Obituary

René Thom (1923–2002)

When I first met René Thom, in 1970, he was already a legend in mathematics. There were many stories about him, which were reverently passed around. It was said, for instance, that his thesis adviser, back in the early 1950s, was concerned that he could not get Thom to write satisfactory mathematical proofs; another eminent mathematician told the adviser not to worry — there are ten people in the world, he said, who can prove these theorems once they have been stated, but only Thom can state them.

Indeed, Thom's own lectures gave some credence to such tales. He was a geometrician; he saw things in his mind and would try to impart his vision with all the means at his disposal, whether they were pictures on the blackboard or analogies from other sciences. In French mathematics, he was unique in this respect. There was general agreement at the time that serious mathematicians were in the business of devising proofs, not explaining them. The meaning of a theorem should be worked out from its formal proof. With Thom, it was the other way around. He showed why things were true, or should be true, and left his audience to work out the proofs.

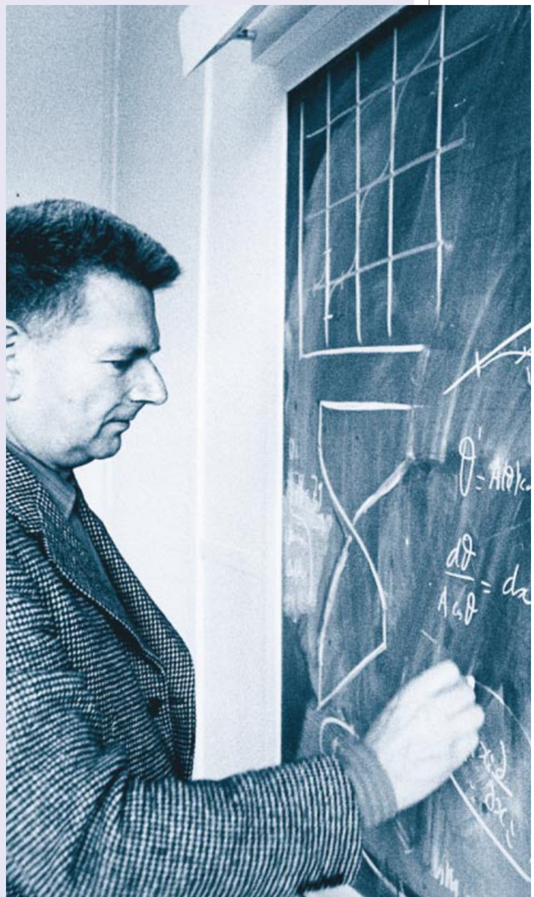
Thom's research had much the same character: he inspired others, such as Bernard Malgrange or John Mather, to prove deep theorems that he alone, at the time, believed could be true. His own work has also deeply influenced modern mathematics. In 1958, he won the Fields medal — the equivalent in mathematics of the Nobel prize — for his early contributions to geometry.

But his most important work was still to come. I will try to explain it as Thom might have done, starting with the central idea from which everything else naturally grows. Thom asked, what is general, and what is singular? What does it mean for something to be ordinary, and when can we say that something is exceptional? An obvious answer to that question comes through probability theory: an event is general if there is a high probability that it will occur. We can say, for instance, that, in general, two straight lines in a plane will intersect: there is only one case in which they don't — when they are parallel. Similarly, two straight lines in three-dimensional space will, in general, not intersect.

Unfortunately, this probability analogy is too simple for many mathematical situations, but this was Thom's achievement: he defined precisely what it means for a property to hold in general (he called such properties 'generic'). He devised a useful tool to check whether a given property is generic, known as Thom's transversality theorem (it sounds even better in French), and it is one of the workhorses of modern mathematics. Instead of looking for properties that are always true, now mathematicians very often try to find properties that hold in general, that are generic.

But Thom did not stop there. If a situation is exceptional, one may still ask how exceptional it is. To answer that question, a classification of singularities is needed, starting from the most frequent ones and working up to the less frequent (and presumably more complicated) ones. This was an enormous programme of research, and only a mind such as Thom's could have conceived it. The mathematics is difficult, and much of the work was done by John Mather. But it was successfully carried through for some particular cases, notably in the study of mappings between spaces of different dimensions, and the results are incredibly beautiful.

Mathematician who devised 'catastrophe theory'



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Thom called the first seven singularities the 'elementary catastrophes', and for a while pictures of the first three (the fold, the cusp and the swallowtail, which exist in three or fewer dimensions) were to be seen in many newspapers and magazines. Some claim that the hype was overdone, but the fact is that the underlying mathematics is very profound, and it is no mean achievement that Thom shared his vision with so many people who had no training in advanced mathematics.

The usefulness of this 'catastrophe theory', as Thom saw it, was in biology, in particular for morphogenesis — the generation of form and structure in an organism. At the time, it was not as fashionable for a mathematician to work on this kind of problem as it is now, but Thom went where his thoughts guided him. The sudden popularity of catastrophe theory took him down paths not usually trod by mathematicians, taking part (and holding his own) in numerous debates on science and philosophy. He also discovered a gift for writing, which he exercised frequently, sometimes to the chagrin of his opponents.

From his PhD studies in Strasbourg in the early 1950s, Thom's career had taken him to Princeton, then back to France, to a position at Grenoble and a chair at Strasbourg. In 1961 he took up a professorship at the new Institut des Hautes Etudes Scientifiques, at Bures-sur-Yvette near Paris, where he remained until his retirement in 1988. He died on 25 October after a long illness, through which his family was a constant support.

Thom was not an aloof character, and he did not crave power. He built his career on his own merits. He was always accessible, always ready to listen. René Thom changed mathematics, just as a great painter changes our view of landscapes, and his vision is his legacy. But for those of us who knew him, there was more to it. This is best expressed by Heraclitus, in a sentence that Thom himself was fond of quoting: "The master whose oracle is in Delphi neither reveals nor hides, but gives hints."

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