

Can Science be more like Music?

The Re-imagining science project

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Biotechnology & Society Online Seminar Series



Image
courtesy
Alexandra Carr

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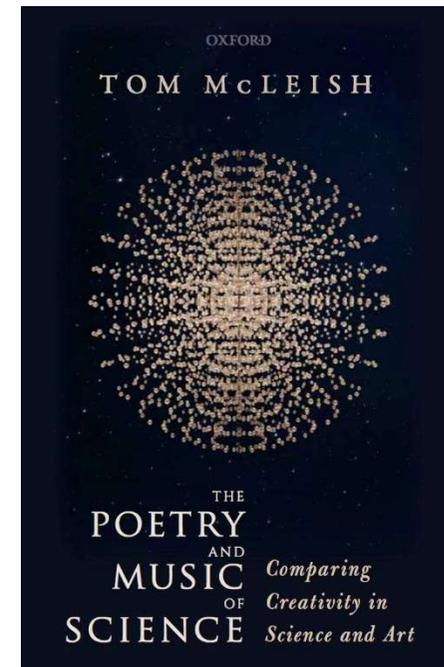
Reimagining Science

15 June 2021

"If science is considered a closed priesthood, too difficult and arcane for the average person to understand, the dangers of abuse are greater. But if science is a topic of general interest and concern—if both its delights and its social consequences are discussed regularly and competently in the schools, the press, and at the dinner table—we have greatly improved our prospects for learning how the world really is and for improving both it and us."

Carl Sagan. *Broca's Brain: Reflections on the Romance of Science*.

This programme is ambitious. The goal is to change people's narrative of and engagement with science. This applies to everyone, everywhere; from the people embedded at the heart of the scientific community to those who feel completely alienated by it. If Reimagining Science is successful, it will change how 'science' is written about, talked about and thought about. The hope is for people to enjoy and engage with science as with the arts or sport (and within sport more like football than polo).



The Real Reason for the Project ...

I didn't choose
science because it
isn't creative

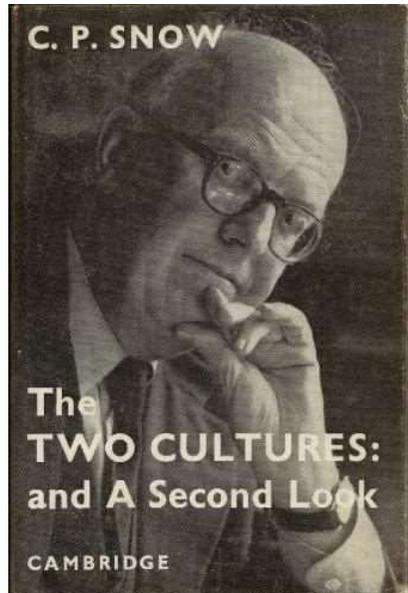


The RRI Reason for the Project ...

Science isn't
creative...
Or imaginative

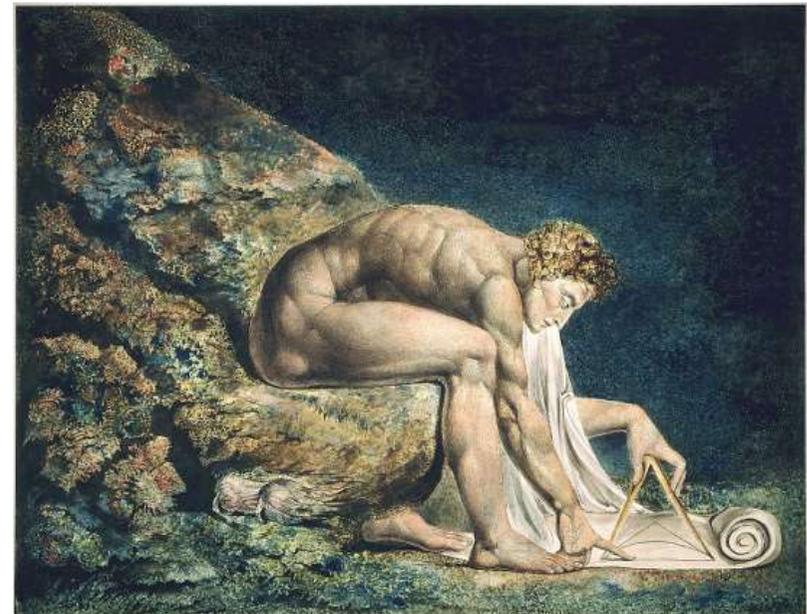


Shadows from Earlier Centuries



‘[My task is] in the grandeur of Inspiration to cast off Rational Demonstration ... to cast off Bacon, Locke and Newton’; ‘I will not Reason and Compare – my business is to create’

