The inquisitive problem solver: An interview with Loren Larson

Deanna Haunsperger and Stephen Kennedy

Loren Larson finds inexpressible beauty and delight in well-designed puzzles and well-crafted problems – ask him about one and his face breaks into a warm and endearing smile. This love has directed many years of his life, from ten years as Problems Editor for the MAA's Math Magazine, to a long-time commitment as Convener of the Questions Committee for the MAA's Putnam exam, to writing The Inquisitive Problem Solver *with Paul Vaderlind and Richard Guy, and now more recently to designing and hand crafting wooden mathematical puzzles. We sat down with Loren and two of his colleagues, Matt Richey and Paul Zorn, a few years ago and asked him about his life with puzzles.*

Q: We're documenting the history of the MAA's first 100 years, and you're part of the story.

LL: Yes, the MAA was influential for me.

Q: Can we start with your early life and work our way up? Do you want to tell us about growing up and elementary school?

Figure 1 Loren Larson as a young boy.

LL: I grew up in a small prairie town in the Flint Hills of central Kansas, in the region described in William Least Heat-Moon's book *PrairyErth*. There were only eight kids in our class and we were together through eighth grade. I have many happy memories.

I was a "city-kid" because my family lived in town (population 250) so I didn't spend summers on a horse as most other boys in my class. But I did have a friend who shared my interest in major league baseball – keeping up with the St. Louis Cardinals (my team) and the Chicago Cubs (his team). Based on box-scores obtained from the Topeka Capital-Journal we kept records and graphs of our players' batting averages, home-runs, and pitching stats.

We also made up our own games: one two-person baseball-like game was played with a small wooden square that a pitcher could curve (sharply) up, down, right, left, and the batter had to hit it to particular spots on the field to get singles, doubles, triples, or homers. We kept stats on the results of these hits and changed the targets to make our numbers mirror the real thing.

Based on my propensity for keeping records of this sort, I had a reputation as a math-guy.

Also, we had county achievement tests in spelling, vocabulary, reading, and mathematics. The top finishers would get blue, red, or white ribbons, just as in track meets. I did well in mathematics so I gradually came to think of myself as being good at math and games.

Game playing was a big part of our family life, especially card games. My dad was an expert bridge player and I like to think I inherited some of his math genes. I think card games go a long way toward developing a sense of probability, and strategy, and memory. I remember when Liz (my wife) and I first dated, we played a few games of Rook with her family, but their interest wasn't really in winning so much as in seeing what would happen. They would make outrageous bids just for the fun of getting the bid, causing great laughter. I was considered a cut-throat player because I kept track of the cards that had been played and offered post-game analysis. I quickly learned that it wasn't in my best interest to play games with her relatives.

Q: What did your parents do for a living?

LL: My dad took a course in bookkeeping after graduating from eighth grade and worked at clerical jobs, ended up later working as a bank-teller in Chicago. But during the depression he moved back to Kansas and worked as a bookkeeper in his brother's lumberyard. Later he had an opportunity to buy his own lumber and hardware store, first in White City, Kansas, and later in Lindsborg, Kansas, where my brother and I attended high school and Bethany College. My mother had taught elementary school before she was married but then was a full-time mother and caretaker. My parents valued education and were determined their two boys would go to college. In some sense, my brother and I were their primary focus in life, and I'm increasingly grateful for their nurture and example.

My mother's first choice for me was that I should become a minister; my father's choice was that I would become an architect and take over the lumberyard. My brother was slated to become a doctor and he has had a long career as an anesthesiologist at the University of California Medical School in San Francisco.

Q: What did you do in college?

LL: I went to Bethany College in Lindsborg, and lived at home; tuition at that time was about $200 a term, but even at that, some of my high school friends felt it was too expensive and went to a state school instead. (One example was my best high school friend Robert E. Paulson, who got a degree at Kansas State University in nuclear physics and became a patent lawyer. He's written a lively and highly-recommended memoir, *Not in Kansas Anymore*, about growing up in Kansas, working in NYC, and living with ALS.)

