Paul Erdős's centenary celebration

Turning 100 might have seemed unremarkable to the Hungarian-born mathematician.

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Paul Erdős was the most prolific mathematician in history.

I take issue with the celebration of Paul Erdős' 100th birthday (he was born 26 March 2013).

Not the celebration itself, but the number. Why 100? The number 100 was chosen, of course, because 10 is the base unit of our number system: We have 10 unique symbols (0-9) that can be combined to represent any conceivable number. Ten units of 10 is 100, so it's a nice, neat factor. If we used a base 12 system, we would have 12 unique symbols, and we'd be celebrating anniversaries of 144 years. But I can't find any particular significance about 100 for Erdős.

Erdős was born in 1913 in Hungary to Jewish parents, both mathematics teachers. He moved to Manchester, England, in 1934 for a post-doctoral appointment, but also spent time (unofficially) working in London, Cambridge and Bristol — establishing a trend of bouncing from institute to institute that would continue for the rest of his life. Erdős did not return to Hungary until 1945, after Soviet troops liberated Budapest from the Nazis. Throughout his life he spent time living in the US, Israel and Britain, and visited Hungary often. But he had no permanent residence. He lectured, taught and worked at dozens of universities, but never held a permanent position at any of them. He died in 1996 of a heart attack while attending a conference in Warsaw.

Next year will mark Erdős's 101st birthday, which would be better than celebrating his 100th birthday, because 101 is a prime number. You can't divide 101 by anything but 1 and itself and still get a whole number (where 100 is the product of 2 x 2 x 5 x 5). Erdős once told his biographer, Paul Hoffman, in a somewhat beautiful and somewhat sad sentiment that prime numbers were his best friends.

A large portion of Erdős's work involved prime numbers. The first significant theorem he ever proved, at age 17, stated that between any number and its double, there is at least one prime number. The Russian mathematical giant Pafnuty Chebyshev had already proved this theorem, called Bertrand's conjecture, 80 years earlier, but Erdős proof was simpler and clearer. Erdős later did a similar job of simplifying the prime number theorem, which reveals how prime numbers will be distributed. Close to zero, prime numbers are common: 2,3,5,7, et cetera. As one climbs higher and higher, however, prime numbers occur more infrequently. (The prime number theorem doesn't show how to find those numbers, which are infinitely abundant. The largest known prime number is $2^{57,885,161} - 1$, which has over 17.4 million digits).

Reducing proofs and theorems to their "elementary" state was a particular talent of Erdős'. He once wrote a simpler proof of a theorem in a paper he was supposed to be refereeing. Erdős believed that "the Supreme Fascist" (God) kept a book of mathematical proofs in their most perfect, simplified states, and it was the task of mathematicians to transcribe the pages from this book.

In some respects, zero was a rather significant number for Erdős. Along with his peripatetic proclivity, he never married, never had children, never bought a home and never had a regular job or very much money. Instead he traveled, carrying all his worldly possessions in two suitcases, making a temporary home with collaborators. This lifestyle took him throughout the US and Europe. At last count, he published papers with 511 people.

Erdős' terrible behavior as a house guest is legendary: opening a carton of tomato juice by cutting a hole in it and not bothering to clean up the mess; banging pots and pans at 4:30 in the morning to wake everyone so they could continue their work.

Despite his obnoxious behavior, Erdős was usually welcomed back, and remained friends with most of the people he visited. Reportedly, he was a radiantly happy person, a delightful collaborator, and had a gift for getting people to do mathematics to the best

of their capabilities. In fact, a more fitting celebration for Erdős might be December 26, 2039, or 1,521 months after his birth: 1,521 is the total number of papers he collaborated on, which is more than any other mathematician in history.

Erdős — who had a lifelong affair with caffeine, and later amphetamines — regularly worked 20 hours a day. Into his 70s, Erdős was publishing more papers per year than many good mathematicians publish during their lifetimes. During a short break he had taken from amphetamines to prove he wasn't addicted, Erdős noted a drop in his productivity, and proclaimed that mathematics had been set back a month.

This tremendous volume of work, spread out over various disciplines and all over the world, has left the mathematician with a very fitting legacy: the Erdős number.

By the simplest definition, a person's Erdős Number is their degree of separation from Erdős via a published paper. If you collaborated with him on a paper, your Erdős number is 1. If you're a co-author with someone who was a co-author with Erdős, you get a 2, and so on. Only Erdős' has 0 as an Erdős number. If you have no collaborative connection, your Erdős number is infinite. As time has gone on the highest reported Erdős number has increased: from 8 in 2000 to 15 in 2013.

Other versions demand that publications may only have two authors in order to be counted toward an Erdős number. There is an Erdős-Bacon number that sums a person's Erdős number with their Bacon number: a degree-of-separation value based on the same postulate but applied to a person's film connection to actor Kevin Bacon (some players allow non-film connections). The first recorded source noting the idea of counting degrees of separation from Erdős was in a mathematics paper published in 1969 by a colleague. The Erdős Number Project, founded by Jerrold Grossman and Patrick Ion, and hosted by Oakland University in Michigan, started in 1995 and is the most extensive resource on Erdős's publications and Erdős numbers.

Erdős numbers have no actual consequence — it's a game. And like most games, it pops up, I've found, between classes, over drinks at meetings and during work breaks. Paul Erdős believed that mathematics was a collaborative activity, and the Erdős number, perhaps unintentionally, reflects that. It brings people together; gives them something to share. Sometimes when a great scientist dies, he or she is remembered with a statue, an institute, a street name or a school, but Erdős has been immortalized with something highly unique: a game derived from his work, and reflecting his collaborative spirit.

(Research for this article was largely based on Paul Hoffman's book on Erdős, The Man Who Loved Only Numbers.)

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