William Blake



The Creativity and Conflict Connection

The remotest discoveries of the Chemist, the Botanist, or Mineralogist, will be as proper objects of the Poet's art as any upon which it can be employed, if the time should ever come when these things shall be familiar to us, and the relations under which they are contemplated by the followers of these respective sciences shall be manifestly and palpably material to us as enjoying and suffering beings.

Wordsworth (1802)

‘the fumes of the laboratory, its alkalics and acids, the mechanical appliances of the observatory, its specula and its lenses, do not appear fitted for a place in the painted bowers of the Muses’ (1850).

Robert Hunt *Poetry of Science* (1848)

Science! true daughter of Old Time thou art!

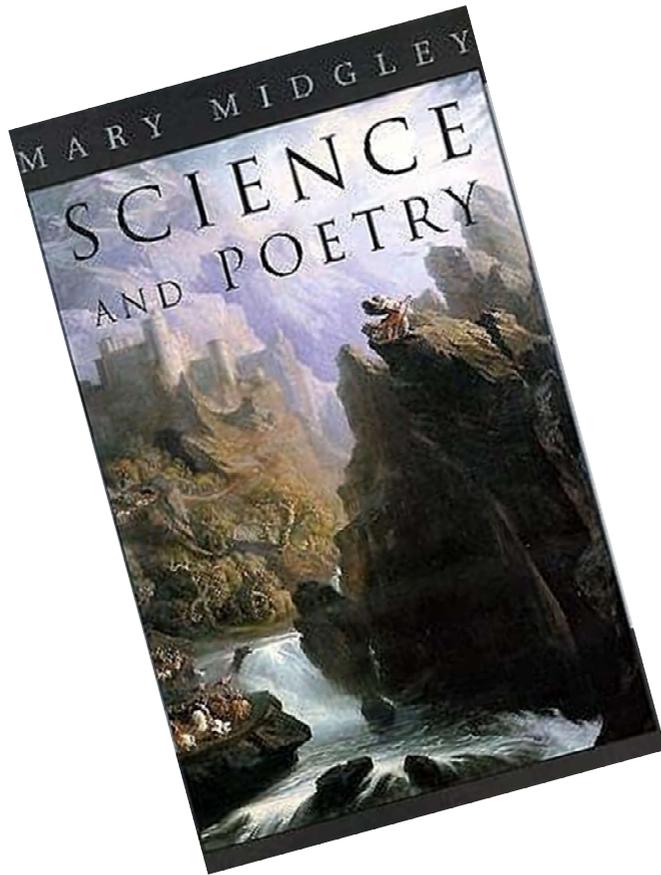
Who alterest all things with thy peering eyes.

Why preyest thou thus upon the poet's heart,

Vulture, whose wings are dull realities ..?

Edgar Allen Poe *Sonnet to Science* (1829)

Poetry-Science becomes the metaphor for the host of 19th century modern Dualisms



"SCIENCE IS THE
ONLY WAY WE
KNOW TO
UNDERSTAND
THE REAL WORLD:"

RICHARD DAWKINS

"TOOTHACHE IS
AS REAL AS TEETH"

MARY MIDGLEY

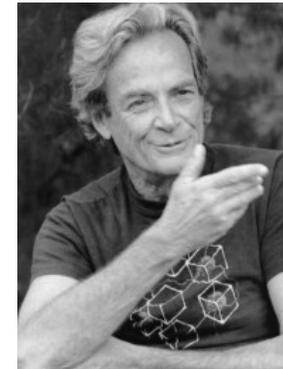
And yet – shared imagination...