Even though there were only about 250 students at the college, we were a bright and talented group and many in our class have kept in touch, though we've spread out all over the country. We had a traditional liberal arts education with lots of requirements: science, literature, art and music, history, philosophy and religion as well as chapel each day.

Mathematics as taught at a small college like Bethany was much different in those days. We started with a full year of algebra, analytical geometry, and trigonometry. We learned these subjects very well; our manipulation skills were far beyond what is now expected in this regard. This was followed by calculus and differential equations, but not much beyond that: teaching of math, history of math, theory of equations, elementary Euclidean geometry; very little theory and no proof-writing.

Q: Were any of your professors PhDs?

LL: There were only two PhDs on the faculty when I started Bethany, one in chemistry (he was the Dean) and one in English literature. There was only one math professor. She was a master teacher and I dedicated my first book to her. Most of our math majors were math-education students so the curriculum was designed mainly for them.

Q: What provoked you to go to graduate school?

LL: Well, in the spring of my sophomore year I applied for a summer internship in mathematics at the White Sands Proving Ground in New Mexico. Through some stroke of good fortune, I was accepted. There were eight students in the program, most of them from large technical universities. We lived together in barracks on the base and worked in the same building, the same floor in fact, as Wernher von Braun, the father of the German V-2 rocket, who had come with his team to White Sands. We went to classes and staff seminars given by senior mathematicians and did computational work that would now be done with a few strokes on a handheld calculator. Mostly, we were there to encourage us to consider a career in aerospace engineering. But the eight of us spent lots of time together: poker and chess in the evenings, camping, rock-climbing, hiking on the weekends. Among other things, we talked about our studies, exchanged our favorite math problems (e.g., the snowplow problem), talked about our math courses (I learned about group theory and topology and lots more) and our plans, and it kind of raised the bar for me. I joined the Library of Science Book Club partly because a membership included a free copy of Newman's four-volume classic, *The World of Mathematics*. That set of books glorified mathematics and mathematicians and I wanted to be part of it! I joined the MAA and looked forward to working on the problems from the *Monthly* and reading the solutions.

Q: Were you submitting solutions?

LL: Yeah, I did. I remember the first: it was pretty routine when I consider it now but at the time I felt very proud of having solved it, and began to think of myself as a mathematician.

Q: Did you ever take the Putnam?

LL: No, it wasn't given at Bethany, and I wouldn't have thought of it as a possibility. However, in my junior and senior year I participated in a statewide mathematics contest for students at the twenty-some small colleges in Kansas, and this also encouraged me to think about graduate school in mathematics.

Q: What was graduate school like?

LL: The first year was a nightmare. Most of us were from small colleges and our professors fresh out of Cal Tech had no idea how hopeless we were. All but two in our class (of 30+) were on probation after the first term. After the first year a lot of our class dropped out and became pilots or computer scientists or joined companies looking for math talent. The second year was better; the turning point for me was my year-long course in group theory taught by W. R. Scott who was then writing his classic book on the subject. Also, in the second year, the department posted a “Problem of the Week” and that brought me a lot of satisfaction and some recognition.

Q: When did you get married?

LL: In those days, it was common to get married right out of college (even right out of high school for those not going to college). Liz and I had known each other through high school and college but we were conservative and waited until after my first year of graduate school.

In the third year I wrote a 200-page technical Master's thesis in mathematical logic and considered transferring to a school where I could pursue this interest. But it was at precisely this time when I got a call from St. Olaf College, asking if I would be interested in joining their math department for a couple years. I knew nothing about St. Olaf but it seemed like a good time to take a break and consider what area to specialize in. So we took the offer.

Q: How did they know about you?

