

Guided by Serendipity: The Influence of Teachers on My Acoustics Career

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I feel fortunate to have been a part of the field of acoustics since 1997. I suspect that most people involved in any field for this long have had their journeys marked by unexpected twists and turns. My experience has certainly been nonlinear. When I think

back to the moments of serendipity that I have experienced, I think of the people who were there to advise and guide me along the way.

Most of my job responsibilities are in teaching introductory classes in physics, acoustics, and astronomy. Looking back as to how I got to this point, I see numerous examples where teachers guided me and influenced my decisions. These interactions seemed small and inconsequential when they took place, but with hindsight, I can now identify how serendipitous my exchanges with my teachers were to my life and career.

I can trace my path to acoustics back to my childhood. I remember for an elementary school project in Des Moines, Iowa, I chose to learn how electronic synthesizers worked. It was the 1980s, and all the music playing on the radio seemed to use electronic keyboards, synthesizers, and drum machines. I went to the library determined to learn how these devices worked so that I could explain it for my project. I am sure I did not understand most of what I found at the library. But I became more convinced that I wanted to have my own keyboard to play at home.

My parents insisted that I first learn to play the piano before they would consider getting me a keyboard. So I started taking piano lessons that lasted through high school. One of my first piano teachers was a music major at a nearby university. After a few months working on the mechanics of how to use each hand to play different parts of simple piano pieces, my teacher would include a few bits of music theory to explain why the notes on the

staff were organized the way they were. To her surprise, I was interested in learning what she was showing me!

In my first year of piano lessons as a fourth grader, I learned a small amount of music theory. It was likely just a fraction of what a college-level music theory class would cover. Looking back now, I see how serendipitous it was to be shown mathematical connections to the music that I could play and the music that I listened to. It was fortuitous for me that my teacher would explain music theory to a kid learning the piano. Looking back now, I am thankful that I paid attention and responded to these tangents to the main lesson.

That piano teacher was the first person who connected music with math for me. Soon after those lessons where we worked on the math of music theory, she would graduate from college and move away. I found other piano teachers, but none who integrated music theory with my piano playing as much as my first teacher. The mathematical connections to music came at a time in my life when science and math classes were starting to become my favorite subjects in school. I took as much math as I could through elementary and middle school.

After starting on the piano, I also had the opportunity in middle school to learn to play the saxophone. For a few

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years, the piano and saxophone were my main musical instruments. I have an older cousin who I have always looked up to, who was at that time an accomplished jazz trumpeter. I had a few opportunities to hear him perform while I was still learning the basics of these instruments.

By going to jazz concerts and listening to jazz albums, it was obvious to me that the rhythm section in the jazz band would be the most fun; the bass, piano, and drums rarely stop playing, unlike the winds where the players periodically take a break to catch their breath. A week after starting high school, I told the band director I wanted to play piano in the jazz band. The director, in turn, convinced me to play the bass drum in the marching band's drum line. After marching band, I went back to playing the saxophone in the concert band my freshman year of high school.

My decision to join the marching band a week into the school year meant that my class schedule had to be changed because bands met when I was scheduled to be in geometry class. The high-school counselors found another section of geometry that worked with my new schedule, although it was with a different teacher.

That teacher, Mr. Marter, must have recognized how much I liked math. Before the end of the year, he told me about a summer program at Iowa State University, Ames, for high-school students interested in math and science. I applied for that program and was accepted into it. That summer math program was my first introduction to mathematical modeling. We learned how to mathematically describe predator-prey interactions, the spread of viruses through a community, and the wonders of Conway's Game of Life (see playgameoflife.com). I had such a great time in this program that I applied and was accepted for a second summer the following year.

I never had Mr. Marter as a math teacher after my freshman year. However, during my last year of high school, I ran into him in the hallway. He asked if I had thought about what I might study in college. I said that although I wasn't certain about a major, I was leaning toward trying to major in mathematics based on my experiences in the summer math programs and math classes throughout high school. He suggested I should go the University of Northern Iowa (UNI), Cedar Falls, for their Science Symposium Scholarship competition.

This chance hallway encounter with my former math teacher was definitely a moment of serendipity for me. The conversation opened many opportunities for me that would shape my life in countless ways.

Mr. Marter pointed out that each STEM department at the university would be making scholarship awards, but the scholarship was for any STEM major the college offered, no matter which department a student competed in. He suggested there would be many students entering the math department's competition, but significantly fewer students trying for the physics department's scholarships. I agreed that it was a mathematically savvy choice to play the odds with a smaller pool of students to compete against.

On the day of the competition, Mr. Marter drove me nearly two hours to the university where I was given an hour-long test on various topics in physics. While the tests were scored, there were tours of all the physics research laboratories. One of the laboratories was an acoustics laboratory where I first met Peter Hoekje (see bit.ly/3WRNCWt). The laboratory had an anechoic chamber that had been constructed by previous students. There were also several projects on display, one of which was a demonstration of a thermoacoustic refrigerator. I was completely blown away that sound could be used to manipulate temperature! For me, this laboratory was the highlight of the tour.