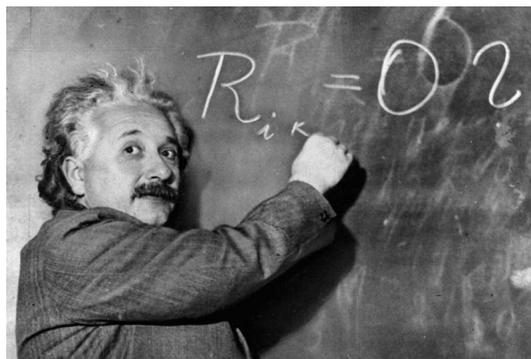
“Those who have learned to walk on the threshold of the unknown worlds, by means of that are commonly termed par excellence the exact sciences, may then with the fair white **wings of Imagination** hope to soar further into the unexplored amidst which we live”

Ada Lovelace

I could imagine the cells in there, the complicated actions inside, **which also have a beauty...**



Richard Feynman



Albert Einstein

Imagination is more important than knowledge.
Knowledge is limited. Imagination encircles the world.

And yet – shared sublime

Schubert can make time stand still. In the last, miraculous months of his life, he expanded his vision of what music could do. His most experimental work is the slow movement of his B flat Piano Sonata. It is as if he has distilled the process of music-making. He takes a harmonic progression, explores it, changes a single note, explores it again; he breaks down a simple melody until only the bones are left and the music is suspended. The result is a play of pure sound, without external reference, that gives us a glimpse of eternity.



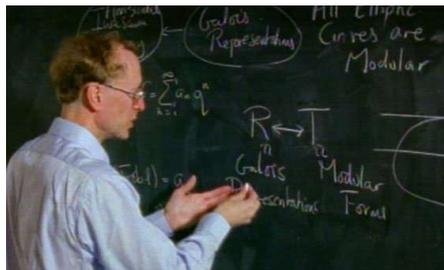
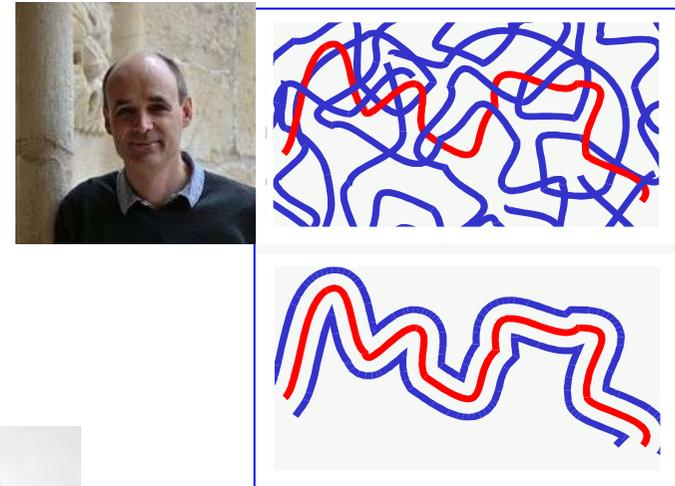
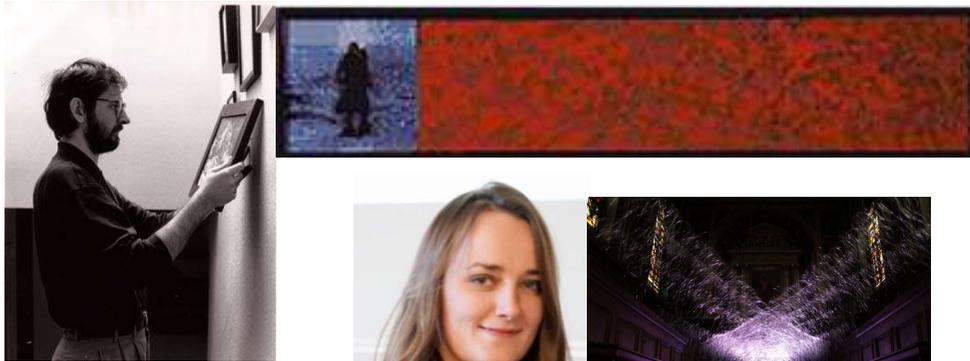
Simon Russel Beale

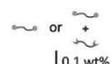
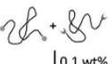
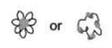
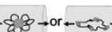


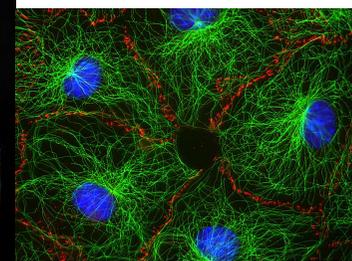
This 'shuddering before the beautiful', this incredible fact that a discovery motivated by a search after the beautiful in mathematics should find its exact replica in Nature, persuades me to say that beauty is that to which the human mind responds at its deepest and most profound.