LL: The chair of the math department, Clarence Carlson, a lifetime Ole, wanted to hire a Lutheran. He must have called various Lutheran schools to ask if they knew of any math graduates in the pipeline, and the president of Bethany was a former St. Olaf English professor who knew of me.

Q: So what did you decide to study for your PhD work?

LL: We decided to return to Kansas where I could study commutative algebra. This decision was based partly on a conversation with Robert Fossum, a St. Olaf alum who was then Secretary of the AMS. He had suggested commutative algebra as a topic that might appeal to me and got me started with reading Zariski and Samuel. Because of my background in mathematical logic, my thesis direction was to find something in the area between logic and algebra. It took a full year of reading seminal works by Serre, Ax and Kochen, Kaplansky, Amitsur, Zariski, and many others, before I was able to formulate a question that seemed approachable. Once I was able to articulate the problem the rest was easy and a huge emotional release. I should add that no matter how discouraged I became with my prospects during this year, I could count on expository articles and problems from the *Monthly* to bolster my spirits.

Q: Did you have a job waiting for you at St. Olaf?

LL: I did. I had returned to graduate school on a scholarship from the Lutheran church on the condition that I would come back when I finished. While away, the department, and the college, and the times, had changed. For one thing, it was the late 1960s, but more locally, the new administration had undertaken a Centennial Study to envision a future for St. Olaf (Lynn Steen was one of the key members of this committee). The result of this report was to broaden the base of its influence from regional to national. The department had added four young dynamic PhD mathematicians: Dick Kleber, Lynn Steen, and Linda and Arthur Seebach (each of whom had done their undergraduate study at Lutheran colleges). Over the next few years the curriculum expanded to include pre-graduate school courses such as two terms of algebra from Herstein, advanced real analysis, and topology.

Figure 2 Paul Humke, Loren Larson, Ted Vessey, and Cliff Corzatt, Swedish Midsommer Celebration, 1980.

Q: Is that when the interest in majoring in mathematics at St. Olaf was starting to ramp up?

LL: Partially yes, but the real increase didn't happen for another five years. Because of Sputnik and the public interest in space exploration, students realized there were lots of jobs for math majors. For one thing, computers were just beginning to make an impact and a math major was a tacit prerequisite to a career in computer science. John Lewis from Harvard joined the faculty as our first computer director and he attracted a large number of students to our department. Steen and Seebach received NSF grants to do summer undergraduate research and their work resulted in a highly-acclaimed book *Counterexamples in Topology*. I was involved in four subsequent NSF-funded summer undergraduate research programs; most of these students became mathematicians and are teaching at colleges and universities across the nation. So our department grew and our influence spread nationally as Steen and Seebach became more involved with the MAA: Telegraphic Reviews for the *Monthly*, the editorship of *Mathematics Magazine*. A growing number of majors were choosing to go to graduate school to pursue careers in mathematics.

In the late 1970s we added a number of master teachers who reached those students who weren't being well-served by our pre-graduate-school curriculum. As a result of their leadership we changed the emphasis from teaching mathematics to teaching students, and this made all the difference (see Ted Vessey's interview for an account of this story). A large percentage of our first-year students enrolled in calculus, so the idea was that if we made these classes fun, they could be enticed to continue with linear algebra. After that, there was a good chance we could offer them attractive and meaningful courses regardless of their major. This philosophy of teaching, making it fun to be in the math department, resulted in a huge increase in the number of majors, from 25 per year to over 100, about 15% of the graduating class. And we continued to have students at the top end going to leading graduate schools.

Q: Your mathematical contributions are in the area of problem-solving rather than algebra. How did this happen?

LL: Initially I was determined to keep up-to-date in algebra and logic, and in my first years at St. Olaf I attended the weekly ring theory seminar at the University of Minnesota. But these sessions, led by Mel Hochster, were very advanced and required more time than I could spare. Furthermore it wasn't something I could share with students because of their limited background. I'm often bothered by undergraduate colleges that expect their math faculty to have a strong publication record to get tenured because for many PhD graduates, the term “publication” means something far beyond what they should be doing. They are paid to teach mathematics, not to do high-level mathematical research.

