in the proof.

Donald, I miss you as my closest friend and my mathematics misses you.

John Nash[5]

I have a lot of memories of Donald Newman, if I bring them up into mind after these 50 years.

Particularly the thing about cars is amusing. I had gotten a new car (bought as a used car and re-painted) in 1953 (it was my second car, after a black Studebaker convertible). This was an Oldsmobile 98 convertible, repainted “Royal Marine” (a light blue color). Donald appreciated that car, and that was, for a while, the best car among a group of friends. Then, a little later, he also got a big convertible from a used-car dealer and this was “the Cadillac without heater.” It was rather more grand than my car, at least in good summer weather.

My friend J. Manganaro (a Ph.D. in chemical engineering) refreshed my memory about a time when he was a student in an honors math class that I was teaching at MIT. One day, I had arranged that “DJ” would come in and take over the class and prove the irrationality of the number π. That was a very memorable experience for Jim M., and he recalls that it took a full class period and that DJ performed the lecturing without any notes.

Of course there are many other memories, and if my memory were properly refreshed there could be a lot more!

Harold S. Shapiro[6]

I have always regarded Donald as my teacher. Even if my thesis adviser officially was Norman Levinson, to whom I was attracted by his book *Gap and Density Theorems*, I never got a problem, nor any help from him. When I told him I was reading that book he simply replied “Oh, don’t read that.” Levinson was then no longer interested in harmonic analysis, but in ordinary differential equations, which (at that time) I had no interest in. But, I did get a problem—from Donald! It

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was a typical Newman problem: an inequality to prove something was bounded by $\sqrt{n}$, when the conventional wisdom only sufficed to give the bound $\sqrt{n+1}$. I became fascinated with this problem, which was the *leitmotif* for my Master's dissertation in 1951 (with the so-called Rudin–Shapiro polynomials as spinoff) and also stimulated my interest in function theoretic extremal problems, which was the subject of my doctoral dissertation and has remained a lifelong interest. So, to all intents and purposes Donald functioned as my thesis adviser.

But he was my teacher in a deeper sense than that! To explain what I mean, I would like to quote a story I enjoyed from Martin Buber's book *Tales of the Hasidim*. Rabbi Leib, son of Sarah (he was a famous mystic), attached himself for some time to the house of study of a renowned holy man (Dov Baer, the Maggid of Mezritch, also known as the Great Maggid). "Ah," said a friend later, "you went to hear Torah from the Great Maggid." "No," replied Rabbi Leib, "I did not go to the Maggid to hear Torah, but only to watch how he laced and unlaced his felt boots."

The meaning of the story (and there are many like it in the lore of mysticism) is, of course, that the Maggid did not have to say Torah . . . he was Torah! Also, that the most important things one learns from a teacher are not this or that fact, but are more in the realm of the intangible: attitudes, a certain style. One of my students expressed this very well in the phrase "the body language of mathematicians." The beginner becomes wiser as he ponders his teacher's remark, "In proving this inequality there is no loss of generality in assuming the right hand side equals 1." Later in life, he cannot remember when he learned this idea.

Donald's "house of study" was, for me, the lunchroom at City College in the years 1947–1948. I remember the scene well: he would be seated at the table reading Landau's *Vorlesungen über Zahlentheorie*. He didn't know much German, but could understand Landau's crisp prose, carried along by the formulas. From time to time some "disciple" would come by and say something like "I see how to get that estimate," and Donald would reply something like "OK, now try to get it *without* the log term." To change the metaphor, he was like a chess player playing twenty games simultaneously. He knew perfectly the position on each board, and could tell you all the previous moves. And I was taking all this in, understanding almost nothing, and yet learning. He didn't have to speak mathematics to me—he *was* mathematics.

So, what did I learn as I watched him opening and closing his copy of Landau? I suppose the most important thing was the obvious *joy* he derived from all things mathematical. The elation at seeing a new theorem (whether one's own or another's, it didn't matter) or an elegant solution to a problem struck a responsive chord in me. This was far removed from the dispassionate "professionalism" I was later to encounter in graduate school. I came from a background (on my father's side) where Torah was studied in this spirit, but my disposition was not suited to this kind of scholarship. Mathematics was a new world, without bounds . . . it was already clear that it was so rich that the smallest of its problems could engage one for a lifetime. Mathematics was an art form. To Donald mathematics and music were inseparable, and through him I learned to love classical music.

