HPS&ST Newsletter
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Introduction

The HPS&ST Newsletter is sent monthly to about 11,000 emails of individuals who directly or indirectly have an interest in the contribution of history and philosophy of science to theoretical, curricular and pedagogical issues in science teaching, and/or interests in the promotion of innovative, engaging and effective teaching of the history and philosophy of science. The newsletter

is sent on to different international and national HPS lists and international and national science teaching lists. In print or electronic form, it has been published for 40+ years.

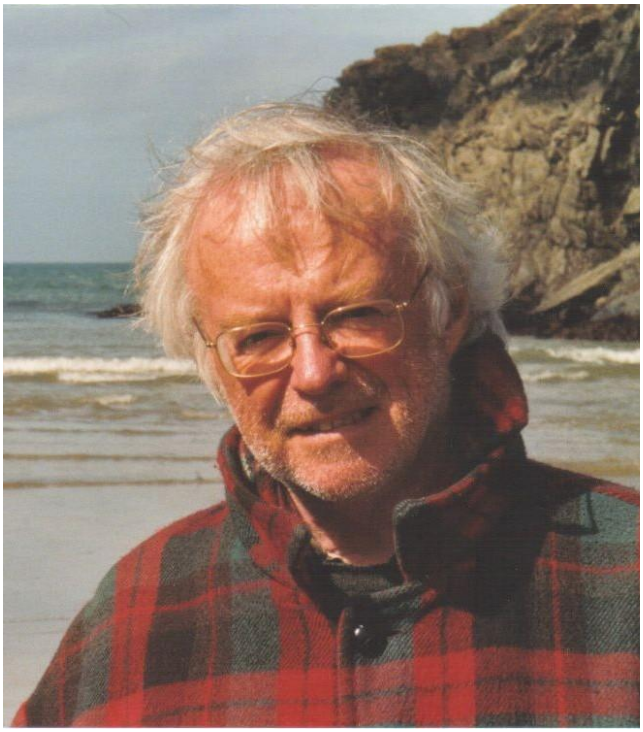
The Newsletter, along with RESOURCES, OBITUARIES, OPINION PIECES and more, are lodged at the website: HERE

The newsletter seeks to serve the diverse international community of HPS&ST scholars and teachers by disseminating information about events and publications that connect to concerns of the HPS&ST community.

Contributions (publications, conferences, Opinion7Piece, etc.) are welcome and should be sent direct to the editor: Michael R. Matthews, UNSW, **m.matthews@unsw.edu.au** .

Nicholas Maxwell (1937-2025)

Nicholas Maxwell (3 July 1937-11 January 2025) was a philosopher who has devoted much of his working life to arguing that there is an urgent need to bring about a revolution in academia so that it seeks and promotes wisdom and not just knowledge.



Nicholas studied philosophy at Manchester University, where he obtained a BA in 1963, and an MA in 1965, and where he taught philosophy of science for one year. For nearly thirty years he taught philosophy of science at University College London, where he became an Emeritus Reader. In 2003 he founded Friends of Wisdom, an international group of people sympathetic to the idea that academic inquiry should help humanity acquire more wisdom by rational means.

He has published fifteen books spelling out different aspects of the argument for an intellectual revolution, from knowledge to wisdom, and has contributed to over thirty other books. He has published over eighty papers in scientific and philosophical journals on problems that range from consciousness, value, and art to the rationality of science, simplicity, scientific realism, explanation, time and quantum theory. For elaborations, see HERE

In a personal reflection he wrote (HERE):

“I moved down to London from Manchester (where I had studied philosophy) and got a job as lecturer in philosophy of science in the Department of History of Philosophy of Science at University College London. Larry Laudan and Paul Feyerabend were among my departmental colleagues.

“I discovered the work of Karl Popper in the early 1960s, partly as a result of attending his seminars at the LSE, and I was immensely impressed. Here was a philosopher passionately concerned with profound, real problems of the real world which he tackled with fierce intellectual integrity and great originality.

“It was an exciting time and place to be doing history and philosophy of science (HPS). London felt like the HPS capital of the world. HPS seemed to be a fledgling academic discipline, having associated with it all the excitement, freshness, high aspirations and optimism of a new discipline.

“But then HPS fell into a sad decline and lost its way. Feyerabend argued for methodological anarchy, for the view that, in science, "anything goes". Barry Barnes and David Bloor. launched "the strong programme": science must be

understood in purely sociological terms, there being no such thing as scientific truth, fact, reason, method or progress. Something similar came from postmodernism, French philosophy, Foucault, Derrida and others.

"The upshot was a whole new way of construing science, which may be called "social constructivism". Scientific knowledge is merely a social construct, having nothing to do with knowledge, truth and falsity, or reason. Sociologists and historians of science took to social constructivism, while philosophers of science looked on in amazement and horror, at the idiocy of it. As a result, HPS broke asunder.

"The integrated enterprise, bringing together history and philosophy of science, which had started out with such high hopes and aspirations, and which was still alive and kicking when I began my academic career around 1965, was no more. The fundamental problem of History of Science - How has scientific progress come about? - could not even be asked. Then, as if matters were not bad enough already, Philosophy of Science began to degenerate into a kind of scholasticism that splintered into a multitude of specialized disciplines: philosophies of the specialized sciences - physics, chemistry, neuroscience, astronomy, botany, and so on.

As a result, Philosophy of Science lost sight of the magnificent endeavour of natural science as a whole, and came to ignore the great, fundamental problems that were, initially, the whole raison d'être for its existence: the problem of induction, the problem of the rationality of science, the problem of how, by what means, science makes progress.

"The upshot of the argument is that we need a revolution in academia, so that the basic aim becomes, not just knowledge, but rather wisdom - this understood to be the capacity, the active endeavour, and the desire, to achieve what is of value in life, for oneself and others."

Nicholas contributed a number of Opinion Pieces to the HPS&ST Newsletter:

"*Is Bad Philosophy Responsible for the Climate Crisis*?" HERE

"*The Metaphysics of Science and Aim-Oriented Empiricism*" HERE

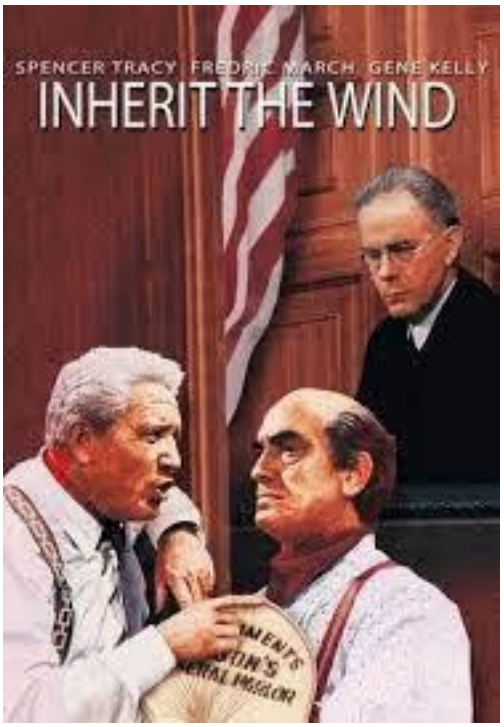
"*What's Wrong with HPS and What Needs be Done to Put it Right?*" HERE

"*The Crisis of Our Times, and What to Do about It*" HERE

The Scopes Trial at 100: Secularism, Race, and Education, 20-21 March 2025

The 2025 Boardman Symposium at the University of Pennsylvania, March 20–21, 2025
The **Kislak Center,** Van Pelt Library
3420 Walnut St., Philadelphia

Beginning with a welcome, film screening, and discussion of **Inherit the Wind** (1960) at 4pm on Thursday, March 20th.



In July of 1925, the eyes and ears of the US were on a county courthouse in the small Tennessee town of Dayton. One of the first true media spectacles of the twentieth century, the Scopes Trial of 1925 was a major turning point in national conversations around religion, science, education,

and mass media. Recent scholarship has also charted significant attention to the trial in the Black press; Black journalists saw in the trial a prism to better understand dynamics around race, religion, and power against the backdrop of the rise of the second Ku Klux Klan and complex debates around eugenics.

The legacy of the trial was largely defined by the 1955 play *Inherit the Wind* and Stanley Kramer's film version of 1960. *Inherit the Wind*, however, was not designed to be a faithful historical record of the trial. It recast the story as a morality tale for the McCarthy era—a free speech parable featuring an earnest teacher sallying forth against an unjust law, only to suffer a judicial backlash from small-minded rural Bible-thumpers. As Edward Larson has shown, this story significantly misrepresented the actual events of the trial and the complicated tangle of religion, science, history, politics, culture, and money at play.

A century later, many of the core issues surfaced by the Scopes Trial remain glaringly relevant. Battles over school curricula—not just around evolutionary biology but teaching about race, sex, and US history—are now common, making the Scopes Trial look like an early salvo in a long series of culture wars around education.

The most recent phase of the running battle over the teaching of evolution happened here in Pennsylvania in 2004, when the Dover Area School Board introduced a biology textbook advancing "intelligent design." Related disputes about the trustworthiness of bioscience (such as the anti-vax movement) have become a defining feature of the contemporary political landscape.