So I gave up on algebra research, acknowledging my own limitations as well as my students' best interests. Here is where the MAA made a huge difference for me. I enjoyed problem-solving of the sort featured in the MAA journals, and this was something I could share with students. It was a form of research that was acknowledged as worthwhile in our department, though of course it wouldn't have amounted to a thing at a research institution. So we formed a St. Olaf Problem-Solving Group and submitted solutions to problems under that name. The group included both students and faculty, but especially those students interested in taking the Putnam Exam, so we regularly worked on those problems as well.

Q: Tell us about being Problems Editor of *Math Magazine*.

LL: This was a huge job that took gobs of time: reading tons of proposals, corresponding with evaluators and posers, checking and editing solutions. After ten years I burned out, but I learned a lot about the problems literature.

Q: Tell us about working with the Putnam.

LL: It was my lifetime privilege to be associated with the Putnam and work with Jerry (Alexanderson) and Leonard (Klosinski), and to meet and work with so many mathematicians whose work I'd read and who generously and congenially served on the Questions Committee. I enjoyed every aspect of being part of the team.

I acted as the convener of the Questions Committee and was there to offer feedback on questions regarding problem selection: appropriateness (in subject matter, level of difficulty and ease of solution), originality, understandability, accessibility, attractiveness, gradability. I was deemed suitable for this task because of being at an undergraduate institution and because of my MAA-related experience with problems. Perhaps the hardest part of these sessions was editing the final statements and solutions so that everyone, regardless of language skill or background, could understand them. Then I would prepare the final draft and send it off for printing.

Q: Is there a secret for writing a good problem?

LL: If there is, I wish I knew it. A necessary condition, but insufficient, is an appreciation, and a compelling desire to think about it for long periods of time. Well, at least that's my experience, but then I think some of the people who served on the Questions Committee seemed to be able to come up with good problems out of the blue whenever we needed one at whatever level. I suppose it's like writing poetry or composing music: it seems easy for some, impossible for others.

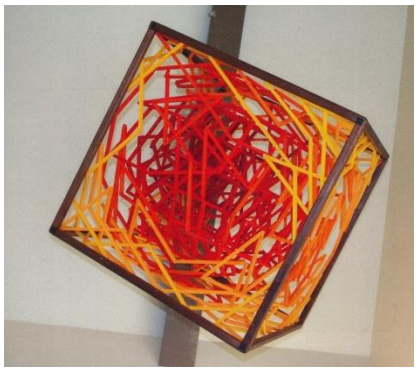

Figure 3 Wooden sculpture by Loren Larson depicting a three-dimensional knight's tour.

Also, of course, a lot depends on the context and what one means by a good problem. Some areas of mathematics just aren't amenable to short clever problems with sparkling high-octane solutions. One of the hard-won lessons I learned in my advisory role was that problems that seemed really good could backfire in the grading room. I remember a nice combinatorial identity which admitted a beautiful solution using a one-to-one correspondence. What happened was that many students worked on both sides of the identity and reduced it to a point where it followed (they claimed) by a well-known identity. Another example involved a nice game that admitted a clever analysis. That problem was a bear to grade – most everyone tried it which was fine, except many of these attempts came down to reading lots of cases which more often than not included an incomplete argument in one of the cases – hence, a lot of reading for nothing. There are good problems whose solutions are easy if you know the right advanced theorem, but wouldn't seem fair if the vast majority could not be expected to know of it. Each year I worried about whether the Committee would find original gems with snappy Putnam-like solutions, but they did! I have lots of favorites and when a fresh problem appears it's a lasting joy.

Q: So what interesting mathematical personalities, characters, people, stand out to you?

