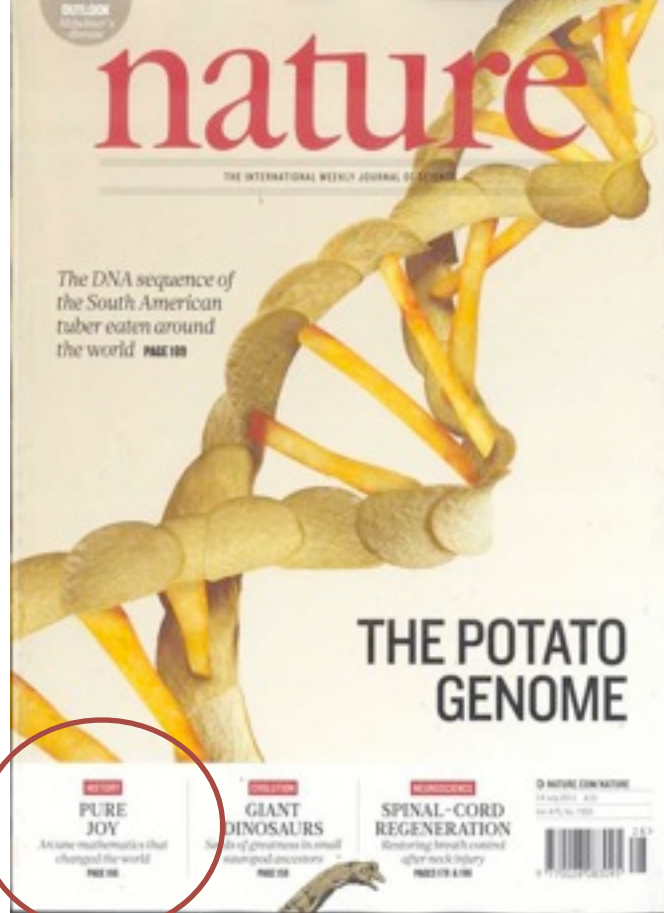


# Unplanned impact of mathematics

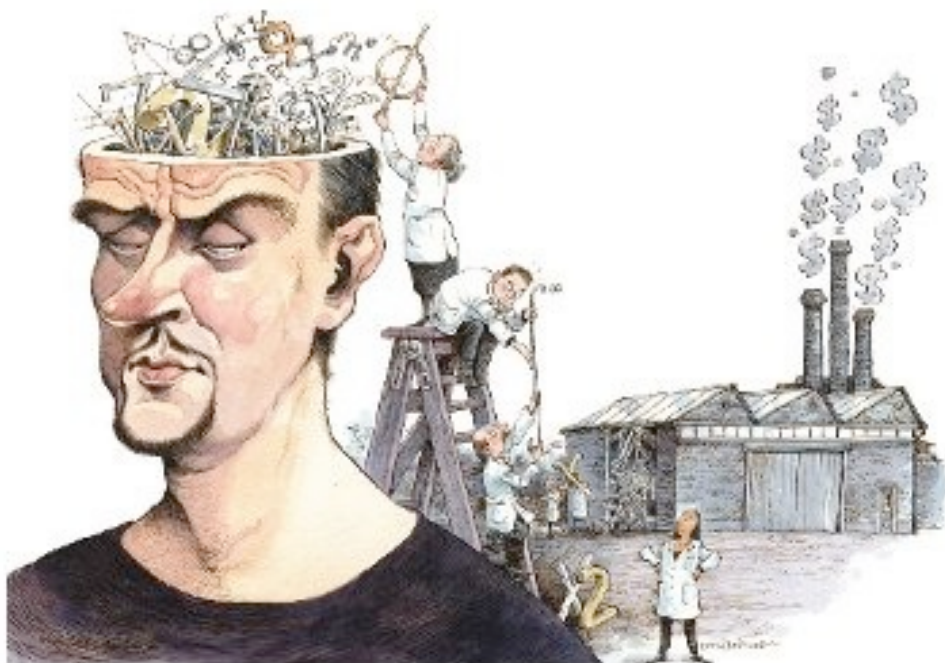
[bit.ly/unplannedimpact](http://bit.ly/unplannedimpact)

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COMMENT



## The unplanned impact of mathematics

Peter Rowlett introduces seven little-known tales illustrating that theoretical work may lead to practical applications, but it can't be forced and it can take centuries.