Debates about secularism—the proper role of religion in public life—have also escalated, with many scholars of religion now focusing attention on rising Christian nationalism in the US—often with a racial dimension. Cultural and political differences between urban and rural constituencies have become acute, leading to widespread alarm over the development of vastly different worldviews—and even disagreement about basic facts.

This 1.5–day workshop will examine the links between the Scopes Trial and our present cultural and religious moment a century later. Free in-person attendance. Online attendance options for Friday sessions also available.

Registration and Full Schedule: HERE

Speakers:

Adam Laats, "The Scopes Trial: The Start of America's Hundred-Year Culture War"
Edward Larson, "The Story of Scopes"
Charles McCrary, "Eugenics, Tech, and Christian Nationalism in 1925 and 2025"
Myrna Perez, "Christian Nationalism and the Afterlives of Scopes"
Shantá Robinson, "The Benefit of Time and Space: An Alternate Conclusion to 'A Crusader and an Advocate'"
Adam Shapiro, "'Scopes Wasn't the First': Nebraska, Tennessee, and the Invention of the Modern Evolution Trial"

2nd European Regional History Philosophy and Science Teaching Conference (IHPST)
27-29th June 2025, Athens, Greece

Deadline for Submissions: 20th March 2025

Conference theme: *Scientific Rationalism and Human Emancipation in Science Teaching: Perspectives from History, Philosophy and Sociology of Science*

Scientific rationalism, which emphasizes the importance of empirical evidence and logical reasoning, plays a crucial role in shaping educational practices that confront

misinformation, disinformation and pseudo-science, fostering critical thinking and inquiry-based learning. Science education goes beyond mere content delivery to engage students in critical discussions about the implications of scientific knowledge for society, incorporating ethical dimensions and social contexts through historical examples (Allchin, 2020) and finally aiming at critical scientific literacy.
We invite contributions from history and philosophy of science in science teaching that integrate scientific rationalism with a commitment to social justice and human emancipation, preparing students to engage critically with both scientific and societal challenges.

Plenary speakers

- Kostas Gavroglu (National and Kapodistrian University of Athens)
- Efthymios Nicolaidis (National Hellenic Research Foundation)

Please send proposals (500-900 words, including references) as an attached Word file to **ihpst2025athens@gmail.com** by March 20th, 2025.

Contact email: **ihpst2025athens@gmail.com**

For details: **https://ihpst2025.primedu.uoa.gr/**

Pragmatism and Measurement: New Directions, University of Pittsburgh 15-16 March, 2025

Location: Center for Philosophy of Science, Cathedral of Learning, University of Pittsburgh

Measurement is a central activity in the acquisition of scientific knowledge. With increasing attention to scientific practice, there is renewed interest determining what contributes to the reliability of measurement, its accuracy, and precision. The epistemology and metaphysics of measurement raise fundamental questions about the relationship between scientific theories and models, human actions, and the natural world. These include:

1. The representational and informational character of measurements (What do they measure?)
2. The evaluation of measurement outcomes (How should we assess the validity or reliability of a measurement process?)
3. The objectivity of measurements (How is the measurement process guided by theory? How is it independent? What are the implications for the status of measurement as evidence?)

This workshop will explore how a philosophically pragmatist epistemology and metaphysics addresses these questions, and how pragmatist frameworks might transform our understanding of the character and constituents of successful scientific measurement.

Confirmed Keynote Speakers:

Nancy Cartwright, UCSD and Durham
Hasok Chang, University of Cambridge
Eran Tal, McGill University

Registration & Information: HERE

Wilhelm & Else Heraeus Foundation Seminar, 1-6 June, 2025: The American and the German Atomic Bomb Projects and Their Legacies

This seminar will showcase new and important work on the German and the American atomic bomb projects and, by providing context and comparing the two cases, yield new insights and understanding of both these two very important historical events and their legacies for science, technology, politics, and culture.

The fear of a German atomic bomb drove the efforts by Americans, British and émigres to build the first American atomic bombs. The Soviet Union responded to the Manhattan Project and detonation of nuclear devices over the Japanese cities of Hiroshima and Nagasaki by creating their own atomic bomb. The American president Harry Truman reacted to the Soviet atomic bomb by ordering the development of an American hydrogen bomb, which led in turn to a Soviet hydrogen bomb and an escalating nuclear arms race. The postwar rivalry between the United

States and the Soviet Union also became a political competition for the "peaceful uses" of the atom, which in turn led to nuclear proliferation.

This has all had a profound influence on the development of physics in America and Germany and other developed countries as well. Both governments have sought to steer scientists and scientific institutions towards specific types of research through investments in grants, equipment, and certain types of research centers. By both comparing the German and American atomic bomb projects and placing them in context, this seminar will shed light on these weapons and their consequences.

Details **HERE**

Leeds Centre for History & Philosophy of Science. Visiting Speakers Programme

19 March (in-person)
Dr Silvia de Bianchi (University of Milan), "'The Dispute on Cosmological Time': Cosmology and Philosophy at Princeton"

30 April (online online)
Dr Stavros Ioannidis (University of Athens), Reconsidering the Structure of Darwin's 'Long Argument'

7 May (in-person)
Dr Charu Singh (University of Cambridge), Challenging the Tridosha: Elements, humors and an Ayurvedic controversy in British India, c.1935

Full details - including abstracts, venues and joining details for those seminars running online - can be found **HERE**:

James Stark
School of Philosophy, Religion and History of Science
University of Leeds
Leeds, LS2 9JT, UK

Web: https://ahc.leeds.ac.uk/staff/1160/professor-james-stark

Thomas Beddoes (1760-1808): Letters

Thomas Beddoes was the pioneering doctor and chemical researcher who in the 1790s established the Pneumatic Institution to conduct experimental treatments with oxygen, hydrocarbonate and nitrous oxide — using apparatus provided by James Watt. He also published on iron smelting, Huttonian geology, preventive medicine, revolutionary politics, and educational reform.

He was a poet, and the friend and mentor of Coleridge, Southey, Wordsworth, Humphry Davy and Thomas Wedgwood. Married to Anna Edgeworth, he corresponded with Richard Lovell Edgeworth and Maria Edgeworth, with Thomas Clarkson, James Black, Joseph Banks and the Duchess of Devonshire.

In anticipation of a full-scale book edition of his collected letters with Cambridge University Press, we are creating an online edition of unannotated transcriptions. The first tranche is available here.

Thomas Beddoes Letters

Tim Fulford
de Montford University
UK

Philsci Archive Top 5

The most downloaded preprints for the last six months:

Chen, Eddy Keming (2023) Laws of Physics.

Rushing, Bruce and Gomez-Lavin, Javier (2024) *Is the Scaling Hypothesis Falsifiable?*

Brown, Matthew J. (2020) *Science and Moral Imagination: A New Ideal for Values in Science.* Science, Values, and the Public . University of Pittsburgh Press. ISBN 9780822946267

Ardourel, Vincent and Bangu, Sorin (2023) *Finite-size scaling theory: Quantitative and qualitative approaches to critical phenomena.* Studies in History and Philosophy of Science Part A, 100. pp. 99-106. ISSN 00393681

Andrews, Mel (2023) The Devil in the Data: Machine Learning & the Theory-Free Ideal

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27th International Congress of History of Science and Technology, Dunedin, June 29-July 5, 2025

The 27th International Congress of History of Science and Technology will be held from **29 June - 5 July 2025** at the University of Otago in Dunedin, New Zealand.

The International Congress of History of Science and Technology (ICHST), held every four years, is the world's premier meeting for history of science and technology. The 27th Congress will be held as a hybrid in-person and online event at the University of Otago's Dunedin campus in June-July 2025. Delegates registered for virtual participation will be able to both present and attend online. The Congress will bring together a diverse group of the world's leading scholars and students in the fields of history of science, technology, and medicine as well as related disciplines. It will be the first time the Congress has been held in Australasia and only the second time in the Southern Hemisphere.

The **theme** of the 27th ICHST is "Peoples, Places, Exchanges, and Circulation."

Details **HERE**

Philosophy of Science Association (PSA), Articles Available

Gratis Downloadable articles:

- ***The Epistemic Projection Approach to Values in Science*** by Wendy S. Parker
- ***Causal Explanation and Revealed Preferences*** by Kate Vredenburgh
- ***Can Confirmation Bias Improve Group Learning?*** by Nathan Gabriel, Cailin O'Connor
- ***Mathematizing Metaphysics: The Case of the Principle of Least Action*** by Michael Veldman
- ***Academic Journals, Incentives, and the Quality of Peer Review: A Model*** by Kevin J. S. Zollman, Julian García, Toby Handfield

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Downloadable books are available HERE

The most downloaded preprints for the last six months of articles deposited in the previous two years are:

Cobb, David (2022) Empiricism in the Philosophy of Science

Wiggleton-Little, Jada and Callender, Craig (2022) Screening Out Neurodiversity

Chen, Eddy Keming (2023) Laws of Physics

Ardourel, Vincent and Bangu, Sorin (2023) Finite-size scaling theory: Quantitative and qualitative approaches to critical phenomena

Stern, Julio Michael and Pereira, Carlos Alberto de Braganca and Lauretto, Marcelo de Souza and Esteves, Luis Gustavo and Izbicki, Rafael and Stern, Rafael Bassi and Diniz, Marcio Alves and Borges, Wagner de Souza (2023) The e-value and the Full Bayesian Significance Test: Logical Properties and Philosophical Consequences

Opinion Page Beyond Causality: The Contribution of Mathematics to Understanding the Connection between Mind and Nature*

GORDON GILLESPIE, Business Consultant, Germany

Gillespie is an actuary, quantitative risk manager and data scientist. He has a doctorate in philosophy and is the author of the German-language book *The Oracle of Numbers: A Short Philosophy of Mathematics* (2023, HERE). He lives in Rüdesheim, Germany.