The fundamental unit of mathematics, and the measure of all things, was the problem. Most conversations began with "Here's a problem." A problem could be something whose answer was unknown to the poser, or an old chestnut making the rounds, or a tantalizing special case of a general theorem. It didn't matter, as long as it was a good problem, which meant: it was easy to state, and had some "point," like possessing an elegant or surprising solution, or an air of paradox. Most of what I have learned in mathematics to this day is by way of problems in this sense.

I would like to mention two very specific features of Donald as a mathematician. One was what I would call his *democratic* attitude. No one was too humble to be taken seriously (and especially, if he came with a good problem, or a good solution). Pedigree didn't matter. If Donald had any bias at all it was *against* "establishment" representatives. This also applied to the mathematics itself. To illustrate how precious this was to me, I can contrast it with what was said to me by an established mathematician who came to give a Colloquium talk at M.I.T. when I was a graduate student. In the Common Room, at coffee before his talk, he asked me what I was working on. Flattered that such a person should take note of my existence, I told him my thesis problem. "Oh," he said, "I had no idea anyone is still interested in that sort of thing. That's 1870 mathematics." Those were tough words, but I had my "network" and could withstand them. To Donald 1870 mathematics wasn't bad, although 1770 (Eulerian) mathematics was better.

A second characteristic of Donald was his *concrete* approach to mathematics. It was (and still is) fashionable among the graduate students to *generalize* everything. So if, say, you had found a cute theorem on polygons and showed it to someone, that person would say something like "Can you generalize this to polyhedra in $\mathbb{R}^n$? I guess what you really are looking for is a theorem on convex sets in topological vector spaces, etc., etc." Donald would take note of the theorem and say, "What does this say in case the polygon is a *triangle*? What if it's an *equilateral* triangle?" *This*, I learned from him and I feel it has stood me in good stead.

Well, those are some reminiscences of Donald in the years 1947–1952. I restricted myself to that period, because afterwards we met infrequently, and also I don't know if I could do justice to his more recent ideas, like probabilistic truth. But thanks, Donald, for all you gave me in those formative years!

Lawrence Shepp[7]

I got to know Donald Joseph Newman in 1957 when I was a junior at Brooklyn Polytechnic Institute and got a summer job at Avco in Lawrence, Massachusetts, thanks to Murray Klamkin, who had been teaching at Poly and had moved on to Avco. I am not sure who brought the two of them to Avco, but it was great for me to have the opportunity to be there for three summers and to interact with Murray and DJ as well as others at Avco including Herb Kamowitz, Jack Klugerman, Steve Scheinberg, Jack Warga, and Walter Weissblum.

I wrote my first paper[8] after the second summer. This was my only joint paper with DJ although we had much correspondence, and he later consulted for me and others at Bell Labs. The paper has some amusing aspects, including a colorful cover story involving "dixie cups," now passé, but the problem, then open, can be stated this way: if balls are thrown one after another each second into n urns, what is the mean value of the first time that each urn has at least two balls in it (where the "double" arises). It is easy to see that the mean time to have at least one ball in each urn is $n \log n + o(n)$ seconds. I am proud to say that I came up with a (albeit clumsy) way to get a formula for the mean. Fortunately, Don quickly found a better formula and wrote up our joint paper. Using the formula he obtained and some non-trivial technique, he showed that the mean of the first time to there being m balls in each urn is asymptotic to

$$\log n + (m-1)n \log\log n + o(n \log\log n), \quad \text{as } n \to \infty.$$

A bit later on Erdős and Renyi made our paper obsolete by a direct tour de force, obtaining all moments, not just the first, for any m. Oh well!

Even more important to my career was that being around Klamkin and Newman enabled me to get into the top five performers on the Putnam exam in my senior year at Poly, which opened

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[8] The Double Dixie Cup Problem (with D.J. Newman), Amer. Math. Monthly 67 (1960) 58–61.

doors for me. One of the problems that Newman gave me to train for the Putnam was this typical Newman problem: Suppose $a_1 = 1$, and

$$a_{n+1} = a_n + a_n^{-1}, \quad n = 1, 2, \ldots .$$

The problem is to find the asymptotics of a_n as $n \to \infty$. The trick, which Newman had to show me, is to take squares. Then

$$a_{n+1}^2 = a_n^2 + 2 + a_n^{-2},$$

and now by adding the terms for $n = 1$ up to $N - 1$ one sees immediately that $a_N > \sqrt{2N}$. By using this, the sum of the terms a_n^{-2} is smaller than $\frac{1}{2}\log n$, and we then can conclude that $a_n \sim \sqrt{2n}$. Looks easy now, but it was very inspiring and heady stuff for me in those days.