S Chandrasekhar

Conversations on *Projects* in Art & Science



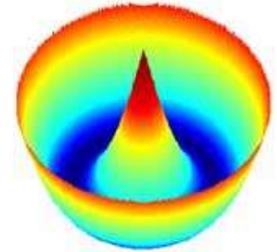
| Polymer type, Functional groups | Ultra-long, Random ($M_w > 1,000$ kg/mol) | Short, End-functionalized ($M_w < 50$ kg/mol) | Long, End-functionalized ($M_w > 400$ kg/mol) |
|---------------------------------|--|--|---|
| |  ↓ 0.1 wt% |  ↓ 0.1 wt% |  ↓ 0.1 wt% |
| AI rest. |  |  |  |
| Flow |  |  |  |



Commonalities (1): A 'Creation Narrative'



- An initial **vision** of object or phenomenon
- A **desire** to represent / understand it
- A series of attempts to **create** such a representation
- The experience of **constraint** and failure
- Spontaneous upwelling of an idea from the **sub-conscious**
- An **aesthetic** and emotional response to success



Desire

There's also a sense of freedom. I was so obsessed with this problem that I was thinking about it all the time – when I woke up in the morning, when I went to sleep and night. And that went on for eight years.

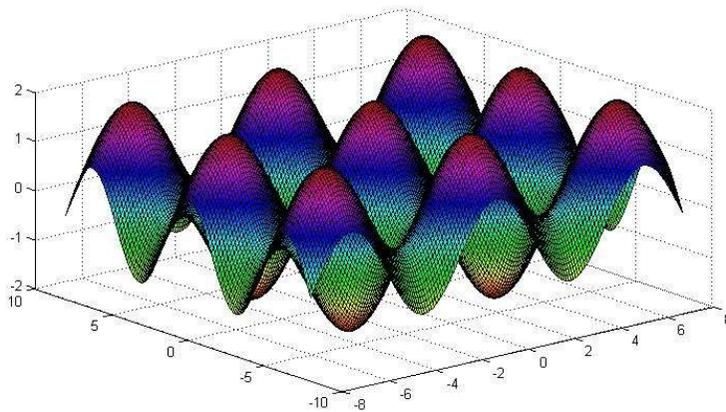


Andrew Wiles

Creative Role of the non-Conscious Mind

I was on a train in January 1985 in Germany, and it was so cold that there was ice inside the windows. I had some insight about the connection between quantum mechanics and chaos and was working this out, suddenly it popped into my head that this is all relevant to the Riemann Zeta function, and I remember the exact moment it happened. Of course, I was prepared, because I had read an article about it 8 years before, but I hadn't thought about it since, I don't know how it happened. It wasn't visual.

Michael Berry



The Art of the Novel

Henry James:

The seeking fabulist's discoveries are, like those of the navigator, the chemist, the biologist, scarce more than alert recognitions... **Ideation**

My business was to watch [the subject's] turns as the fond parent watches a child perched for its first riding lesson ... for developments' **Observation**

The fruit of such **incubation** depends 'immensely on the general turn of the mind capable of it, and on the fact that its loyal entertainer, cultivating fondly its possible relations and extensions... is terribly at the mercy of his mind.'

The quest is for the subject as a whole by 'matching' ... the big piece with the snippet **Illumination**

The luxury of this aesthetic is greatest 'when we feel the surface, like the thick ice of the skater's pond, bear without cracking the strongest pressure we throw on it.' **Verification and the constraint of form**

The Art of Scientific Investigation

William Beveridge:

‘attitude of mind of being constantly on the look-out for the unexpected’.