As a child, I read a joke about someone who invented the electric plug and had to wait for the invention of a socket to put it in. Who would invent something so useful without knowing what purpose it would serve? Mathematics often displays this astonishing quality. Trying to solve real-world problems, researchers often discover that the tool they need was developed years, decades or even centuries earlier by mathematicians with no prospect of, or care for, applicability. And the tool has to wait, because once a mathematical result is proven to the satisfaction of the discipline, it doesn't need to be re-evaluated in the light of new evidence or refined, unless

it contains a mistake. If it was true for Archimedes, then it is true today.

The mathematician develops topics that no one else can see any point in pursuing, or pushes ideas far into the abstract, well beyond where other would stop. Chatting with a colleague over tea about a set of problems that ask for the minimum number of stationary guards needed to keep under observation every point in an art gallery, I outlined the basic mathematics, noting that it only works on a two-dimensional floor plan and breaks down in three-dimensional situations, such as when the art gallery contains a mezzanine. "Ah," he said, "but if we move to 3D we can adapt..." This extension and abstraction

without apparent direction or purpose is fundamental to the discipline. Applicability is not the reason we work, and plenty that is not applicable contributes to the beauty and magnificence of our subject.

There has been pressure in recent years for researchers to predict the impact of their work before it is undertaken. Alan Thorpe, then a chair of Research Councils UK, was quoted by *The Times Higher Education* (22 October 2008) as saying: "We have to demonstrate to the taxpayer that this is an investment, and we do want researchers to think about what the impact of their work will be." The US National Science Foundation is similarly focused on broader

# Unplanned impact of mathematics

- Comment piece in Nature
- Organised on behalf of the British Society for the History of Mathematics

# Unplanned impact of mathematics

- Mark McCartney & Tony Mann (quaternions in computer vision & video games)
- Graham Hoare (Riemann geometry in relativity)
- Edmund Harriss (stacking oranges in modem channel coding)
- Juan Parrondo & Noel–Ann Bradshaw (Parrondo's paradox in epidemiology & finance)
- Peter Rowlett (law of large numbers in insurance)
- Julia Collins (knots in everything)

# Unexpectedly useful

- Me: “Trying to solve real-world problems, researchers often discover that the tools they need were developed years, decades or even centuries earlier by mathematicians with no prospect of, or care for, applicability.”

# Nature of mathematics research

- Me: “The mathematician develops topics that no one else can see any point in pursuing, or pushes ideas far into the abstract, well beyond where others would stop.”
- “extension and abstraction without apparent direction or purpose is fundamental to the discipline.”

# The funding problem

Tim Harford's Undercover Economist column in the FT



# Tim refers to

- “Peter Rowlett, a maths educator and historian”

# The funding problem

- Tim: “Academics are always being asked to demonstrate the ‘impact’ of their research. ... But while it is not unreasonable to ask whether a particular piece of academic research is useful, the difficulties in answering the question are extraordinary.”
- Gives examples – his own (imaginary numbers in electrical engineering); Caroline Series’ (non-Euclidian geometry & special relativity) and

# The funding problem

- Asks:
- “So are imaginary numbers typical of the unexpected bounties of pure mathematics – or an unrepresentative poster child?”

# The funding problem

- Me again, “There is no way to guarantee in advance what pure mathematics will later find application. We can only let the process of curiosity and abstraction take place, let mathematicians obsessively take results to their logical extremes, leaving relevance far behind, and wait to see which topics turn out to be extremely useful. If not, when the challenges of the future arrive, we won’t have the right piece of seemingly pointless mathematics to hand.”

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