Don was the fastest mathematical mind I had ever encountered and it was daunting to watch him solve problems instantly. I am a competitive type and saw that I could not challenge him on speed since I would simply have no chance. DJ especially loved problems and he imprinted on me that one should approach mathematics not systematically but by solving little problems. I still do that today and though I have had other mentors, much of my philosophy of mathematics comes from these early experiences at Avco with DJ. Don would solve problems with a flash of brilliant insight and he would produce such insights regularly. I guess he saw others as somewhat cowed by him and several times made me feel more at ease with his statement, "No one mathematician completely dominates any other mathematician," all appearances to the contrary notwithstanding. Perhaps in a bad moment, though, Don once told me that I should not go into mathematics because I was not strong enough. I tried to roast him at his retirement from Temple University by re-telling this piece of advice he gave me, but he instantly squelched me by asking me whether I ever did actually go into mathematics! In retrospect, his advice probably inspired me more than it hurt me though it was painful at the time. Incidentally, I did go into mathematics.

Joseph Bak[9]

I first met Donald in 1966 when I entered the Belfer Graduate School of Science of Yeshiva University. The faculty was uniformly top-rate, but Prof. Newman's first-year course in real analysis stood out. In most of the first-year courses, the instructors and students were both overwhelmed by the amount of material to be covered. The faculty met the challenge by preparing very thorough notes and speaking quickly. The students responded by taking notes feverishly, and then spending the rest of the week trying to decipher them. There wasn't much time for insight—that would, hopefully, come later—nor was there much opportunity for give-and-take. In fact, there wasn't much eye contact between faculty and students. Both were focused on the blackboard. The instructor filled it, and the students copied it.

The atmosphere in Prof. Newman's class was very different. First, he had very few notes, if any. Second, he never seemed to be in a hurry. He strolled into class like someone with a good story to tell. Of course, it wasn't a "popular" story. The topic, after all, was theoretical mathematics. But it was always interesting. He focused on the key ideas and guided us through the evolution of the results, prompting us to anticipate the next step. Throughout the class, he pointed out the highlights, which included not only the final forms of the theorems and proofs, but also earlier

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ideas and approaches that didn't quite work, partial results, and every so often, a really "beautiful" idea or argument.

(As an aside, Donald believed that all beautiful theorems should have equally beautiful proofs and, in many cases, he provided his own. Thus he gave his own proof of the fundamental Min-Max Theorem of Game Theory, the classic Prime Number Theorem and Cauchy's Closed Curve Theorem. He even had his own proof of the Bolzano–Weierstrass Theorem, based on the remarkably original demonstration that every sequence has a monotonic subsequence.)

Donald's presence was felt equally outside the classroom. The Belfer Graduate School building (in the 1960s) was actually just several floors in an apartment building, above a catering hall. Either by pure chance or by incredibly good planning, the floor with the faculty offices had a large open central area with couches, the ubiquitous coffee pot, blackboards, and bulletin boards. A particularly busy spot was the bulletin board outside Donald's office, where he regularly posted problems, some with hints attached. There was a constant flow of traffic through his office, including students offering solutions to his problems, others seeking additional hints, and colleagues looking for help with their own research. Donald's ability to immediately penetrate the mysteries of a problem that others had been working on for weeks was truly remarkable. At colloquia, he frequently had suggestions to improve the results being presented or to offer a simpler approach. I even recall one colloquium where the speaker sat down and took notes as Donald went to the board and outlined his on-the-spot suggestions.

Perhaps because he saw things so quickly, he often underestimated his own contributions. When I urged him to put his complex-analysis lectures into book form, he insisted that there really wasn't anything new in his approach. Fortunately I was able to convince him otherwise. The book, which we co-authored so that he didn't have to bother with all the details, is still being used 25 years after we wrote it, has been published in a special Far East edition, has been translated into Greek, and has elicited numerous positive reviews for all the original ideas that Donald felt everyone already knew. (In fact, some of the ideas in the book are the basis for a recent article in the June/July 2007 edition of the *American Mathematical Monthly*.)