...**Ideation**

..as many extraneous influences as possible are eliminated and close observation is possible so that the relationships between phenomena can be revealed **Incubation**

‘the conjuring up of the idea is not a deliberate, voluntary act. It is something that happens to us rather than something we do.’ **Illumination**

Verification and the constraint of form ..He wished to learn as much as possible from an experiment so he did not confine himself to observing the single point to which the experiment was directed, and his power of seeing a number of things was wonderful ... *quoting Darwin’s son on his father*

‘... Science too has dual characteristics. It has a logical, objective, cool, and rational or rigorous face – the aspect of the finished product that appears in manuals and is presented to the public in conventions and conferences... The other face is fantastic, subjective, individualistic, intuitive, and lively, and reflects the *process by which the new is created*. It is a process based on perception and *inspiration*, obviously supported by an acute mind. Scientists can use their imagination to *grope forward, in a desperate struggle* of trial and error, *seeking out the secrets* of the universe. If by chance they find a solution and their efforts are rewarded, then they can be *truly happy*: that rarely happens. This is the *creative process which is the essence of science*.’

Leo Esaki (1956), Nobel Prize for electron tunnelling

Commonalities (2) : 3 Creative Modes

- The *visual* in art and scientific imagination
- The *textual* in poetry, metaphor, the novel and scientific experiment
- The *abstract* in music and mathematics

1. Visual Imagination

*The elements [of productive thought] are, in my case, of **visual** and some of muscular type. Conventional words or other signs have to be sought for laboriously only in a secondary stage, when the mentioned associative play is sufficiently established and can be reproduced at will.*



In the ancient sense of the word ‘theory’ – the studied impression of a formal, frequently religious, event by experienced onlookers, the painting offers a perfect ‘theory’ of nature at that moment and place.

On Monet’s The Pines

2: The Textual (1): Fictional Literature and Experimental Science

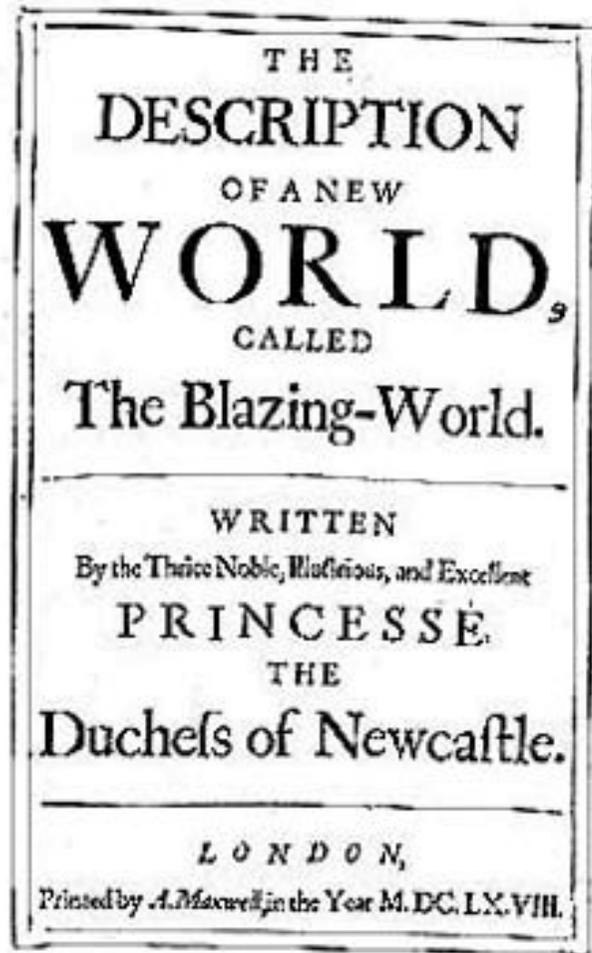
Works of fiction resemble those machines which we contrive to illustrate the principles of philosophy, such as globes and orreries.

Joseph Priestly *Warrington Academy Lecture* 1761

Novelistic writing [enables an attention to] the inexhaustible detail of the world, the endlessness of the task of understanding ... and the apprehension of the unique.

Iris Murdoch *Existentialists and Mystics* 1998

The Problem with Experiment – in a Novel



But these telescopes caused more differences and divisions amongst than ever they had before ...