Gillespie completed his studies in mathematics and physics at Johannes-Guttenberg-Universität in Mainz and Freie Universität Berlin, and continued his post-graduate studies in model theory and mathematical logic at the University of Illinois, Chicago. After returning to Freie Universität Berlin to study philosophy, he completed his academic training with a PhD thesis on Dummett and Wittgenstein in 2002. Since 2006 he has been professionally active as a freelance consultant for insurers, banks, and other companies in the financial services industry.

Email: info@gillespie-aktuar.de

In 1959, the English writer and physicist C P Snow delivered the esteemed Rede Lecture at the University of Cambridge. Regaled with champagne and marmite sandwiches, the audience had no idea that they were about to be read the riot act.

Snow's *Two Cultures*

Snow diagnosed a rift of mutual ignorance in the intellectual world of the West. On the one hand were the 'literary intellectuals' (of the humanities) and on the other the (natural) 'scientists': Snow's much-discussed *Two Cultures* (Snow 1959).

Snow substantiated his diagnosis with anecdotes of respected literary intellectuals who complained about the illiteracy of the scientists but who themselves had never heard of such a fundamental statement as the second law of thermodynamics. And he told of brilliant scientific minds who might know a lot about the second law but were barely up to the task of reading Charles Dickens, let alone an 'esoteric, tangled and dubiously rewarding writer … like Rainer Maria Rilke.'

Sixty-plus years after Snow's diatribe, the rift has hardly narrowed. Off the record, most natural scientists still consider the humanities to be a pseudo-science that lacks elementary epistemic standards. In a 2016 talk, the renowned theoretical physicist Carlo Rovelli lamented 'the current anti-philosophical ideology'. And he quoted eminent colleagues such as the Nobel laureate Steven Weinberg, Stephen Hawking and Neil deGrasse Tyson, who agreed that 'philosophy is dead' and that only the natural sciences could explain how the world works, not 'what you can deduce from your armchair'.

Meanwhile, many humanities scholars see scientists as pedantic surveyors of nature, who may produce practical and useful results, but are blind to the truly deep insights about the workings of the (cultural) world. In his best-selling book *The Fate of Rome* (2017), Kyle Harper convincingly showed that a changing climate and diseases were major factors contributing to the final fall of the Roman Empire. The majority of Harper's fellow historians had simply neglected such factors up to then; they had instead focused solely on the cultural, political and socioeconomic ones.

In my own book, *The Oracle of Numbers: A Short Philosophy of Mathematics* (2023), currently only available in the original German, I tried to counter this intellectual parochialism. During my academic training in mathematics, physics and philosophy, I witnessed many instances of this narrow-mindedness and always wondered why highly intelligent people in these fields guarded themselves against major insights from the other fields. I wanted to motivate them, and the inquisitive general public, to open their minds and see that the never-ending quest for a better understanding of the world follows many paths.

Ludwig Wittgenstein once said: 'I want to show the colourfulness of mathematics.' In that spirit, I placed mathematics at the centre of my project because, in my view, mathematics searches along more of these many paths than any other intellectual discipline. It is connected on a deep level both with the natural sciences and the humanities. It bridges the gulf between them, and it does so by putting certain metaphysical and epistemological dogmas into question, as will become clear in the following.

Mind vs. Nature: A Deep Divide of Worldviews

The divide between the two cultures is not just an academic affair. It is, more importantly, about two opposing views on the fundamental connection between mind and nature. According to one view, nature is governed by an all-encompassing system of laws. This image underlies the explanatory paradigm of causal determination by elementary forces. As physics became the leading science in the 19th century, the causal paradigm was more and more seen as the universal form of explanation. Nothing real fell outside its purview. According to this view, every phenomenon can be explained by a more or less complex causal chain (or web), the links of which can, in turn, be traced back, in principle, to basic natural forces. Anything – including any aspect of the human mind – that eludes this explanatory paradigm is simply not part of the real world, just like the 'omens' of superstition or the 'astral projections' of astrology.

On the opposing view, the human mind – be it that of individuals or collectives – can very well be regarded separately from its physical foundations. Of course, it is conceded that the mind cannot work without the brain, so it is not entirely independent of natural forces and their dynamics. But events of cultural significance can be explained as effects of very different kinds of causes, namely psychological and social, that operate in a sphere quite separate from that of the natural forces.

These divergent understandings underpin the worldviews of each culture. Naive realists –

primarily natural scientists – like to point out that nature existed long before humankind. Nature is ordered according to laws that operate regardless of whether or not humans are around to observe. So the natural order of the world must be predetermined independently of the human mind. Conversely, naive idealists – including social constructivists, mostly encountered in the humanities – insist that all order is conceptual order, which is based solely on individual or collective thought. As such, order is not only not independent of the human mind, it's also ambiguous, just as the human mind is ambiguous in its diverse cultural manifestations.

The clash of cultures between the humanities and the natural sciences is reignited over and over because of two images that portray the interrelationship of mind and nature very differently. To achieve peace between the two cultures, we need to overcome both views. We must recognise that the natural and the mental order of things go hand in hand. Neither can be fully understood without the other. And neither can be traced back to the other.

The naive realist and the naive idealist fall prey to the same error, albeit in opposite directions – which gets us some way to the essence of the disagreement between the two cultures. Both confuse *determination* with *explanation*. 'Determination' refers to the emergence of a real-world phenomenon through a more or less complex web of cause-and-effect relationships. For example, when particle physics tells us that the Northern Lights result from solar winds colliding with Earth's atmosphere, we get an explanation of the luminous phenomenon by having its main causally determining factor pointed out to us. Similarly, when psychological research informs us about the potentially long-lasting effects of trauma, we can explain the behaviour of victims of childhood abuse, to a certain extent, as a result of how repressed memories influence their actions.

Now, the realist and the idealist – the scientist and the literary intellectual – both agree that explaining a phenomenon *always* means, in essence, revealing such determining causal relationships. Their views differ only in that for the realist the causal network is rooted in a firm natural basis, whereas for the idealist the basis is conceptual and therefore dependent on a contingent cultural embedding.

Mathematics as the Bridge

The best mediator of a conciliatory view that avoids the mistake of the naive realist and the naive idealist is mathematics. Mathematics gives us shining proof that understanding some aspect of the world does not always come down to uncovering some intricate causal web, not even in principle. Determination is not explanation. And mathematics, rightly understood, demonstrates this in a manner that lets us clearly see the mutual dependency of mind and nature.

Mathematical explanations are *structural*, not causal. Mathematics lets us understand aspects of the world that are just as real as the Northern Lights or people's behaviour, but are *not* effects of any causes. The distinction between causal and structural forms of explanation will become clearer in due course. For a start, take this example. Think of a dying father who wants to pass on his one possession, a herd of 17 goats, evenly to his three sons. He can't do so. This is not the case because some hidden physical or psychological forces hinder any such action. The reason is simply that 17 is a prime number, so not divisible by three.

Those who remember mathematics only as a dull school subject that is mainly about applying unmotivated formulas in the context of uninspired exercises will naturally be sceptical about my claim that mathematics can bridge the gulf between the two cultures. The usual presentation of mathematics to the broader public makes it appear, at best, as a useful auxiliary discipline for the natural and technological sciences, or, at worst, as a curious collection of cute logical tricks. How could such a discipline possibly contribute to a better understanding of the interrelationship between mind and nature?

A first idea is given by Riemannian geometry, the foundations of which were laid in the mid-19th century by Bernhard Riemann, building on the work of his teacher Carl Friedrich Gauss. Gauss was fascinated by the intrinsic curvature at any point on the interior of a smooth surface. What

does this mean? Take a flat sheet of paper. It has zero curvature everywhere, and this remains so even after it is rolled up into a play telescope; the apparent curvature is merely extrinsic, it exists only relative to the surrounding three-dimensional space. In contrast, the surface of a sphere has a non-zero intrinsic curvature everywhere. The surface doesn't just look crooked, it really is crooked – in and of itself, so to speak.

Riemann elevated Gauss's concept of intrinsic curvature to more than two dimensions. Ever since, one can meaningfully and precisely ask whether the 'space around us is curved in itself'. Before Riemann, this would have been a meaningless sequence of words, at best with some associative force in the hands of a gifted poet. Riemann's geometry made conceivable what was not only unimaginable before, but unthinkable in the truest sense of the word.

The example of Riemannian geometry not only demonstrates the ability of mathematics to broaden our intellectual horizons with new perspectives. It also shows how this intellectual-aesthetic advantage can yield unexpected scientific, and even practical, benefits: it provided the conceptual resources Albert Einstein needed to develop his general theory of relativity.