Donald appreciated the good things in life, but his love for mathematics was unadulterated by considerations of personal gain or glory. I once asked him what he would have done if he had lived in a different time or in a different place where he couldn't make a living thinking about mathematics all day. His immediate answer was that he would have done whatever it took to get by, but he still would have spent almost all of his free time doing mathematics.

Aside from his obsession with mathematics, Donald found some time for other pursuits. He loved classical music and enjoyed singing in a choir. He also loved cars. In a biography of John Nash (on which the movie "A Beautiful Mind" was based), Donald is recalled as one of Nash's close friends, who was admired, among other things, for his top ranking on the annual Putnam examination during their college years, and his white Thunderbird convertible during their days in graduate school. Donald found a way to combine his interests in mathematics and in cars. In a problem-solving seminar, he challenged us to find the order of magnitude for the number of turns it would take to park a car in terms of the extra "epsilon" length of the parking spot beyond the length of the car. I was actually the beneficiary of his hobby of collecting interesting cars. One summer, when he was invited to lecture in San Diego, he made me an offer I couldn't refuse. In exchange for watering his plants, I could drive all of his cars. I'll never forget the look on my brother's face when I picked him up at the airport that summer in my white Cadillac.

Donald was a great teacher, a very generous colleague, and a wonderful friend. The mathematical world will certainly miss him, but his legacy will undoubtedly continue to inspire students of mathematics far into the future. I know that I will think of him whenever I encounter a really beautiful argument or insight. And none of us who had the pleasure of working with him will ever forget him.

Eli Passow[10]

I am fortunate enough to have had the privilege of being associated with Donald Newman for more than 30 years, first as a student at Yeshiva University, and later as a colleague—although hardly an equal—at Temple University, a dual relationship which afforded me an opportunity to see this remarkable mathematician in his different roles.

Most of his graduate students were intimidated by Newman. We hesitated to ask questions in class, lest we seem stupid. Whether this hesitation was self-imposed or not isn't clear, and he did mellow as time went on; perhaps he eventually understood that most people weren't quite as smart as he was. His lectures were always well thought out, although I don't know whether he actually prepared them. He seemed to know the subject so thoroughly that preparation may not have been necessary. He usually presented just the bare bones of the topic, leaving us to fill in the details, and when we did, we learned much more than if everything had been fleshed out. More than anything else, we learned to appreciate style and elegance.

Doing research with Newman was usually a one-sided show. His mind was so fast that when you asked him a question he usually began solving the problem before you had finished stating it. It was hard for mortals to keep up with him, as he pulled one tool after another from his bag of tricks. And he made it seem easy, even though he was working hard. The only way you could function as an "equal" was if you knew much more about the problem than he did. You could then explain why some of his suggestions wouldn't work, or be ready to follow up new ones that flowed from him. And he could be wrong: When I began working on my thesis, I suggested an approach, which he said couldn't work. Who was I to contradict Newman, so I abandoned it, tried other things which didn't work, and eventually changed to another problem. A couple of years later, the problem was solved by someone else, using the method I had suggested. Another incident comes from our Temple days: Newman was spending a semester in California, but came back to Philadelphia for a day. I had proved that if f is a piecewise linear function on [0, 1] with just one change of slope at $1/2$, then $B_{2n+1}(x) - B_{2n}(x)$ is identically equal to 0, where B_n is the nth Bernstein polynomial. I had worked on the converse for quite some time without success, and I showed it to Newman that morning. In characteristic fashion, he said that he would solve it over lunch. When I saw him in the afternoon, he said that he hadn't finished it and that he would solve it on the plane back to California. I called him a week or so later (since I hadn't heard from him), and he said that it was much harder than he had originally thought. After his return to Philadelphia, we worked on it together extensively, but never solved it. (Nor has anybody else. Newman thought that it might be undecidable, which would have been much more interesting than the conjecture itself!)

But if he could be wrong, he could also change his mind. Growing up in New York, he developed typically liberal attitudes toward many issues. In the 1970s, this meant a coolness or even antipathy to the State of Israel. Newman never visited Israel until 1980, when he attended a 6-week-long workshop held at the Technion. I was on sabbatical that year at the Technion and witnessed the gradual change in his attitude. As he said, "My wife and I were charmed by Israel," he better understood the problems of the region and was much more favorably inclined toward Israel. He subsequently returned to Israel several times for professional visits. His altered perception of

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Israel possibly influenced his philosophy on social issues, which became more conservative in his later years.

