'Principia Mathematica' Celebrates 100 Years

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NPR's Robert Siegel talks to math writer Julie Rehmeyer about the 100th anniversary of *Principia Mathematica*, a landmark work in mathematical logic. Written by Alfred North Whitehead and Bertrand Russell, it was their attempt to show that all of mathematics could be reduced to logic. Rehmeyer writes regular columns for *Science News* and *Wired Magazine*.

ROBERT SIEGEL, host:

One hundred years ago this month, Cambridge University Press in England published a book that lost money, that according to one of its two co-authors was probably read in full by only six people, but that influenced the thinking of people who influenced the thinking of other people, who influenced the thinking of still others, and so on and so forth.

It was volume one of Bertrand Russell and Alfred North Whitehead's "Principia Mathematica." Two more volumes of the work would follow.

I am deeply in over my head in these mathematical and philosophical waters, but Im hoping that Julie Rehmeyer can swim through them a bit. She writes about math for Science News and for Wired. And she joins us now from Berkeley, California. Welcome to the program once again.

Ms. JULIE REHMEYER (Science Writer, ScienceNews.org and "Wired" Magazine): Thank you, delighted to be here.

SIEGEL: And first, describe for us what Bertrand Russell and Alfred North Whitehead were trying to show in this book that in 1910.

Ms. REHMEYER: They were really trying to rescue math from a deep crisis of foundations. Mathematicians had found some surprising results that led them to realize they needed to be a whole lot more careful than they had been previously.

So, Russell and Whitehead set out to show that math really boiled down to logic and to define at the very most basic level what mathematics was, and to show then that all of math was logical consequences from some very, very simple principles.

SIEGEL: Even if the math they were describing involved things that we didn't see in everyday life and that seemed to...

Ms. REHMEYER: That's exactly right.

SIEGEL: ...violate common sense.

Ms. REHMEYER: That's exactly right. And in particular, what mathematicians had found that they were responding to was that they had discovered non-Euclidean geometries, which are kind of whole different universes of geometry that are mathematically consistent but utterly non-intuitive and not at all what we experienced in the everyday world.

SIEGEL: Where two parallel lines might in fact meet at some point.

Ms. REHMEYER: Well, one version is where two parallel lines might in fact meet, and another version is where there are lots of different parallel lines through one point.

SIEGEL: That is a measure of their rigor that Ive read, which is how long it took them in this work to prove that one plus one equals two.

Ms. REHMEYER: Indeed. It took them well into Volume 2.

(Soundbite of laughter)

Ms. REHMEYER: Eighty pages into Volume 2. And when they proved it, they have this wonderful little note after it that says: The above proposition is occasionally useful.

(Soundbite of laughter)

SIEGEL: Now, how influential was this work, or was it simply a big deal for 1910 and subsequent years but forgotten long after?

Ms. REHMEYER: Well, it certainly has not been forgotten. It's been very influential. But the interesting thing is it's been influential in a kind of unexpected and, in some ways, sort of tragic way.

The book kind of laid the seeds for its own undoing. About 20 years later, a German mathematician named Kurt Godel used what Russell and Whitehead had done in the Principia to show that it actually couldn't do what it aimed to do, that

it couldn't contain all of math, that there would be true mathematical statements that were not logical consequences of the axioms that it set out.

And that really, it was completely shocking, and it completely transformed our understanding of what math fundamentally is.

So the interesting thing about it is, on the one hand, it kind of destroyed the whole project, and on the other hand, Godel couldn't have come to that conclusion without the work of the Principia. So it kind of ate its own tail in a funny way.

And in a certain way, at this point, one of the biggest contributions of the book is that it laid the groundwork for computation, even though that was not in Russell or Whitehead's mind at all. Computers had barely been conceived of at that point.

CONAN: But you mean the project of writing code for computers?

Ms. REHMEYER: That's exactly right because the Principia is getting rid of all of the ambiguities of natural language, you know, English language. And part of the reason that so few people have read is that it's almost all symbols. It's really almost impossible to read. It's like sitting down and reading a computer program.

So that process of turning mathematics essentially into code is exactly what ultimately needs to be done to build computers. And it had a huge influence on the design of computers that lasts till this day.

SIEGEL: For us baby boomers who remember Bertrand Russell as largely a political dissident of the 1950s, this is actually what he was famous for, is a mathematician, yes?

Ms. REHMEYER: Oh, yeah, absolutely, absolutely. Though, you know, his political work I think grew out of his mathematical views in many ways. He saw logic as being fundamental to everything, and his political beliefs I think grew out of that in many ways.

SIEGEL: Thank you, Julie.

Ms. REHMEYER: Thank you. This was fun.