Thus, Einstein was able to see gravity not as a force causing material objects to attract each other, but as a purely geometrical, that is, structural, element of the Universe. The Universe is curved in itself. And, since the Big Bang, it has been expanding, but not into a pre-existing surrounding space. The Big Bang was no explosion that ejected matter outwards (causal); there was and is simply no 'outside'. Rather, the Universe is expanding in the sense of a certain continuous change of its intrinsic curvature (structural). It is thanks to Einstein, and Edwin Hubble, that we know this and can use it for useful things like the GPS. But it is only thanks to Riemann that we can think it at all.

Mind and World: no Separate Spheres

The difference between causal and structural explanations becomes clearer with regard to Immanuel Kant's conception of 'transcendental idealism', as laid out in his *Critique of Pure Reason* (1781). For Kant, empirical experience is possible only within a given conceptual framework, which in turn does not arise from empirical experience, but rather constitutes the human mind. And a crucial part of this framework is Euclidean geometry.

The world is not 'in itself' populated by spatially and temporally delimited objects that interact with each other in a variety of ways. According to Kant, the world is structured this way because the human mind is able to grasp it in this way, and in this way only. Euclidean geometry, so he believed (he couldn't know anything about Riemannian geometry yet), determines the spatial dimensions of this order. Thus, geometry is just as much a study of an elementary trait of our mind as of the space around us.

Kant's transcendental idealism doesn't only suffer from the fact that Euclidean geometry turned out to be not quite as constitutive as he thought. More severely, his conception of empirical knowledge, as an act of understanding through which conceptually formed 'judgments' miraculously emerge from mere 'sensations', remains completely obscure, as even well-meaning readers of the *Critique* must admit.

But we can attribute at least one fundamental insight to Kant: Mind and world are no separate spheres that must first be connected, so that the question arises as to how exactly this might be achieved. Rather, both depend on each other. Just as the world does not simply prescribe spatial, temporal and other structures that our mind then has to decipher, the mind is not free to impose any structure on the world at will. This is most impressively demonstrated by mathematics, which, despite the lack of empirical restrictions, does not fall into wild speculation.

Mathematics eludes the causal paradigm of explanation. Its explanations are of a very different kind than those in terms of cause and effect, as another look at the relationship between geometry and physics shows. Ten years before his general theory of relativity, Einstein had in 1905 presented to an astonished world its preliminary form, the special theory of relativity.

In this theory, a special form of Riemannian geometry devised by Hermann Minkowski plays a key role, with rather peculiar consequences. The most notorious is the so-called 'twin paradox'. A pair of twin brothers have applied to take part in a space mission, but only one of them has been selected. The aim of the mission is to travel to the farthest regions of space, thanks to the latest rocket technology at nearly the speed of light. After the chosen brother returns to Earth, still a young man, he visits his brother and reencounters an old man.

It is quite common to explain this 'paradox' as a consequence of the accelerating forces acting on the travelling brother in his rocket. (See, for example, Richard Feynman's *Lectures on Physics*.) And indeed, it seems very plausible, even inevitable, to assume that some physical cause must be responsible for the age difference. But that is false, the true reason lies in the structural framework within which the forces occur: the geometry of spacetime. Space and time cannot be considered separately, rather they are intertwined in an overarching common structure. And within this structure, the path, or 'world line', of the astronaut on the mission is simply shorter than that of his brother on Earth. This is not a cause, but – in Kant's terms – a basic aspect of our transcendental explanatory framework.

Mathematics highlights the limits of natural scientific explanation. This becomes even clearer when we consider how the idea of an all-explanatory physical theory or 'world formula' came about in the first place. In other words, how did scientists come to believe, or at least hope, that a mathematical description of nature on the most fundamental level exists, with which every worldly phenomenon is explainable in the sense that its entire causal history can be derived from basic laws, at least in principle?

The starting point was the mechanistic view of the world, according to which all physical systems consist of tiny, indivisible particles that either interact with each other like billiard balls through direct collision, or by means of remote forces. It was Isaac Newton's mathematical model of classical mechanics that gave this idea its standing, in conjunction with his law of gravity. Newton's model allowed him to explain an astonishing wealth of very different phenomena, such as the movements of the planets around the Sun and the falling of apples from trees, in a uniform way.

Before Newton, nobody thought of an 'all-explaining' physical theory. There were various natural phenomena for which individual explanations were sought. For example, Ptolemy's 'epicycle theory', which was based on complex nested circular movements, was responsible for the movements of the planets around Earth. Completely different explanations were given for the falling of objects on Earth. But then Newton appeared on the scene with his model – and with him 'Laplace's demon'. This figure, presented by Pierre-Simon Laplace in 1814, not only knew Newton's laws, but also the locations and velocities of all particles in the entire Universe at any given time, as well as the forces acting on them. According to Laplace, this enabled the demon to calculate the exact state of the entire Universe for any point in time, be it in the future or the past.

Of course, to Laplace and his contemporaries, the demon was a mere fictional figure, but one with a true core. If a physical system can be regarded as 'closed', ie, as one whose interactions with its environment are negligible, a scientist can in principle predict the behaviour of the system with arbitrary accuracy. All she has to know with sufficient accuracy are the forces acting within the system, as well as the initial spatial distribution of the elementary system components and their velocities at the relevant point in time. Such a demonic scientist would possess what Dr Frankenstein dreamed of: 'absolute' control and penetration of the functioning of any physical system, including humans and their life and thought processes.

So, it may seem, but it is a fallacy. Laplace's demon can predict the behaviour of any physical system exactly, and it can also deduce in detail the state of the system at any time in the past. But even the demon does not understand every aspect of the system's behaviour. Again, determination is not explanation.

Take, for example, the height of every adult in Paris. Laplace's demon can calculate the exact

body lengths of all adult Parisians. And it can explain for each of them exactly how their genes, diet and other environmental influences led to them reaching their respective heights. As another example, if we throw lots of coins in the air at once and note the number of coins showing heads after landing on the floor, and we repeat this many times, the demon can predict for each iteration and each coin whether it will show heads or tails. And the demon can explain in detail how each outcome was causally determined.

But there is a fact the demon cannot explain. If we plot in a diagram the frequencies with which the different body lengths or counts of heads occur, the result is, in both cases, an approximate bell curve. Why? The forces acting in both cases are obviously very different. Nevertheless, the overall distributions of the heights and of the heads' counts are very similar. Laplace's demon can't explain this fact, at least not if its theoretical knowledge is limited to the causally determining laws of nature.

The Central Limit Theorem: Not a Natural Law, but an Explainer of Nature

The key to an explanation is the central limit theorem, a fundamental result of mathematical probability theory. The theorem states that, under appropriate conditions, a certain version of the mean of a sample converges to the so-called standard normal distribution (visually the bell curve). But probability theory is not entailed by those natural laws. In particular, the central limit theorem doesn't follow from them. Laplace's demon couldn't even formulate the theorem. Very different concepts are needed to state the theorem than those of differential calculus, which are essentially sufficient for the laws of nature, at least in their Newtonian form.

Physics has undergone many changes since Laplace, most notably the emergence of relativity theory and quantum mechanics. Today we know that the world is not populated by tiny, indivisible billiard balls from which all material objects are composed in more or less complex ways. And Newton's model is flawed in its geometric foundation alone. But that doesn't change the argument. Even if these two currently incompatible pillars of physics – relativity and quantum physics – can someday be brought together in a unified theory, there will still be mathematical explanations of physical phenomena (for example, the approximate normal distribution of body lengths in a population or of the counts of heads in repeated coin tosses) that do not follow from the unified theory.

In his 'Two Cultures' speech, Snow located mathematics clearly in the camp of the sciences. But, as we have seen, mathematics doesn't adhere to the explanatory paradigm of causal determination. This distinguishes it from the *natural* sciences. Nevertheless, mathematics tells us a lot about nature.

According to Kant, it does so because it tells us a lot about the human mind. Mind and nature are inseparable facets of the world we inhabit and conceive. So, why should the humanities not also count as a science? They can tell us just as much about that one world on a fundamental level as the natural sciences. Mathematics demonstrates this clearly.

Some naive realists like to make a clever move here. As persistent adherents of scientism – that is, the metaphysical doctrine that only the concepts and methods of enquiry used by the natural sciences, or more specifically physics, can account for what's real – they simply attribute to the unified theory everything that could possibly prove to be a 'useful' part of mathematics now or in the future. But this semantic sleight of hand does not solve the basic problem of scientism: The world is structured in diverse ways, and in many different degrees of abstraction.

On the most fundamental level are relations that determine the spatial and temporal order of events. Within this geometric structure, intricate and diverse causal structures arise that allow us, if well enough understood, to explain many of the phenomena emerging from them. But there are also more abstract structures, for instance those of probability theory, or for that matter psychology, sociology, linguistics, etc. And there is no scientific criterion, understood in the narrow sense of scientism, that could tell us which of these structures really do shape the world and which ones we only choose to see the world through.