I did well enough on the test to be invited for a scholarship interview after lunch. I don't recall much about that interview, other than Peter Hoekje helping me find the right words to express why I thought I liked physics more than the other sciences. At the end of the day, I placed third in the physics competition, which meant I had been awarded a small scholarship for the first two years of college.

By the end of the school year, I learned that one of the two people who had placed ahead of me in the competition had decided not to attend UNI, meaning that a full tuition scholarship was available to me. I accepted the scholarship and became a physics major that fall.

For some time in college, I tried to keep playing music a part of my life. I played in the marching and pep bands for two years in college. I was tired of carrying a bass

drum in marching band. Instead, I switched to the trombone, an instrument I learned in high school.

My freshman physics laboratories were in the afternoons. Band rehearsals were in the early evenings on the same days as physics. Carrying a trombone across campus, I would go from physics laboratory to the cafeteria for dinner and then to band rehearsal. One day, a physics laboratory partner kindly invited me to join her and her friends at the cafeteria. What I didn't know was that by accepting this invitation, I would meet the friend in that group, Renae, who I would marry five years later. I look back on that dinner invitation as one of the most serendipitous moments of my life! Had I not agreed to dinner, I may never have had the chance to meet my wife.

After a year of physics classes, Hoekje invited me to work on some projects in his acoustics laboratory. One of the first projects I was a part of was attempting to determine how much the vibrations of a trombone's bell contribute to the total sound radiation from the instrument. Part of this project involved a visit to Northern Illinois University (NIU), DeKalb, to use the TV-holography system in Thomas Rossing's (see bit.ly/3AkDbBX) laboratory. The project resulted in my first Acoustical Society of America (ASA) meeting presentation (see doi.org/10.1121/1.418711) in June 1997.

The visit to Rossing's laboratory was another instance of serendipity for me. I could see the possibilities of continuing to study acoustics. I was grateful that he would take me on as one of his graduate students in his laboratory, so less than a week after Renae and I were married, we moved to DeKalb so that I could start my PhD at NIU under Rossing's guidance.

While at NIU, I learned that all graduate students begin with knowledge gaps, often assumed to be purely academic. However, these gaps extend beyond missing coursework or unfamiliar academic content. For instance, I didn't understand how my graduate program's funding worked.

Early in my first year, a graduate student advisor informed me that the physics department would fund me as a teaching assistant for the five years needed to complete my degree. I did not know to apply for graduate fellowships until after being in graduate school for more than two years, meaning I missed the opportunity to apply. Although some graduate students might have

been frustrated by not securing a research assistantship, I saw the teaching assistant role as a chance to gain valuable classroom experience. It took years after graduating to realize how fortunate I was to have had that guaranteed support.

Being a teaching assistant for more than just a year provided me with unique opportunities that I otherwise wouldn't have had the chance to pursue. By the time I had finished graduate school, I had become manager of the university observatory, taught every introductory laboratory course, and had even taught sections of the introductory astronomy course.

Other smaller opportunities would also come my way, such as invitations from civic organizations such as local Rotary Clubs to give a presentation on something related to science. Once I was asked to teach a noncredit short course in astronomy for NIU's continuing education department. It was only a couple of sessions, but strangely, this course made me more nervous than the regular astronomy course I was teaching to college students. I decided to make the best presentation I could and do my best to disguise my nervousness. I am pretty sure that at least one person in the class could sense my anxiety because at the end of the last session, this attendee assured me that I was a "natural teacher" (her words) and that I should keep doing what I was doing. I don't know if I believe in the idea of a natural teacher, but I appreciated her encouragement.

While in graduate school, I was introduced to many gifted educators thanks to Rossing and his passion for physics and acoustics education. He brought me to many physics teacher meetings, including local physics teacher alliance meetings and section meetings of the American Association of Physics Teachers. Through these meetings, by listening to other teachers and asking questions, I came to see that meaningful teaching was more than just being a subject expert and explaining the topic to a room full of students. I became fascinated by the work done in the physics education research community. By learning from those who study how best to teach, I started to improve my teaching practices.

I can draw a straight line from these experiences in graduate school to my first academic job after graduate school to the current position in teaching physics and

astronomy at Joliet Junior College (JJC), Joliet, Illinois, a two-year college near Chicago. When I started at JJC, I proposed a general education course in musical acoustics. My main motivation for proposing the course was that I wanted to continue to teach a course that I loved. What I didn't know at the time was that the music department was starting a certificate program in music technology and that the allied health program was starting a degree program in diagnostic medical sonography. Both programs needed my course as a prerequisite; serendipity is everywhere!

For me, there have been many small moments of serendipity that have helped me get to where I am today. Sometimes, I can point to a specific person at a moment in time, like my first piano teacher or my high-school math teacher, who provided that nudge that would come to dramatically shape my career trajectory. In other cases, the interactions would be spread over longer time as in the case of being mentored by Tom Rossing.

When I look back, I'm struck by how I often did not recognize the serendipity in the moment when it occurred. The people in my life have given me many chances to grow personally and professionally. By choosing to say "yes" to new opportunities, these serendipitous events have shaped my journey in countless ways. I view many situations as opportunities for learning or growth. Although not every opportunity has borne fruit, I still approach challenges as opportunities and look later for the serendipity that resulted.

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