Margaret Cavendish *Blazing World* 1668

From 'Reading' to 'Writing' Nature

The World is a Great Book, not so much of Nature as of the God of Nature, ... crowded with instructive Lessons, if we had but the Skill, and would take the Pains, to extract and pick the out: the Creatures are the true Aegyptian Hieroglyphicks, that under the rude form of Birds, and Beasts etc. conceal the mysterious secrets of Knowledge and of Piety.'

Occasional Reflections [Robert Boyle](#)

Science being a publick blessing to mankind ought to be extended and made as difusiv as possible, and should, as the Scripture sayes of sacred knowledge, spread over the whole earth as the waters cover the sea'

Complete English Gentleman [Daniel Defoe](#)

2: The Textual (2): Poetry & Theoretical Science

Poetry may be especially fitted as a medium for helping us apprehend something of the mystery in that phrase 'the Word made Flesh.'

Malcolm Guite *Faith Hope and Poetry* 2012

Science describes accurately from outside, poetry describes accurately from inside. Science explicates, poetry implicates. Both celebrate what they describe. We need the languages of both science and poetry to save us from merely stockpiling endless "information" that fails to inform our ignorance or our irresponsibility..

Ursula Le Guin *Late in the Day (Poems)* 2016

Words like 'mind' and 'body' ... come out of the same underlying world-visions which also emerge both in poetry and science.

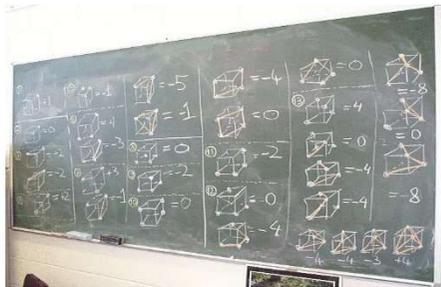
Mary Midgley *Science and Poetry* 2001

3. The Abstract: Mathematics and Music

What is the cause then, among the thousand products of our unconscious activity, some are called to pass the threshold, while others remain below? Is it a simple chance which confers this privilege?

Evidently not; among all the stimuli of our senses, for example, only the most intense fix our attention, unless it has been drawn to them by other causes. More generally the privileged unconscious phenomena, those susceptible of becoming conscious, are *those which, directly or indirectly, affect most profoundly our emotional sensibility.*

Henri Poincaré



‘... the allegory of mathematics which is music’
George Steiner

‘What distinguishes composers of the first rank is their ability to set up strategic problems (of harmony) and to solve them.’

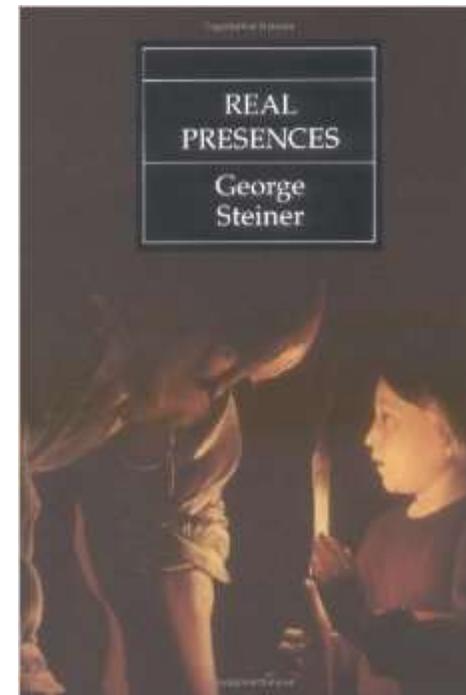
Julian Horton (Durham)



3. The Abstract: Mathematics and Music

G Steiner: *“the wager on the meaning of meaning ... when we come face to face with the text and work of art or music ... is a wager on transcendence.”*

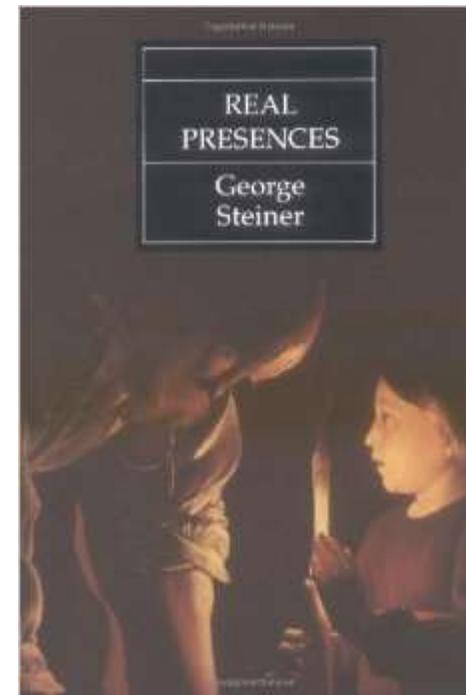
Real Presences



What's it all *for*? – befriending matter

G Steiner: *“Only art can go some way towards making accessible, towards waking into some measure of communicability, the sheer inhuman otherness of matter...”*