Those naive realists who claim that only the natural sciences can capture the structure of the world face a dilemma. Either they reduce the role of mathematics to a minimum and claim that only those mathematical models are permissible that refer to structures determined by the natural sciences beforehand. Then, however, they are committed to an implausible position according to which higher-level abstract relations as they are established, for example, by the central limit theorem are mere 'projections' onto the world – not an essential part of it. Or else they recognise such relations as 'scientific' too.

But then they have to present a convincing argument as to why, of all non-empirical, conceptual-analytical disciplines, whose standards of validity are fundamentally different from those of the natural sciences, only mathematics should be admitted into the illustrious circle of the 'true sciences'.

I am not aware of any such argument. There are indeed rational standards by which we can distinguish true from merely imagined structures; standards as to what constitutes an objective measurement, a reliable observation, a valid deduction, or a cogent argument. However, these standards are much more complex and discursive than proponents of scientism want to admit. To simply state from the pulpit that only those structures are true that they have to accept as true in order to avoid the first alternative of the dilemma, the reduction of the role of mathematics to a completely implausible minimum, is not very convincing.

To sum up the argument against "naïve realism": The mind and world/nature are mutually dependent. This claim is not affected by Big-Bang time-lags between the temporal appearance of matter and of mind. The "naivité" of this materialist argument lies in the conflation of causal/chronological dependency and structural/explanatory dependency. Certainly, the mind is causally dependent on the brain, the body, and its physical surroundings, according to the laws of nature (whatever they may be), and not vice-versa. But that's not the point; the point is that the fundamental laws of nature, which a future unified physical theory may or may not make explicit, does not entail *all* structures needed to *rationally* explain all aspects of nature, much less of the world.

The central limit theorem, just as one example of many, explains certain natural phenomena that already occurred long before humans were around. But the relations of probability theory (and of other mathematical theories) do not follow from any set of natural laws and are not definable without (implicitly) referring to how the mind structures the world. In short, I argue that structures that the human mind needs to rationally understand the world are just as "real" as the causal structures discovered by the natural sciences.

This definition of "real" via "rational" may very well be circular, but that's no problem for my argument, since I'm not arguing for a reductive metaphysical programme. Quite to the contrary, I argue for a sophisticated form of realism that neither falls into the trap of reductive physicalism, or so-called "naturalism", nor into that of solipsistic idealism, or social constructivism.

Mathematics and Humanities

Mathematics undermines the causal explanatory paradigm not only in its natural scientific manifestations, but also in its uses in the humanities. We give explanations for a wide variety of phenomena by hidden causes way too often and way too fast, where the simple admission to having no explanation would not only be more honest, but also wiser. Wittgenstein spoke of the disease of wanting to explain. This disease shows itself not just in our private everyday exchanges and in the usual public debates, but also in scholarly discourse of the humanities.

When confronted with individual or collective human thinking and behaviour, it is tempting to assume just a few underlying factors responsible for the thinking and behaviour. But, more often than not, there really is no such neat, analysable set of factors. Instead, there is a vast number of natural, psychological and societal factors that are all equally relevant for the emergence of the phenomenon one wants to explain. Perhaps a high-end computer could incorporate all these factors in a grand simulation. But a simulation is

not an explanation. A simulation allows us to predict, but it doesn't let us understand.

The aim of the humanities should not be to identify causes for every phenomenon they investigate. The rise and fall of empires, the economic and social ramifications of significant technological innovations, the cultural impact of great works of art are often products of irreducibly complex, chaotic processes. In such cases, trying to mimic the natural sciences by stipulating some major determining factors is a futile and misleading endeavour.

But mathematics shows that beyond the causal chaos there can be order of a different kind. The central limit theorem lets us see and explain a common regularity in a wide range of causally very different, but equally complex, natural processes. With this and many other examples of structural mathematical explanations of phenomena in the realm of the natural sciences in mind, it seems plausible that mathematical, or mathematically inspired, abstraction can also have fruitful applications in the humanities.

This is by no means meant to promote an uncritical imitation of mathematics in the humanities and social sciences. (The overabundance of simplistic econometric models, for instance, is a huge warning sign.) Rather, it is meant to motivate scholars in these fields to reflect more upon where and when causal explanations make sense. Complexity can't always be reduced to a graspable causal explanation, or narrative. On the contrary, often the most enlightening enquiries are not those that propose new factors as the true explainers, but those that show by meticulous analysis that far more factors are crucially in play than previously thought. This, in turn, should motivate scholars to seek aspects of their subject of interest beyond causality that are both relevant and amenable to structural forms of explanation. Besides probability theory, chaos theoretical methods and game theory come to mind as mathematical sub-disciplines with potentially fruitful applications in this regard.

The Mental World and the Physical World: One and the Same

However, the main point of our discussion is not that mathematical applications in the humanities might bridge the gap between the natural sciences and the humanities. The point is that mathematics, not really belonging to either camp, shows them to be on an equal footing from the start. The natural scientific paradigm of explanation is not the role model that all respectable forms of enquiry have to follow. Mathematics shows that natural causes can't explain every phenomenon, not even every natural phenomenon and not even in principle. So, there is no need for the humanities, the 'sciences of the mind', to always strive for explanations by causes that can be 'reduced' to more elementary, natural forces.

Moreover, mathematics shows that causality, of any kind, is not the only possible basis on which any form of explanation ultimately has to stand. Take for example the semantic relationships between many of our utterances. It is not at all clear that these can be explained in terms of psychological causes, or any other causes. It is not unreasonable to believe that the world is *irreducibly* structured, in part, by semantic relations, just as it is structured by probabilistic relations.

This insight indicates a possible reconciliation of the natural sciences and the humanities. It implicitly refers to something that Richard Rorty explicitly expresses in *Philosophy and the Mirror of Nature* (1979) as follows:

> The intuition behind the traditional distinction between nature and spirit, and behind romanticism, is that we can predict what noises will come from someone's mouth without knowing what they mean … This intuition is quite correct … [But] this is not because anything is in principle unpredictable, much less because of an ontological divide between nature and spirit, but simply because of the difference between a language suitable for coping with neurons and one suitable for coping with people.

The divide between the natural sciences and the humanities does not stem from the supposed fact that only those mental phenomena are real that are explainable in natural-scientific terms. Nor is the divide due to some extra-natural mental order,

determined by causal relationships of a very different kind than those studied in the natural sciences. The mental world and the physical world are one and the same world, and the respective sciences deal with different aspects of this one world. Properly understood, insofar as they deal with the same phenomena, they do not provide competing but complementary descriptions of these phenomena.

Mathematics provides the most impressive proof that a true understanding of the world goes beyond the discovery of causal relationships – whether they are constituted by natural or cultural forces. It is worth taking a closer look at this proof, for it outlines the bond that connects mind and nature in particularly bright colours.

Kant understood this bond as a 'transcendental' one. The late Wittgenstein, on the other hand, demonstrated its anchoring in language – not in the sense of a purely verbal and written practice, but in the sense of a comprehensive practice of actions the mental and bodily elements of which cannot be neatly separated. In the words of Wittgenstein, 'commanding, questioning, recounting, chatting are as much a part of our natural history as walking, eating, drinking, and playing.'

Mathematics too is part of this practice. As such, like every science, it is inseparably rooted in both nature and the human mind. Unlike the other sciences, this dual rootedness is obvious in the case of mathematics. One only has to see where it resides: beyond causality.

* This essay first appeared in *Aeon* magazine 14 February 2025. Permission to republish is gratefully acknowledged.

Invitation to Submit Opinion Piece

In order to make better educational use of the wide geographical and disciplinary reach of this *HPS&ST Note*, invitations are extended for readers to contribute opinion or position pieces or suggestions about any aspect of the past, present or future of HPS&ST studies.

Contributions can be sent direct to editor. Ideally, they might be pieces that are already on the web, in which case a few paragraphs introduction, with link to web site can be sent, or else the pieces will be put on the web with a link given in the Note.

They will be archived, and downloadable, in the OPINION folder at the HPS&ST web site **HERE**.

Varia

- *Educational Sciences Journal.* Submissions sought for thematic issue on Science Literacy. Contact guest editor William F. McComas by 18 April.
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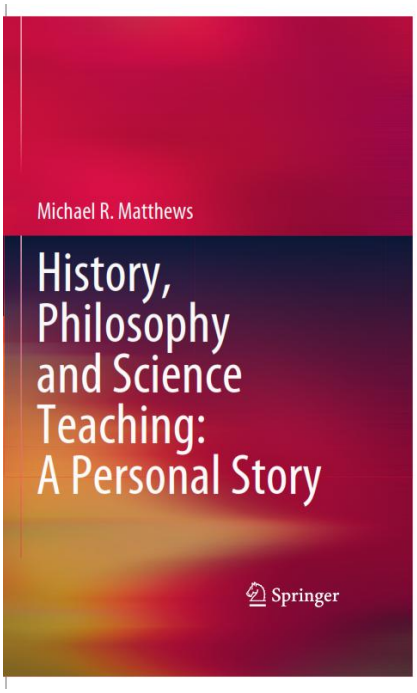
Featured Book: Michael R. Matthews, *History, Philosophy and Science Teaching: A Personal Story*, Springer, 2021.