On a personal level, Newman was not generally close to his students. When I invited him to my wedding several years after finishing my degree, he said, “I don’t do things like that.” But he could be very supportive. When my thesis wasn’t going well and I considered the possibility of leaving graduate school, he refused to hear of it. He told me that I deserved the degree, that I would get it soon enough, and to just be patient. And he was right. Many years later, when Newman was at Temple, I was in the midst of a personal crisis, and he offered me incredibly warm support and advice, more so than many friends who were much closer.

Newman once introduced Erdős at a conference, saying, “Erdős is God.” Hearing gasps from the audience, Newman, who loved classical music, said, “O.K., O.K., Erdős is Mozart.” How would I introduce Newman? Perhaps, “Newman is Vivaldi or Mendelssohn,” or some other composer whose joy is felt in his music. But Newman’s own words best summarize his approach to mathematics. In the preface to his book *A Problem Seminar* (New York, 1982) he writes: “Some of us are old enough to remember . . . the days when Math was fun (!), not the ponderous THEOREM, PROOF, THEOREM, PROOF, . . . , but the whimsical ‘I’ve got a good problem.’ ”

Louis Raymon[11]

Donald J. Newman’s mathematical feats are legendary. I will reminisce, instead, on a personal level.

To me, Donald Newman had qualities reminiscent of an adult version of Salinger’s Holden Caulfield, but with greater maturity and control. Donald immersed himself intensely in things that he considered “real”; he had no inclination to deal in anything that was not genuine. Mathematics was real; social justice was real; family, tribe, humanity—the arts, the five senses—were real. Freedom was the right of every individual. Tasteful humor was real. What was not real to Donald? He hated trite or meaningless conversation, politicians, dishonesty, anything phony. Individualists were admired; those who built themselves up on the backs of others were subjects of his disdain. Anyone who interfered with the freedom of others was to be thwarted.

His response upon meeting a colleague who would greet him with “how is everything?” would typically be “I have a problem that’s right up your alley!” Some colleagues misunderstood Donald, finding him aloof or intimidating. His disdain for small talk contributed to that image. Brilliance is intimidating, but Donald had no intention of making anyone genuinely feel insecure.

A revealing anecdote: In Princeton in the 1950s parking was at a premium. There were meters for parking available in which a small period of parking could be bought for even a penny. Members of the Institute and their guests would park there and, in the midst of their work, would often forget to replenish the meter. As Donald told it, the meter maids were very dedicated to being certain that even short parking violations were punished with a hefty fine. When Donald walked the streets of Princeton, he had his pockets filled with pennies, totally frustrating the meter maid by staying ahead of her and inserting a single penny in each overtime meter.

A favorite witticism: As famous problems began to fall, Donald was asked his opinion whether all “solvable” problems will eventually be solved. Donald’s response: “Every such problem will be solved. Each solution will raise two new problems so that, at the end of time, we will know everything, but we will know nothing.”

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Ed Saff [12]

Donald Newman was a master prospector of mathematical gems—he wrote relatively short, innovative articles that have had huge impact. His 1964 article on rational (versus polynomial) approximation to $|x|$ spawned an industry. Above all, I always admired his mathematical aesthetic—his sense of what was deep yet beautiful.

He was not someone I would call "easily approachable," but I always gained great insights from our conversations. He had an impact on my career as well, starting from his participation in my Tampa conference in the early 1970s. We have unfortunately lost a real gem in approximation theory.

Boris Shekhtman[13]

"I have a problem." In most circles, the phrase is a non-starter, yet music to the ears of a mathematician, none more so than Donald Newman. I first met Donald in 1981, right after my Ph.D., in a month-long workshop in Montreal. Having been at the short end of "I have a problem" conversation before with many talented people, I had a plethora of face-saving excuses: "this one works harder; this one has more tools, that one is older and doesn't have a life." With Donald it was different. I had no reasons not to come up with his ingenuous and simple arguments, except the most devastating one of all: he is just smarter.

Herta, his wife, once told me that, as a boy, Donald wanted to be a train conductor to have time to think of mathematics between the stops. "You must have been surprised to be paid for doing mathematics," I asked Newman. "I still am," he replied with joy that left no doubts as to its sincerity.

I also remember giving him a five dollar bill at a conference. "What bet did you lose to me this time?," he asked excitedly. When I told him that I borrowed the money at the previous conference, he was visibly disappointed.