SIEGEL: Julie Rehmeyer writes about mathematics for Wired Magazine and Science News. She spoke to us from Berkeley, California.

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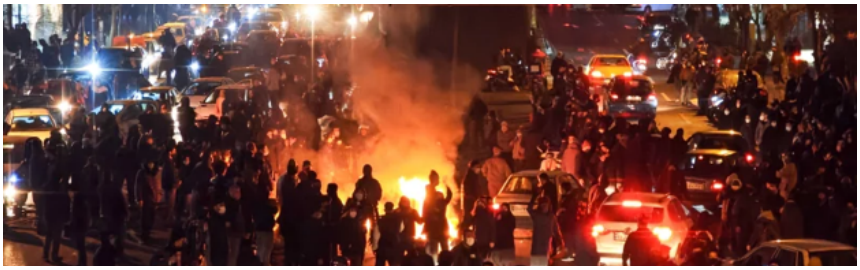

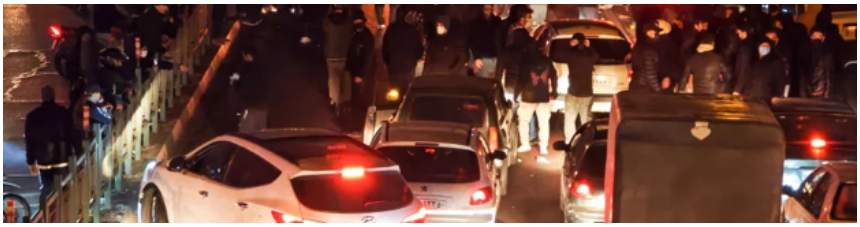

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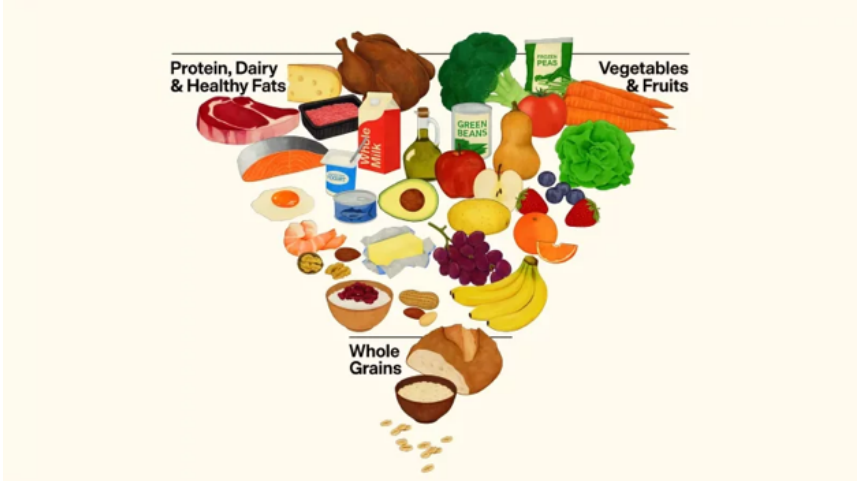

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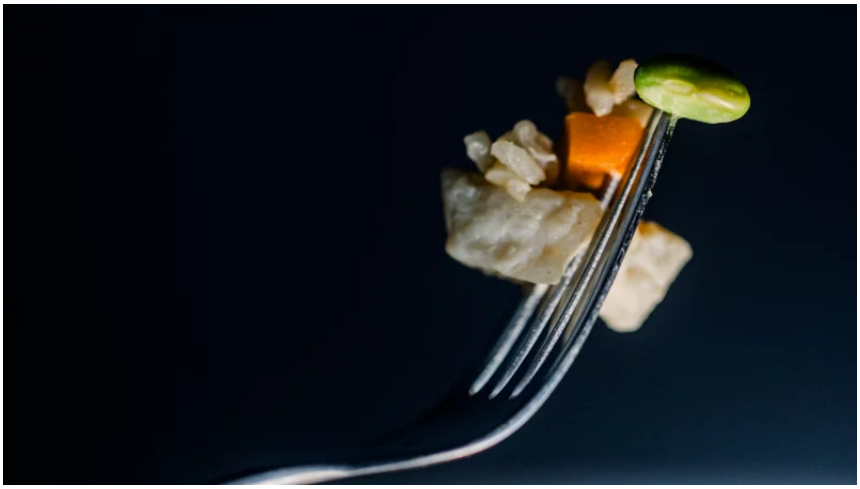