This 10-chapter, 300-page autobiography with 700 references charts Matthews' intellectual and

career trajectory from Catholic schooling, to science teaching, to lecturing in philosophy of education, to lecturing and researching in science education. More particularly: from completing a science degree and teacher training at Sydney University (1968), high school science teaching at Dulwich High School in Sydney, completing a double-honours degree in psychology and philosophy, teaching philosophy of education at Sydney Teachers College then at the University of New South Wales, completing a master's degree in history and philosophy of science, being Foundation Chair of Science Education at University of Auckland, and returning to science education teaching and research at UNSW until his retirement in May 2008, thereupon becoming and remaining an honorary associate professor in the School of Education.

The book charts many of the fields to which Matthews has contributed: philosophy in teacher education, religion and worldviews in classrooms, constructivism, pendulum studies, Ernst Mach, Joseph Priestley, Feng Shui, Cultural Studies, Mario Bunge, Nature of Science (NOS) research.

The 'take home' lesson is that science education, at all levels from classroom teaching to university research, is enhanced if teachers and researchers have competence and interest in both HPS *and* philosophy of education. This is because both disciplines make unique and indispensable contributions to the many theoretical, curricular, and pedagogical issues that occupy students, teachers, curriculum writers, examiners, and government policy makers.

The book is available **HERE**

AUTHORS OR PUBLISHERS of suitable HPS&ST books who would like an appropriate Preface, Introduction or First Chapter of their book featured in the newsletter, and placed in the RESOURCE folder of the HPSST website, should contact newsletter editor Michael R. Matthews

Centenary of Quantum Mechanics Journal Special Issue, Call for Papers

Special Issue: "100 Years of Quantum Mechanics: Philosophical Perspectives". *Epistemology & Philosophy of Science*"

UNESCO recognizes 2025 as the centenary year of Quantum Mechanics.

Epistemology & Philosophy of Science is a leading peer-reviewed quarterly journal founded by the Institute of Philosophy of the Russian Academy of Sciences. The journal is committed to publishing high-quality research at the intersection of epistemology, philosophy of science, and scientific methodology. The journal provides a platform for international dialogue and exchange of ideas in both English and Russian. See **HERE**

About the Special Issue:

The Special Issue is dedicated to the ***centenary of quantum mechanics***. The aim of this issue is to explore the philosophical implications and ongoing impact of quantum mechanics on our understanding of reality and the nature of scientific knowledge. We seek contributions that examine both historical developments, contemporary philosophical perspectives in quantum mechanics and its impact on science and culture.

- Historical and philosophical analysis of quantum mechanics development
- Contemporary interpretations of quantum mechanics
- Measurement problem and observer effects
- The nature of quantum experience and reality
- Quantum probability and causality
- Epistemological foundations of quantum theory
- Methodological changes brought by quantum mechanics
- The significance of quantum mechanics for science and philosophy
- Quantum language and its philosophical implications
- Quantum mechanics' influence on metaphysics
- Prospects of the quantum worldview
- Interdisciplinary implications of quantum theory
- Cultural reception of quantum ideas

Confirmed Contributors: Lev Vaidman (Tel Aviv University), Jonas Arenhart (Universidade Federal de Santa Catarina), Valia Allori (University of

Bergamo), and Sebastian Fortin (Universidad de Buenos Aires)

Submission Requirements:
- Original paper has not been published previously, nor is it currently under consideration for publication elsewhere.
- The preferred length: up to 7,000 words
- Languages: English or Russian
- Format: Please follow the journal's general guidelines: https://journal.iphras.ru/forcontributors

The deadline for submissions: August 1, 2025.
Publication Date: December 2025

How to Submit: Please submit your manuscript to **vbazhanov@gmail.com**
OR **v.terekhovich@gmail.com**
When submitting, please indicate "100 Years of QM Special Issue" in your cover letter.

For further details or queries, please contact the Editors:
Dr Valentin Bazhanov (vbazhanov@gmail.com)
Dr Vladislav Terekhovich (v.terekhovich@gmail.com).

Ri Freer Prize Fellowships

Founded in 1799, the Ri is a world-famous independent charity dedicated to enhancing public understanding of science and the role of science in society. Among its many luminaries, the analytical chemist and pioneer of modern experimental physics, Michael Faraday, is the most famous. Philip Freer was a collateral descendant of Faraday and a great philanthropist who established the Philip Freer Trust to support postgraduate students to "make a difference in the world"

Type of award: Prize Fellowship for doctoral candidates in their unfunded writing-up year.
Areas of research supported: history of science and technology; heritage conservation science; history of the Royal Institution.

Stipend: £18,000 (the Fellowship will pay maintenance but not fees).

Duration of Fellowship: 12 months (commencing 1 October 2025).

Type of award: Prize Fellowship for doctoral candidates in their unfunded writing-up year.
How to apply: To apply, please send the following documents via this application form - https://rigb.tfaforms.net/33 All written application materials should be in PDF format All files must be clearly labelled to include the name of the applicant and the name of the document.

For more information on the application materials please refer to the Ri Website https://www.rigb.org/about-us/work-us/ri-freer-fellowship

Two Ri Freer Prize Fellows will be announced by June 2025 All queries should be directed to Freer Administrator Hannah Pratt - hpratt@ri.ac.uk

Deadline for applications: 31 March 2025

HoST – Journal of History of Science and Technology. Thematic dossier to be published in 2026

HoST - Journal of History of Science and Technology, recently indexed by Scopus, is an open access, on-line peer-reviewed international journal devoted to the History of Science and Technology, published in English by a group of Portuguese research institutions and De Gruyter Brill/Sciendo. HoST encourages submissions of original historical research exploring the cultural, social and political dimensions of science, technology, and medicine (STM), both from a local and a global perspective.

Past thematic issues have dealt with topics as diverse as circulation, science communication, natural history, or the relation between science, technology and politics. Future issues might deal with both established and emerging areas of scholarship. The editors of HoST are looking for proposals for a thematic dossier to be published in 2026 (HoST volume 20, issue 2-December).

Each thematic dossier should be prepared by the guest editor(s) and include four research papers along with an introduction.

Submission guidelines

Proposals should include the following items:

1. An abstract describing the topic for the thematic dossier and its significance (500 words);

2. A list of the contributors along with the titles and abstracts (300 words) of the four research papers;

3. Brief CVs (300 words) of the guest editor(s) and authors;

The guest editor(s) and the contributors must be prepared to meet HoST's publication schedule:

- Abstract and titles submission: **31 March 2025**
- Submission of complete research papers: **30 February 2026**
- Publication: **December 2026** (Issue 20.2)

Proposals will be subject to approval by the Editorial Board and authors will be informed of the outcome by the end of **April 2025**. Submissions should be sent as an e-mail attachment (preferably in one single .doc, .docx, .rtf or .odt file), to the chief-editor: chiefeditor@johost.eu

Golden Oldie: HPS&ST Research from 30+ Years Ago

Good HPS&ST research is clearly written, philosophically informed, well-argued, and has enduring value. Clarity encourages critique and evaluation, where flaws can be identified and corrected. This is a condition for the advance of knowledge.

Much education research is timely. This is useful. But an unfortunate consequence can be that what is timely today might be irrelevant tomorrow. Circumstances change. The research might leave no trace. Conversely, some research can leave a big trace but be philosophically flawed and so do educational and, ultimately, cultural damage.

Good HPS&ST research has a long shelf-life. In defence of this claim, the HPS&ST Newsletter will identify 30+ years-old articles that had, and still have, philosophical, historical and educational value. These Golden Oldies are available, month-by-month **HERE**

Sixth in the series:

Jung, Walter: 1983, 'Toward Preparing Students for Change: A Critical Discussion of the Contribution of the History of Physics to Physics Teaching'. In F. Bevilacqua & P.J. Kennedy (eds.) *Using History of Physics in Innovatory Physics Education*, Pavia University, pp.6-57. Reprinted in *Science & Education* 1994, 3(2), 99-130.

Available **HERE**

Walter Jung (1926-2011) was an influential German physics educator who died in May 2011 at age 85 years. Fortunately, some of his work appeared in English:

Jung, W.: 1986, `Cognitive Science and the History of Science', in P.V. Thomsen (ed.) *Science Education and the History of Physics*, University of Aarhus, pp.24-54. Reprinted in *Science & Education* **2**(1), 31-56.

Jung, W.: 2012, `Philosophy of Science and Education', *Science & Education* 21(8), 1055-1083.

Jung, W.: 1993, 'Uses of Cognitive Science to Science Education', *Science & Education* **2**(1), 31-56.

His obituary can be read **HERE**.

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Berge, M., Anderhag, P. (2025). The Role of Joking for Learning Science: An Exploration of Spontaneous Humour in Two Physics Education Settings. *Sci & Educ*, 1-22. https://doi.org/10.1007/s11191-025-00622-7

De Ávila, N. P (2025). Universal enough: the politics of nomenclature in seventeenth-century selenography. *The British Journal for the History of Science*, 1–21. doi:10.1017/S0007087424001377

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Recent HPS&ST Related Books

Bozeman, Barry (2025). *Science Competes: Informing Policy in a Time of Distrust, Fracture, and Chaos.* Cambridge, MA: The MIT Press. ISBN: 9780262552431

"Policymakers, like most people today, have a world of information within easy reach, much of it wrong. How, amid the chaos and misdirection of our day's information ecosystem, can science compete for the attention and trust of those who make public policy—especially at a time when issues like proliferating infectious diseases and climate change put a premium on accurate and relevant scientific information?