LL: There are so many that have made a big impression on me. In my first stint at St. Olaf I was drawn, in our weekly problems-seminars, to the strong personalities of O. E. Stanaitis from St. Olaf, John Dyer-Bennett and Sy Schuster from Carleton. Over the years our departments have attracted a lineup of interesting people, and I could go on about each. Lynn (the franchise) Steen and Mark (in haste) Krusemeyer stand out as paragons of excellence, each in his own way.

The duo of Jerry and Leonard from Santa Clara stand out, always inspirational and fun, loaded with mathematical gossip gleaned from their countless connections. I don't think Paul Halmos ever wrote an uninteresting sentence, and my times with him and Virgina were likewise unforgettably special. Talk about personality! They had it in spades – enthusiastic, good humored, generous, uplifting.

The Questions Committee members, who I refer to as the Putnam grandmasters, were extraordinary in different ways. Their personalities ran the gamut, from the commanding presence of Paul Sally and Mel Hochster to the more low-key demeanor of Richard Stanley and Abe Hillman. Gene Luks, with an encyclopedic memory for all things Putnam, could talk through problems on the fly, strategically breaking them down into manageable chunks ("thinking" as Paul Halmos would say, "like a mathematician"). These guys seemed invincible to me! But I was in awe of each of them: George Andrews, Hugh Montgomery, Fan Chung, Ian Richards, Harold Stark, Bruce Reznick, Stephen Krantz, and the list goes on. I was perhaps most impressed with those who could tick off dazzling problem ideas seemingly without effort: Michael Larson, George Gilbert, and Bjorn Poonen.

Bjorn is an interesting case: a four-year Putnam Fellow from Harvard with a Zen-like kindness. He was an undergraduate when I was *Magazine* Problems Editor. On the day of the deadline for submissions, I would receive a packet of solutions from Bjorn, all of them elegantly solved and beautifully presented in longhand, seemingly done the night before as though for a Putnam warmup session. If I had always chosen the best solution to feature in an issue, I would have chosen his for each problem, but that didn't seem fair to the other solvers. He once told me he liked my problem book, a compliment I'll never forget.

Q: How did you end up doing *The Inquisitive Problem Solver* with Richard Guy?

Figure 4 Louise and Richard Guy, 2007.

LL: I met Paul Vaderlind at the University of Stockholm in Sweden and he gave me a copy of his problems book. Because of my Swedish heritage, I was interested in learning Swedish and I thought translating his book would be a fun way to do it. I submitted the translation to the MAA and Richard Guy was on the selection committee and thought the book had potential. He recognized that the problems were interesting and that a good problem should suggest other good problems. So he offered to work with me to rewrite it and make it suitable for the MAA, keeping in mind that asking good questions is just as important to the progress of mathematics as answering questions. That became one of our main objectives; hence the title.

We worked on the book for a couple years, exchanging e-mails daily, and I often went to Calgary for a week or two at a time. These sessions with Richard were the best times of my mathematical life. We got up at 7:00, walked to his office a mile away, climbed the five flights of stairs to his office, and worked steadily all day without a lunch break. Time passed quickly and soon it was

5:00, and we'd walk back and Louise would have dinner ready. Then we'd clear the table and continue working (that is, playing) until 10:00. On the weekends Louise, Richard and I would go to the mountains for a full day of hiking (and he was well into his eighties). In the preface, Richard writes, “Have fun reading the book; we doubt if you'll have more fun than we did in writing it!”

Q: You were retired so you could work full time?

LL: I was working on two problem books and the Putnam, and I simply wanted to put all my energy into it.

It was a full-time commitment to keep up with George Gilbert, Mark Krusemeyer, Richard Guy, and members of the Questions Committee. This was a once-in-a-lifetime opportunity and a way to make use of my unique background. It seemed important to me to make these problems available to a wider readership and was a way to contribute to the MAA. In addition to this, I had also recently taken up fine woodworking as a hobby and I intended to make time for that.

