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Math and games

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If John Nash GS '50 is the phantom of Fine Hall, then his colleague John Horton Conway is the building's resident surrealist.

If students were to pass by the windows on the third floor of Fine Hall, they'd find Conway, who spends most of his day in the iconic mathematics building, playing children's games on a blackboard. Conway has pioneered a field known as recreational mathematics, a specialty that Conway said he believes is misnamed.

"My colleagues would not think a children's game is worthy of study. It is," Conway said. "In England we have an expression, to take the mickey out of something. This takes the mickey out of being a serious mathematician."

For as long as he could remember, Conway had a special proclivity for math. Though legend has it that he began reciting the powers of two when he was only four years old, Conway said his mother was simply exaggerating his childhood in Liverpool, England.

"I don't quite know what she means by it," Conway said. "It might just have meant one, two, four, eight. I'm not entirely sure I believe her, actually."

Regardless of how Conway's interest in math was first piqued, it was clear by the time he took a British high school placement exam at age 11 that he was gifted. But it wasn't only in math that he excelled. In his first year of secondary school, Conway placed in the top three in the entire school in every subject.

As he advanced academically, he shifted his attention to the sciences. By the last year or two of school, he had devoted himself to mathematics. But at age 14, he struck a low.

"Puberty sort of hit me, and my academic thing declined all over the place," Conway explained. "And then one of the teachers got hold of me. He told me I was being a fool for wasting my time. I listened."

After pulling himself out of what he described as the "trough in the graph" of his high school years, Conway took the entrance exam for Cambridge University just a few weeks before his 17th birthday. He first gained interest in recreational mathematics at Cambridge.

Conway said he most enjoys playing children's games, noting that legendary pastimes like chess and Go "emphasize historical and arbitrary aspects" too much. Conway first began thinking of games while he was a student at Cambridge. When he saw the British national Go champion play a game, he began to recognize that the board game was a compilation of other, simpler games.

"Adding games up led to the greatest discovery of my life," Conway said of his discovery of surreal numbers, a new category of numbers that encompasses real and infinite ordinal digits. "It was a whole new collection of numbers and something I've always been pleased about."

Following this realization, Conway wrote "Winning Ways for Your Mathematical Plays." The first volume of the book was so popular that its sales financed later volumes. In addition, he has co-written additional books on a variety of other subjects such as sphere packing and number theory.

"I must be dead, by the way," Conway noted, "because my first book, 'Regular Algebra and Finite Machines,' is about to be reprinted by Dover." Dover Publications is well known for reprinting classic works.

Conway stayed at Cambridge until 1985, when he experienced a "rejuvenating change." While at Princeton giving a colloquium lecture, he was on his way to Prospect House when he was surprised by a request.

"The then-chairman of the math department said, as we were going into lunch, 'I'd like to talk to you about your future,'" Conway explained. "I turned around to my wife, following behind, and I said, 'I think he's going to offer me a job. What do I do?'"

Conway rejected the offer initially but was persuaded to stay at Princeton for a year as a visiting professor and then reconsider the offer. Though he said that nothing specifically convinced him to stay, Conway pointed to a picture in his mind that pushed him to accept a teaching position at the University.

"My memory says, when I went back to Cambridge, I sort of thought, 'If you don't accept this job, you'll be doing for the next 30 years what you did for the last 30 years,'" Conway said. "That just seemed so deadening."

"I hadn't realized at the time just how good the mathematics department at Princeton was," Conway continued. "Before I came here, the really famous mathematicians, I wouldn't pay very much attention to which institution they came from. Harvard, Princeton, Chicago, Berkeley: They were all American as far as I was concerned."

When he arrived at Princeton, though, Conway said that he suddenly realized how many of those famed mathematicians taught at the University. Conway said that he doesn't actively consider the merits of the University at which he teaches.

“In a way, I don’t think about where I am,” Conway said. “I think about what I think about. You find me sitting here in this little alcove. It’s what I do. I just scribble, and every now and then I’m fortunate enough to discover something.”

At the moment, Conway “scribbles” on the facing blackboard filled with more shapes and drawings than numbers or figures. He said he likes to make students play a simplified but no less challenging version of the game ‘dots and boxes’ with him. Should the student beat Conway even once out of 10 attempts, the student wins entirely, Conway explained.

Max Rabinovich ’13 was a student of Conway two years ago. It was their interaction outside of class that helped Rabinovich get to know the professor better.

“[MAT 217: Honors Linear Algebra] was not very hard, so it wasn’t a good example of his brilliance,” Rabinovich explained. “I’d talk to him outside of class, for he likes to tell stories. He knows all these great figures in mathematics.”

Rabinovich described Conway as having a very specific view of any given subject in mathematics. This view, along with a great excitement, comes through in the way Conway teaches. Rabinovich shared a story that took place in another of Conway’s classes.

“He was saying that we call something epsilon and want to prove it’s small, but it can be whatever. It could be anything — 100, 10,000,” Rabinovich said. “He rushes out of the room, which is hard for him because he has a cane, slams the door and gets ready to open the door and yell, ‘Epsilon equals a million!’ but the door is locked. He wanted to be dramatic, but instead he locked himself out of the room.”

When students see this side of John Conway, they can see why he describes himself as “allergic to work.” Indeed, there’s a lot to Conway that his impressive mathematical record often overshadows.

“I’m a bit unusual in that most of my colleagues are great world experts in something,” Conway said. “I’m not a world expert in anything, but I do know a tremendous amount.”

For Conway, the desire to learn all he can is rooted in his interest in etymology. Conway said he learned a great deal about geology just by thinking passively about the names of geological eras. Another time, while on his regular walk home in the dark, Conway decided that he should learn the names not of constellations but of individual stars. Soon, he grew fond of guessing things like the phase of the moon or the number of petals on a flower and checking whether he had predicted correctly.

“Knowing what the moon looks like is very similar to ordering it to be that way,” Conway explained. “I’m not a power maniac, but it’s very funny. Knowing a lot of things does that.”

When asked how he can make mathematical discoveries, write books and still feed his other intellectual interests, he said this is how it has been for his entire life.

“I’ve been like it all my life. Part of it is by being old, which is not a good piece of advice. But also I’m not busy ... I’m working halftime now,” Conway said. He last taught in the spring of 2010. “And since I never did much work anyway and half of zero is zero, it hasn’t made much difference,” he added.

Conway’s description of his life makes his days seem remarkably run-of-the-mill. An insomniac, he often lies in bed for a few hours before getting up to go to Small World Coffee when it opens at 6:30 a.m.

“I sit there for ages,” Conway said. “I’m not going to tell you for how long. I do a Sudoku puzzle — my 10-year-old gave me a Sudoku calendar — I read the paper, then I come here.”

Though he said he does miss the lush gardens and the rich history of Cambridge, Conway has only briefly entertained the idea of returning — and only every now and then.

“We’re remarkably free here,” Conway said of his position at Princeton. “Nobody tells me off for playing games. In fact, I’ve made playing games be serious.”

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