"What's needed, Barry Bozeman suggests in *Science Competes*, is a clearer understanding of how scientific information is conveyed, how it is understood and used, and where it fits in the wide array of information that might be of use to those who make and administer policy, laws, and regulations, as well as citizens who actively participate in public life. Acknowledging the importance of different sorts of information—historical, experiential, political—to decision-making, Bozeman

focuses on enhancing, not maximizing, the effective use of science in public policy. This entails recognizing that valid and useful scientific information is not necessarily formal scientific knowledge, but often takes the form of science by-products such as raw or structured data, graphics, and conceptual models.

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More information HERE

Daum, Andreas W. (2024). *Alexander von Humboldt: A Concise Biography*. Princeton, NJ: Princeton University Press. ISBN: 9780691247366

"In this lucid biography, Andreas Daum offers a succinct and novel interpretation of the life and oeuvre of Alexander von Humboldt (1769—1859). A Prussian nobleman born into the age of European Enlightenment, Humboldt was a contemporary of Napoleon, Simón Bolívar, and Charles Darwin. As a naturalist and scholar, he traveled the world, from the Americas to Central Asia, and recorded his observations in multiple volumes. Humboldt is still admired today for his interdisciplinary outreach and ecological awareness.

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More information HERE

Decker, J. (2025). *Logic for Everyone: From Proof to Paradox*. Cambridge: Cambridge University Press. ISBN: 9781009220538

"A rigorous, yet accessible and entertaining introduction to the field of logic, this book provides students with a unique insight into logic as a living field and how it connects to other fields of inquiry including philosophy, computer science, linguistics, and mathematics. With no background knowledge needed, students are introduced to a critical examination of 'classical logic', and the technical issues and paradoxes that may be encountered. Each chapter includes key pedagogical features such as marginal notes, definitions, chapter summaries and practice exercises. Arguments are backed up by authentic examples of logic within natural languages and everyday life.

"The flexible chapter structure allows instructors to tailor their teaching for either a one-semester or two-semester course, according to their students' needs and knowledge. Online resources include a companion website featuring further readings, class handouts, LaTeX resources, along with an Online Proof Evaluator allowing students to get real-time feedback." (From the Publishers)

More information HERE

Dippel A., & Warnke, M (2025). *Knowing Reality Through Computer Simulation*. Columbia, NY: Columbia University Press. ISBN: 9783837674804

"Are computer simulations theory, experiment, or something in between? Anne Dippel and Martin Warnke explore the epistemological status of computer simulations. By examining the erosion of concept-based truth in the digital age in combination with pathways of knowledge in physics, they offer a media ethnography of the famous quantum physics double-slit experiment and its simulation. Recognizing simulations as central to shaping reality and multiplying illusions, the authors propose "operational realism" as epistemic composure in the digital era. The work raises ethical questions about algorithmic world design, offering humor, revelations, and insights into new ontologies of knowledge." (From the Publishers)

More information HERE

Frank, A, Gleise, M., & Thompson, E. (2025) *The Blind Spot: Why Science Cannot Ignore Human Experience*. Cambridge, MA: The MIT Press. ISBN: 9780262553032

"It's tempting to think that science gives us a God's-eye view of reality. But we neglect the place of human experience at our peril. In *The Blind Spot*, astrophysicist Adam Frank, theoretical physicist Marcelo Gleiser, and philosopher Evan Thompson call for a revolutionary scientific worldview, where science includes—rather than ignores or tries not to see—humanity's lived experience as an inescapable part of our search for objective truth. The authors present science not as discovering an absolute reality but rather as a highly refined, constantly evolving form of human experience. They urge practitioners to reframe how science works for the sake of our future in the face of the planetary climate crisis and increasing science denialism.

"Since the dawn of the Enlightenment, humanity has looked to science to tell us who we are, where we come from, and where we're going, but we've gotten stuck thinking we can know the universe from outside our position in it. When we try to understand reality only through external physical things imagined from this outside position, we lose sight of the necessity of experience. This is the Blind Spot, which the authors show lies behind our scientific conundrums about time and the origin of the universe, quantum physics, life, AI and the mind, consciousness, and Earth as a planetary system. The authors propose an alternative vision: scientific knowledge is a self-correcting narrative made from the world and our experience of it evolving together. To finally "see" the Blind Spot is to awaken from a delusion of absolute knowledge and to see how reality and experience intertwine.

"*The Blind Spot* goes where no science book goes, urging us to create a new scientific culture that views ourselves both as an expression of nature and as a source of nature's self-understanding, so that humanity can flourish in the new millennium." (From the Publishers)

More information HERE

Landry, Marc (2025). *Mountain Battery: The Alps, Water, and Power in the Fossil Fuel Age*. Redwood City, CA: Stanford University Press. ISBN: 9781503639775

"By the end of the nineteenth century, Europeans had come to see the Alps as the ideal place to fashion an alternative to the era's dominant energy source: coal. After 1850, Alpine water increasingly became "white coal": a power source with the revolutionary economic potential of fossil fuel. In this book, Marc Landry shows how dam-building in the nineteenth and twentieth centuries transformed the Alps into Europe's "battery"—an energy landscape designed to store and produce electricity for use throughout the Continent. These stores of energy played an important role in supplying the war economies of west-central Europe in both world wars as demand for munitions and other factory production necessitated access to electrical energy and the conservation of coal.

"Through historical research conducted in archives across Europe—especially in Germany, Austria, France, Switzerland, and Italy—Landry shows how and why Europeans thoroughly transformed the Alps in order to

generate hydroelectricity, and explores the effects of its attendant economic and military advantages across the turbulent twentieth century. Landry surveys the environmental and energy changes wrought by dam-building, demonstrating that with global warming, melting glaciers, and calls for a green energy transition, the future of white coal is once again in question in twenty-first-century Europe." (from the Publishers)
More information HERE

Li, Lan A. (2025). *Body Maps: Improvising Meridians and Nerves in Global Chinese Medicine.* Baltimor, MD: Johns Hopkins University Press. ISBN: 9781421450964

"A historical and cultural study of how representing invisible anatomical structures has reshaped our understanding of human anatomy.

"In *Body Maps*, Lan A. Li unveils a rich history of the hidden landscapes of the human body. This compelling study explores the world of "invisible" anatomy, explaining how hand-drawn body maps have shaped our understanding of the human form across cultures and centuries. From the meridian charts in East Asian medicine to neurophysiological illustrations, *Body Maps* traces the evolution of anatomical representation from the tenth to the twentieth centuries. Drawing on case studies across time and place, from Kaifeng to Dejima and from Beijing to Berlin, Li expertly navigates the complex interplay between Eastern and Western medical traditions.

"At the heart of this history remains a perennial mystery: How did representations of jingluo (meridians) become intertwined with—and sometimes subsumed by—concepts of nervous anatomy? By examining the graphic history of these invisible structures, *Body Maps* challenges our assumptions about the stability of medical knowledge and invites us to reconsider the nature of anatomical "reality." Each chapter opens with a single image and explores how practitioners negotiated between materiality and metaphor, with the nature of the body and the symbols used to represent it.

"*Body Maps* is a thought-provoking exploration of how images shape our understanding of the world. By bringing together insights from the history of science, postcolonial studies, art history, Chinese studies, critical cartography, and medical anthropology, Li offers a fresh perspective on the cultures of objectivity that have defined our approach to the human body." (From the Publishers)

More information HERE

Oldofredi, Andrea (Ed.) (2025). *Guiding Waves in Quantum Mechanics: One Hundred Years of de Broglie-Bohm Pilot-Wave Theory*. Oxford, UK: Oxford University Press. ISBN: 9780198901853

"The pilot-wave theory developed by de Broglie and Bohm has a special place in the history of contemporary physics, being the very first alternative formulation of quantum mechanics. As is well-known, such a framework established itself as a leading interpretation of the quantum formalism, representing a solution to the major technical and conceptual challenges affecting the orthodox view. Indeed, the de Broglie-Bohm theory not only solves the famous measurement problem, one of the most cogent issues faced by standard quantum mechanics, but it also clarifies the formal structure of the latter theory as a consequence of a consistent set of principles and a precise, unambiguous ontology.

"This volume aims to provide the reader with a discussion of the pilot-wave perspective, which is as informative, comprehensive and accessible as possible, while at the same time clarifying confusions and misunderstandings that are unfortunately still common, despite the long history of this theoretical framework.

"The book features chapters about the various perspectives on the pilot-wave theory, its extensions to relativity and quantum field theory, and its experimental applications to various branches of physics, such as quantum electrodynamics, quantum chemistry, and quantum engineering. Moreover, the volume

includes essays on the history and philosophy of the de Broglie-Bohm theory in order to delineate its developments and the vicissitudes of its pioneers, as well as to understand the scientific image of the universe it provides." (From the Publishers)

More information HERE

Spencer, N., & Waite, H. (2025). *The Landscapes of Science and Religion: What Are We Disagreeing About?*. Oxford, UK: Oxford University Press. ISBN: 9780198878759

"The relationship between science and religion has long been a heated debate and is becoming an ever more popular topic. The scientific capacity to manipulate and change humans and their environment through genetic engineering, life extension, and AI is going to take a huge leap forward in the twenty-first century, provoking endless debates around humans "playing God".

