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IFOUGHI NEW IDEAS ON BUSINESS AND CREATIVITY

SAGE OF DISCOVERY

The London Institute for Mathematical Sciences is at the forefront of a new way of doing scientific research in the UK. Physicist and founder Thomas Fink is a man on a mathematical mission

 $\frac{z}{N}P(x) + -U_{\overline{Q}}(N,C+1) - \frac{x}{N}U_{\overline{Q}}(1)$

n a Georgian townhouse in the heart of London's Mayfair, Thomas Fink is talking about the beauty of physics. "The skill as a physicist is to see a mathematical pattern or structure and to realise that Then later on, 'How about some teaching? And by it goes deep down and emerges somewhere else," he the way, could you help us apply for this research says. "So you use fundamental mathematics to unify grant?" You end up doing less of what you are two things that were thought to be different. It's a very creative process.'

The fortysomething Fink's own career offers a case me. And that was how this place got going." in point. How to unify the son of a smalltown Texan family, none of whose members had previously gone the non-profit Institute is now housed in five storeys to university (or even owned a passport) with this dapper, metropolitan academic who's in the process of overturning the way physics and mathematics research is done in Britain? As founder and director of the London Institute for Mathematical Sciences. Fink has established an alternative to the age-old university research model. Funded by grants and donations, the Institute allows scientists to do what they do best, without distraction.

Fink knows university life well, having blazed a trail of distinction from Caltech to Cambridge to the École Normale Supérieure in Paris, and he knows funding from British Research Councils. Previously the downsides for those who want to direct all of their energy into research.

"You start off really excited about understanding something that hasn't been understood before," he says. "It's an incredibly thrilling thing, like exploring a part of the world that hasn't been seen. Imagine that! So that's your PhD and maybe your first

postdoc. But quickly there are other demands made on your time. 'Can you get involved in this committee?' 'We need you to help mark papers.' passionate about and good at, and more stuff that distracts you. That problem very much struck

Having started life in a single rented room in 2011, in a listed building belonging to posh homeware purveyor Thomas Goode. It was previously derelict and Fink was given permission to use it provided it was completely restored and refurbished. Its precipitous staircase gives it the air of an Oxbridge college, and there's a whiff of chalk dust in the air. As Fink puts it, "We don't do experiments - it's just theory. Pencil, paper and blackboards."

Last November, the Institute was officially recognised by the UK government as an Independent Research Organisation, allowing it to gualify for its money had come mainly from overseas sources. such as the European Commission and the US Defense Department. But now, says Fink, the Institute has "joined the Formula One team of research institutes in the country" and its increased status will allow it to attract more scientists. It's currently responsible for publishing between

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25 and 30 papers a year on a range of subjects within the fields of physics, maths and the theoretical sciences. Fink cheerily brandishes a list of what he considers the Institute's top ten papers, whose titles seem to vie with each other for abstruseness. The winner is possibly 'The complex dynamics of memristive circuits: analytical results and universal slow relaxation'.

"Wherever a problem can be understood more deeply using mathematics, then we're open to that," says Fink.

A recent paper that brought the Institute to Business Life attention was titled 'How much can we influence the rate of innovation?' It was co-authored by Fink and Martin Reeves, director of the Henderson Institute,

"The most satisfying way to live life is at the intersection of order and chaos"

a think tank set up by the Boston Consulting Group, which funded the paper's research and is a major backer of the Institute.

The study attempted to find a structure to the apparently chaotic field of technological innovation. To do this, it defined innovation as a process of combining different 'building blocks'. Fink gives as an example GPS, which is made up of three innovation building blocks: satellites, antennae and triangulation algorithms. And once those building blocks are put together, GPS itself becomes a building block to be combined with other technologies. Innovation comes from combining the blocks into both complex and simple products.

It's the sectors that display many simple products alongside more complex technologies that are most likely to grow quickly, according to the study, because access is easier for new disruptors. There are serious real-world implications to this, says Fink: "It shows that markets where the range of product complexity is widest are more accessible to 'lean' startups and companies in the developing world that have scarce resources."

The top floor of the building is home to LIMS Ventures, a startup incubator that allows the Institute's scientists to attempt to bring their discoveries to market. Current projects include a company using mathematics in personalised medicine and another using fractal mechanics to make lightweight structures. There's also a crowdfunding site, Kickscience, which allows donors to support the Institute's research projects.

In the ground floor hallway, the building's original floor tiles display what's known as a 'Penrose pattern', named after the British mathematician and physicist Roger Penrose. As Fink points out with some satisfaction, what's interesting about the pattern is that it can cover an infinite plane without repeating itself. Patterns and systems are what fascinate him. It's this fascination that first ignited his passion for maths and physics. And it has also led to a couple of unusual excursions during the course of his academic career.

The first came while he was working at the Cavendish Laboratory in Cambridge and by chance came across a newspaper report about a new way to tie a necktie. "I thought to myself. 'How do you systematise tying a tie knot?" he recalls. "Physicists



have looked at various kinds of knot theory and it's pretty complex."

So Fink sat down with a colleague, Yong Mao, to work out the mathematics of tie knots. They discovered 85 possible knots, of which only four were already known, and they wrote a fun paper about it, which was shared among their fellow physicists. Then

> Fink's PhD supervisor suggested submitting it to a journal, so he sent it to Nature and was surprised to find that they wanted to publish it. When they did, he had a bigger surprise in store. "If I'd won the Nobel Prize, I don't think I'd have had more attention," he laughs. "It started off with the local newspaper, then we got a call from the Telegraph then the New York Times I remember the Cambridge University press officer calling to say, 'I just want to warn you, your office is surrounded by television crews."

The paper subsequently became a book, he 85 Ways to Tie a Tiewhich has sold more than 200,000 copies. Following this success, Fink attempted to systematise the whole of male life in The Man's Book, a kind of taxonomy of everything relating to manhood, which sold 100.000 copiesGQ called it "compellingly brilliant". Fink says the book started out as an attempt to systematise his own life. "The nice thing about boiling something down to a system is that you don't have to think as much," he says. "It simplifies life."

But as Fink admits, not all of human life can be reduced to systems, no matter how beautiful its patterns and structures can sometimes seem.

"Some things are true or false, black or white, provable or not provable," he says. "But for other things, which can bring deep meaning to our lives, like friendship, kindness or love, system-building can be very destructive. Somehow it seems to me that the most satisfying way to live life is not in total chaos and not with total order - it's at the intersection of order and chaos. Some would say that's where life itself got started. And, as an organising principle for our own lives. I think that's the boundary we should try to find ourselves on most of all."

Interview by Tim Hulse. Photography by Wilde Fry More information: lims.ac.uk