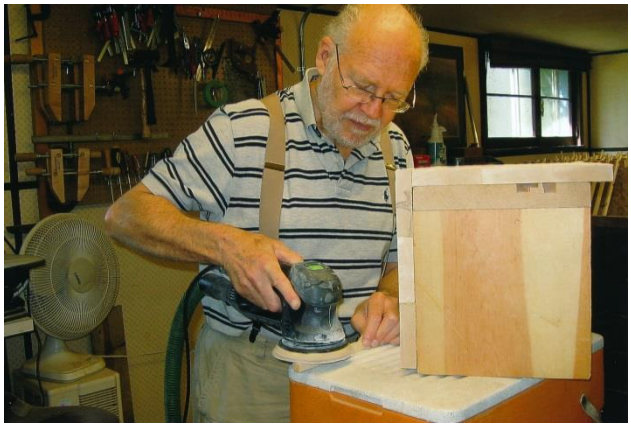

Figure 5 Loren Larson in his woodworking studio.

Q: Why woodworking?

LL: Through high school and college I worked as a carpenter building houses. A couple years before I retired, three old-growth trees fell in our yard and I had the wood milled into boards. I took a few lessons in woodworking and acquired a few necessary hand tools and power equipment. Part of the reason was that my children needed furniture and I was happy to respond by making beds, tables, chairs, bookcases, chests, cabinets, desks, whatever they needed. Then, as grandchildren arrived I made blocks and wooden puzzles for them. This hobby has grown to the point where woodworking is my passion in the way mathematics used to be. In fact, I now have a website (woodcraftedart.com) and sell crafts at local fairs. I like the challenge and precision that fine woodworking requires and the outlet it offers for creativity.

Q: Have you invented any puzzles or games?

LL: Yes, Richard and I invented a few for the book, and Barry Cipra has posed several problems that made great wooden puzzles. One of my sliding block puzzles has become an obsession because it suggests so many interesting problems I can't resist. (Note: A special case of this problem will soon be coming out as an APP for the iPad – it’s called Makey-Snakey.) All my puzzles have connections to mathematics and because most of them are accessible to school children, I bring them to class for them to play with and teach some mathematics at the same time.

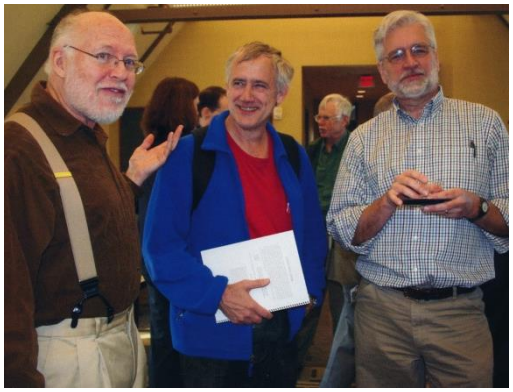

Figure 6 Loren Larson, Barry Cipra, and Paul Zorn.

Q: So, what's Liz think about your obsessions with mathematics and woodworking?

LL: She's gotten used to it and puts up with it. Fortunately, she also had an active life as a librarian with involvements in numerous community activities. Plus, she's an inveterate reader. But she keeps telling me, “Oh, it's so nice when you're just sitting here reading in the evenings. It's just nice to have you here.” I should add that our family has been the most important thing in our lives -- our children and inlaws and grandchildren. They are our world, there's nothing more to say.

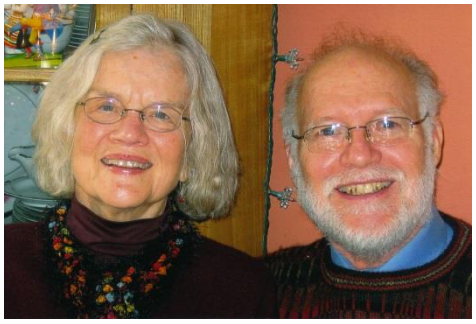

Figure 7 Liz and Loren Larson