Real Presences

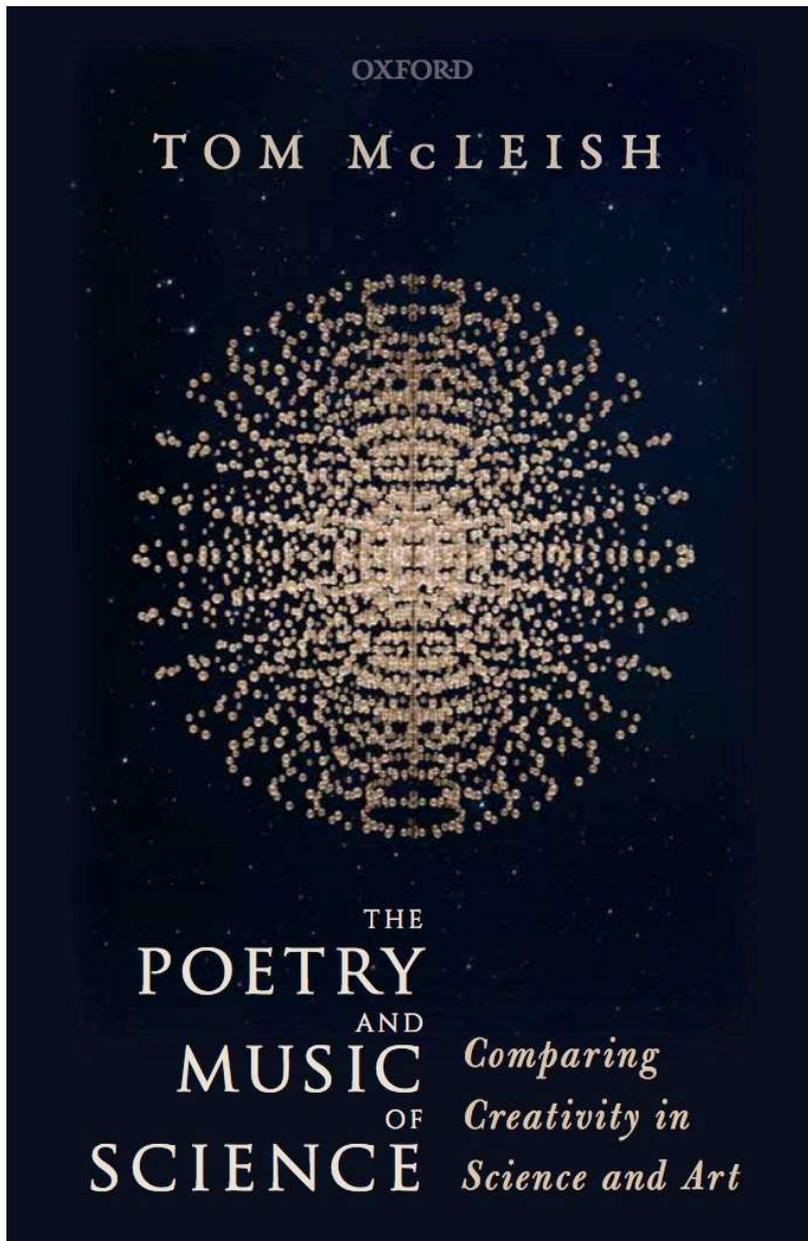


How do we get better at being more creative as scientists?

- Travel by bus a lot
- Go for walks
- Get enough sleep
- Assume 'Juno' orbits
- Get varied mind-food



- Do other stuff than science
- Talk with different people
- Write about it – even when you don't know what 'it' is



How does this change our work, communication, mission?

Q&A and Responses

Image courtesy Alexandra Carr