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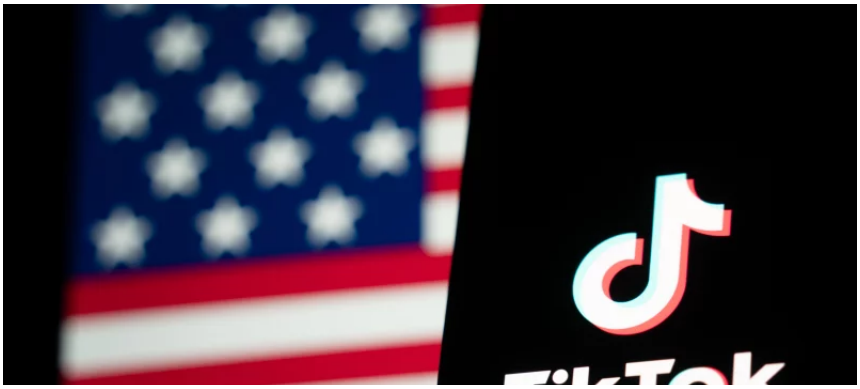

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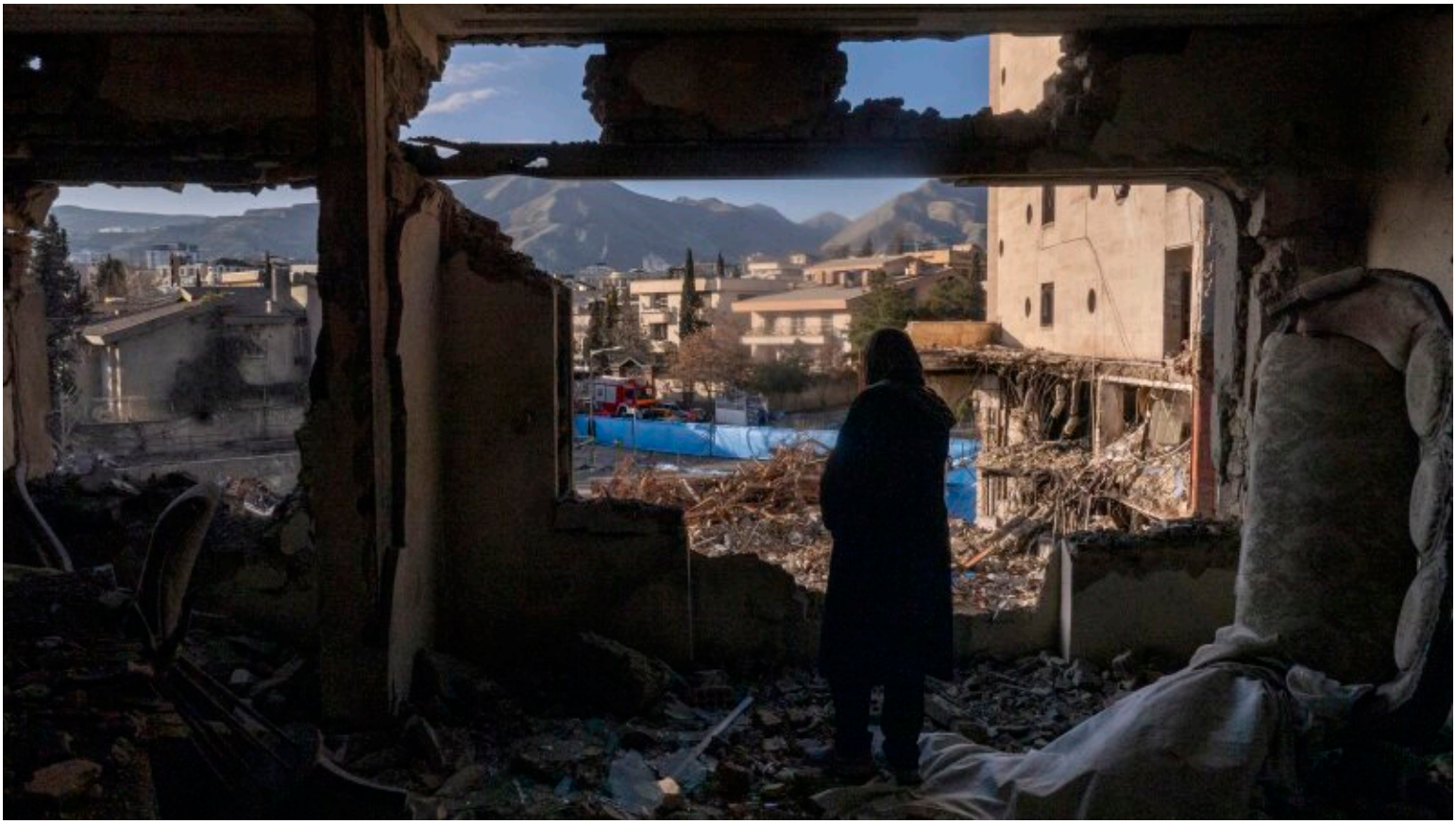

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