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From Elements to a Set

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My father, a high school teacher in my native China, had a childhood dream of becoming an electronic engineer. However, because the university entrance exams all across the country were cancelled during the Cultural Revolution, he did not have a chance to pursue that dream right after secondary school. Instead, he worked in his rural hometown as a farmer until 1977, when the college entrance exam system was restored. His interest in science and engineering was re-ignited as he prepared to take this life-changing exam in the following year. He spent a whole month's salary on a series of self-teaching books in math, physics and chemistry. Even though he studied these books very hard, he was assigned to the Ancient Chinese Culture major in college because his Chinese culture test score was higher than his math score. With regret, he put his math and science books aside. Later, he moved them to the top of a shelf in a neglected storage room.

One day during my summer vacation in 1994, when I was 10, my dad brought home a half-burned book from a used book market. The first half of this book, as well as its cover, were missing, but I could see colorful circles, triangles, and lines in it. I picked it up and browsed for a few pages but could not understand the terms inside, like "definition" and "proposition". I turned to my dad and asked him what the book was. He was not sure about the title of the book, but he suspected that it was a book from Euclid's *Elements*. He further told me that it covered a topic in mathematics called Euclidean geometry. I was so intrigued by the graphs and notations in it that I asked him to explain them to me in detail. In response, he magically fetched an old book from the top of a broken bookshelf in our storage room and passed it to me. The book was called *Teach Yourself Euclidean Geometry* and was one that he had used for his college entrance exam. He told me later that he was very excited at that moment, because he felt that he was passing his dream on

to the next generation.

So, my journey through the magical world of geometry began with my dad's guidance – he studied the book one chapter ahead of me and reminded me of the pitfalls and thorns he encountered in his study. At that time, I was spending weekdays during the school year living with my grandparents in a rural area five miles from my dad's house, but he visited me every week to discuss the theorems and exercises in that book. Every time he went to the provincial capital, he also brought back iced yogurt drinks and books for me, two delicious things for a little boy.

The hunger for knowledge that I inherited from my dad motivated me to read all the books on the top shelf, but I wasn't even tall enough to reach them. I finally persuaded my dad to give the bottom level of the bookshelf in our living room to me, so that I could reach all the books I wanted to read. That mahogany shelf, the only furniture we had then, carried my first collection of books, the ones I borrowed from my dad.

The first book of my own on that shelf came in 1997, when I was in junior high school. I came across Heinrich Dörrie and David Antin's *100 Great Problems of Elementary Mathematics* in the reference room of my school's library. Since it was in the reference room, I could not check it out. This book, in my eyes, brought the ultimate beauty of mathematics to a junior high school boy knowing only elementary mathematics, and I wanted a copy of my own. The idea of owning this masterpiece hovered in my brain for months. After failing to find it by searching the bookstore from top to bottom, and without knowing of the technology called photocopying, I decided to hand-copy that book to a new notebook. For one semester, I copied the whole text, replicated graphs, drew the cover picture, copied the preface, and even renumbered the content page. My book copying project finally added the first book of my own to my collection, the book I hand-copied!

The effort I put into this awkward book copying project finally rewarded me five years later. In 2001, I won the first prize in a national mathematics olympiad. I solved one of the major

problems in that competition using a creative method derived from Problem 62 in that book. Even now, after eight years, I am still able to remember the number of that problem, since I went through every detail of that book by copying it. The award I got from the competition, a $\$100$ gift card to a bookstore, was soon converted into a dozen more books on mathematics for my collection. It was the first book that finally kick-started my personal collection.

In college, I became more fascinated with the idea of building my own collection of books. Although I chose mathematics as my undergraduate major, I soon became interested in computer science as well. But because of the lack of computer science courses in the mathematics department, I realized that teaching myself was the only possible way. The hunger for knowledge again occupied my mind and motivated me to read all the computer science books in the library. Upon graduation, I checked my library record: I had checked out 612 books, about 400 of them in the computer science section. However, the more I read, the more I understood that there was a large gap between the level of computer science development in China and the United States. Usually, books and papers covering advanced topics and new developments in computer science are only available in English. Thus, I started to read and collect these materials in English. I had to collect them myself instead of checking them out in the library because English books were only available for graduate students. Fortunately, the city of Nanjing, where my college was located, has the largest wholesale book marketplace in eastern China, and I could buy English books there at a very low price. Reading my collection of English books also improved my English language skills, and finally helped me win an offer from Washington University to study my beloved subject – artificial intelligence.

After I moved from China to the United States, my book collection continued to grow. Surrounded by English bookstores and with books from Amazon.com only one click away, I am finally able to feed my book addiction to my satisfaction. In the last three years, my book collection has grown from the one suitcase of books I brought with me from China to about two hundred

volumes. I now have more books than the small boy with his one shelf could ever have dreamed of owning. That half-burned copy of Euclid's *Elements* has grown into a vast set of books.

People with large collections of books are generally happy except when moving. I have to admit that moving books is painful, but can be inspirational. Recently, when moving to a new apartment, I happened to put D. Poole's *Computational Intelligence*, G. Pólya's *How to Solve It* and Kuhn's classic *The Structure of Scientific Revolution* next to each other in a box. When I unboxed them, I read the titles from left to right and realized that it was just like a conversation: given a computational intelligence problem, how to solve it? Using structure. A light bulb suddenly lit up in my brain – I could use structural information in one of my research problems. This idea derived from a random glimpse of my books finally became a research paper.

Recently, my girlfriend, who is a librarian, tried to categorize all of the books in our house using the Dewey Decimal System. She was surprised at how many books carried numbers in the 000s (computer science) and 500s (mathematics). I smiled and told her, it would be surprising if the result was not like this. My book collection defines me perfectly.

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