These two episodes encompass "My Donald Newman" as I knew him through the years of enjoyable, though often humiliating, collaboration and friendship: A child at play, original and creative, free and unrestrained by social convention, and always, always competitive. A genius who refused to grow up. A friend with a flair for life and mathematics, amusing himself and inviting others to share the joy.

Donald, I have a problem! I miss you, wherever you are now. The game is not the same without you. If and when I get there, I hope to have a five dollar bill on me for a bet, and to hear you say: "Here is a cute answer to your problem."

Roderick Wong[14]

It was about 40 years ago when I was still a graduate student at the University of Alberta. Donald Newman was one of the three speakers of our summer school. The other two were I.J. Schoenberg and Paul Turán. Newman was by far the youngest among them. He was smoking a big cigar when he was listening to the lectures delivered by the other two speakers. I remember that he, in one of the lectures, spotted three errors written on the blackboard. For the first two

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times, the speaker argued back a little and finally made the corrections. On the third occasion, the speaker just erased his own writing right away, and said “You are always right” and wrote down what Newman suggested. When Newman was giving the lecture, he mentioned that he had difficulty in proving a result (which I no longer remember). Several people in the audience made suggestions, and he could immediately tell them where their arguments would break down. The quickness of his mind was really amazing and impressive.

Doron Zeilberger[15]

Don Newman was a great mathematician, but he was even a greater problem-solver. Problem-solving is not the same as math, and I am sure that if Don would have been less addicted to problem-solving, he would have achieved much more in “regular” mathematics, but of course, he didn’t care; he just wanted to have fun.

To cite just a few of his masterpieces, his proof of Morley’s Theorem and his solution of the 12-coin problem are masterpieces worth many “serious” theorems and proofs.

I met Don for the first time when I gave an interview talk at Temple, at the beginning of 1990. To illustrate my talk, I put on the blackboard a recent *Monthly* problem that was meant to illustrate my talk,

$$\sum_{n=0}^{\infty} \frac{1}{n!(n^4+n^2+1)} = \frac{\mathrm{e}}{2},$$

but Don stole my thunder: he did it on the spot, in less than a minute.

Don was not big on e-mail, so often I got e-mail from John Nash, who really adored Don, to print out and give to Don.

Yuan Xu[16]

I was a student of Dr. Newman from 1986 to 1988. I always called him Dr. Newman, as, at first, I didn’t catch on to the casual (and, to a Chinese student just arrived, shocking) American way of being on a first name basis with everybody, even with one’s professors, and later I had so much respect for him that I couldn’t possibly change. I remember him teaching his graduate courses: he walked in with no more than a small piece of paper and often not even that, wrote little on the board, had no use for the eraser, but could teach his subject so very clearly and lively. What I learnt most from him, however, is a way to look at mathematics, a way of living in it, cherishing it, and enjoying it.

Once, during our weekly meeting, he was sizing up a problem and talking about ways of looking at it. I was busy working at the blackboard, trying hard just to catch up with his thoughts. After some time, I suddenly realized that the problem we were trying to solve had little to do with the one that we started up with. So I stopped and said so. He looked at me and asked, “Is this a good problem?” I said yes. “Is it non-trivial?,” I said yes again. “Then why should you worry?” So we continued. Later, he explained that each good problem has a core that is the essential part; one should first identify it, and then “if you solve it, that is it.” Circling around does not count.

Another time, we took a walk after our meeting. It was the afternoon of a beautiful spring day. He was in a good mood and talked to me lightly along the way. At one point he said that one needs

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two things to be a good mathematician; one is technical skill, the other is style, and the second one is more important. I asked what he meant by style. He explained that it was hard to define and used the word “aesthetic” in his explanation. He then had to explain that word, as I didn’t get it right away.

Looking back, I shouldn’t have bothered asking for further explanations of what style meant; it was right there, next to me. Dr. Newman had style. He was a great mathematician.

List of publications of D.J. Newman

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Donald Newman started to contribute, both problems and solutions, to *The American Mathematical Monthly*, with 56(8) (1949) and, very soon thereafter, had at least one contribution in essentially every issue of that journal until vol. 74(10) (1964), and, less frequently, for several years thereafter. His last contribution is in vol. 94 (7) (1987). MathSciNet recorded a total of such 194 entries. He also has one entry, in vol. 67 (9) (1960) of the Monthly, under the Classroom Notes.

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