"But what do we mean by this? Asking this question is surprisingly hard work. Attempts to 'essentialise' science, let alone religion, quickly run into trouble. Where are the boundaries? Whose definition of science is definitive? Which concept of religious is the authoritative one?

"Ultimately, neither "science" nor "religion" can be pinned down to one single meaning or definition. Rather, they encompass a family of definitions that relate to one another in a complex web of shifting ways. Drawing on extensive research with over a hundred leading thinkers in the UK — including Martin Rees, Brian Cox, Susan Greenfield, A.C. Grayling, Ray Tallis, Linda Woodhead, Steve Bruce, Adam Rutherford, Robin Dunbar, Francesca Stavrakopoulou, and Iain McGilchrist — *The Landscapes of Science and Religion* takes the much-needed step of asking what science and religion actually are, before turning to the familiar question of how they relate to one another.

"Building on this, by paying particular attention to those who sense some form of conflict here, Spencer and Waite explore where the perceived conflict really lies. What exactly are people disagreeing about when they disagree about science and religion, and what, if anything, can we do to improve that disagreement and bring about a fruitful dialogue between these two important human endeavours." (From the Publishers)

More information HERE

Staley, K. W. (2025). *An Introduction to the Philosophy of Science* (2nd ed.). Cambridge: Cambridge University Press. ISBN: 9781009098250

"This thoroughly updated second edition guides readers through the central concepts and debates in the philosophy of science. Using concrete examples from the history of science, Kent W. Staley addresses questions about what science is, why it is important, and the basis for trust in scientific results.

"The first part of the book introduces the central concepts of philosophy of science, with updated discussions of the problem of induction, underdetermination, rationality, scientific progress, and important movements such as falsificationism, logical empiricism, and postpositivism, together with a new chapter on social constructionism.

"The second part offers updated chapters on probability, scientific realism, explanation, and values in science, along with new discussions of the role of models in science, science in policy-making, and feminist philosophy of science. This broad yet detailed overview will give readers a strong grounding in philosophy of science whilst also providing opportunities for further exploration." (From the Publishers)

More information HERE

Stolow, Jeremy (2025). *Picturing Aura: A Visual Biography*. Cambridge, MA; The MIT Press. ISBN: 9780262551748

"*Picturing Aura* is the first book of its kind: an extended historical, anthropological, and philosophical study of modern efforts to visualize the hidden radiant force

encompassing the living body known as our aura. This rich, interdisciplinary study by Jeremy Stolow chronicles the rise and global spread of modern instruments and techniques of picturing aura, from the late nineteenth century to the present day, exploring how its images are put to work in the diverse realms of psychical research, esotericism, art photography, popular culture, and the New Age alternative medical and spiritual marketplace.

"At their core, pictures of auras are boundary objects that operate simultaneously in multiple conceptual and practical realms, serving varying goals of making art, healing bodies, and exploring the cosmos. Drawing on extensive archival as well as field research, Stolow reconstructs a global history of this boundary-crossing enterprise through its evolving media technologies, markets, and cultural arenas. It is a story shaped through exchanges among professionals and amateurs, scientists and occultists, countercultural artists and entrepreneurs, metropolitans and hinterland figures. With more than 60 full-color illustrations, Picturing Aura brings to light a remarkable, entangled history of picture-making that challenges settled assumptions about religion, art, and science." (From the Publishers)

More information HERE

Taylor, Mark C. (2025). *After the Human: A Philosophy for the Future*. Columbia, NY: Columbia University Press. ISBN: 9780231218610

"The world is on fire and time for avoiding impending disaster is rapidly running out. This catastrophe has deeply entrenched foundations: a belief in human exceptionalism and human mastery over the Earth. Accelerating technological changes ranging from genetic engineering, synthetic biology, and nanotechnology to biobots, neuroprosthetics, and artificial intelligence are creating new worlds in which human beings will either be radically transformed or become extinct.

"*After the Human* is an ambitious and audacious grand synthesis that weaves together philosophy, theology, quantum mechanics, relativity theory, information theory, ecology, plant and animal cognition, and artificial intelligence to forge a new philosophical vision for the future. Mark C. Taylor calls for replacing human exceptionalism with a theory of radical relationalism, an account of the world in which everything is interrelated and codependent. People, in this telling, are not isolated individuals separated from each other and set apart from the complex world they are destined to dominate but integral parts of a vital web, where differences enrich each other and nourish the greater whole. Ranging from the grounded worlds of dirt and soil to the most abstract realms of quantum ecology, *After the Human* reveals the alternative intelligences and transformative possibilities that provide hope for life beyond our perilous moment." (From the Publisher)

More indormation HERE

Authors of HPS&ST-related papers and books are invited to bring them to attention of the Newsletter's assistant editor Paulo Maurício (**paulo.asterix@gmail.com**) for inclusion in these sections.

PhD Awarded in HPS&ST

We welcome publishing details of all PhDs awarded in the field of HPS&ST. Send details (name, title, abstract, supervisor, web link) to editor: m.matthews@unsw.edu.au

Coming HPS&ST Related Conferences

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March 6-10, 2025, US Philosophy of Education Society, PES, annual conference, Baltimore. Details: **HERE**

March 15-16, Pragmatism and Measurement, University of Pittsburgh
Details: **HERE**

March 23-26, 2025, NARST Annual Conference, National Harbour, Maryland, USA
Details: **HERE**

March 24-26, 2025, German Society for Philosophy of Science, GWP.2025, city of Erlangen.
Details: **HERE**

March 27-29, 2025, Integrated History and Philosophy of Science, 10th conference. CIT Pasadena, CA
Details: **HERE**

March 27-28, 2025, Workshop on Scientific Pluralism, Epistemic Diversity, and Progress in Science. University of Wupppertal Submissions by 15 November
Details: **HERE**

May 20-21, 2025, Celebrating Ian Hacking, The University of Texas at Dallas
Details: **HERE**

June 11-14, 2025, Sixteenth Biennial History of Astronomy Workshop, -14, 2025, University of Notre Dame.
Details: **HERE**

June 26-27, 2025, 'Women's Scientific Literatures: The Poetry and Poetics of Early Modern Natural Philosophy' Anglia Ruskin University, Cambridge
Details: HERE

June 27-29, 2nd European Regional IHPST Conference. Athens
Details: HERE

June 29-July 5, 2025 International Congress of Science and Technology, Dunedin, New Zealand
Details: **HERE**

July 1-5, 2025, Australian Science Education Research Association (ASERA) annual conference, Deakin University, Melbourne
Details: **HERE**

July 20-25, 2025 ISHPSSB Conference, University of Porto.
Details: **HERE**

August 25-29, 2025, European Science Education Research Association, biennial conference, Copenhagen
Details: **HERE**

22-25 June 2026, 8th ICASE World Conference on Science & Technology Education, University College, Cork, Ireland
Details: **HERE**

HPS&ST Related Organisations and Websites

IUHPST – International Union of History, Philosophy, Science, and Technology
DLMPST – Division of Logic, Mathematics, Philosophy, Science, and Technology
DHST – Division of History, Science, and Technology
IHPST – International History, Philosophy, and Science Teaching Group
NARST - National Association for Research in Science Teaching
ESERA - European Science Education Research Association
ASERA - Australasian Science Education Research Association
ICASE - International Council of Associations for Science Education
UNESCO – Education
HSS – History of Science Society
ESHS – European Society for the History of Science
AHA – American History Association
FHPP APS - Forum on History and Philosophy of Physics of the American Physical Society
HAD AAS - Historical Astronomy Division of the American Astronomical Society.
ACS HIST – American Chemical Society Division of the History of Chemistry
GWMT - Gesellschaft für Geschichte der Wissenschaften, der Medizin und der Technik
ISHEASTME – International Society for the History of East Asian History of Science Technology and Medicine
EASE - East-Asian Association for Science Education
BSHS – British Society for History of Science
EPSA - European Philosophy of Science Association
AAHPSSS - The Australasian Association for the History, Philosophy, and Social Studies of Science
HOPOS – International Society for the History of Philosophy of Science
PSA– Philosophy of Science Association
BAHPS - Baltic Association for the History and Philosophy of Science
BSPS – The British Society for the Philosophy of Science
SPSP- The Society for Philosophy of Science in Practice
ISHPSB - The International Society for the History, Philosophy, and Social Studies of Biology

PES– The Philosophy of Education Society (USA)

The above list is updated and kept on the HPS&ST website at: **HERE**

HPS&ST related organizations wishing their web page to be added to the list should contact assistant editor Paulo Maurício: paulo.asterix@gmail.com

HPS&ST NEWSLETTER PERSONNEL

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The newsletter has been produced and distributed for 30+ years with very little turnover of personnel. But new enthusiasm, connections and ideas are needed. If you have one or other of these qualities and would like to contribute to the newsletter, please make contact with the editor, sending a brief biog statement and your ideas on what you might be able to contribute.