HPS & ST

HISTORY, PHILOSOPHY, SCIENCE & TEACHING

NEWSLETTER

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Ideas, debates and opportunities across the HPS&ST community

A monthly international digest of scholarship, events, publications and teaching in the history and philosophy of science.

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EDITORIAL

Introduction

The HPS&ST Newsletter is sent monthly to about 12,000 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, Opinion Piece, etc.) are welcome and should be sent direct to the editor: Michael R. Matthews, UNSW, **m.matthews@unsw.edu.au** .

CALLS & EVENTS

University of Pittsburgh, Centre for Philosophy of Science, Podcasts

Season Three of our podcasts begins with a discussion on 'Perception and Understanding' with Visiting Fellow Alfredo Vernazzani. https://www.centerphilsci.pitt.edu/fellows/vernazzani-alfredo/

The podcast is available on:

YouTube: https://youtu.be/hygShRSuw-U?si=Jz-cnbvEHgH08P9m

Spotify: https://open.spotify.com/episode/22k4AV5cdbd8JeupXdW31B?si=dda353c0d7804c65

Apple: https://podcasts.apple.com/us/podcast/conversations-at-the-center/id1874323410

CALLS & EVENTS

Institutionalising Knowledge: Online Workshops

We are pleased to invite you to ***Institutionalising Knowledge***, a new online workshop series examining the history of knowledge and its institutions from the early modern period to the present, with a global scope.

The series brings together research on universities, academies, learned societies, religious institutions, and other sites of knowledge production and exchange.

The workshops are held online and are open to researchers at all career stages.

Michaelmas Term 2026 (all times UK time)

14 October, 3.00–4.15 pm *'You are ignorant like one who has never slept in Siwindhe': grandmotherhood, storytelling and credentialed expertise in Western Kenya, 1850s–1980s* Esther Ginestet (North Carolina State University)

11 November, 3.00–4.15 pm *Prize contests as stimuli for knowledge exchange in the long 18th century* Avi Lifschitz (University of Oxford)

2 December, 3.00–4.15 pm *Between capital and province: Greek Orthodox intellectual life in Istanbul and Athens at the turn of the 19th century; the Patriarchal Academy of Kuruçeşme and the Philomousos Hetaireia* Nicolas Nicolaides (Centre for Asia Minor Studies)

To receive the Zoom link, please email mif24@cam.ac.uk, laura.royer@idehist.uu.se, or fill out this form.

Further information is available here.

CALLS & EVENTS

Royal Society Conference: AI and the History of Science, 5 March 2027

A conference will take place on Friday 5 March 2027 at the Royal Society, 6-9 Carlton House Terrace, SW1Y 5AG, London 9.30 am – 5.00 pm

Deadline for submissions: **18 October 2026**

Artificial intelligence presents historians of science with an unusual double challenge: it is at once an object of historical enquiry and an instrument that is beginning to reshape how that enquiry is conducted. Large language models are trained, in part, on the digitised traces of past science; they are simultaneously being taken up, with varying degrees of confidence and caution, to transcribe, parse, translate and interpret those same traces. Historians of science are well placed to examine this moment: the discipline has long studied how new instruments and infrastructures alter what counts as knowledge, whose work is recorded, and how records are read.

The Royal Society is interested both in how the emergence of AI should be understood historically, and in what its adoption means, in practice, for research on the history of science. This includes research undertaken in and on collections such as the Society's, which record over three and a half centuries of scientific activity and could themselves become machine-readable at scale. The Royal Society Centre for the History of Science is joining with *Notes and Records*, the Society's journal of the history of science, in holding a 1-day conference to explore these themes.

The event is intended as an interdisciplinary gathering of historians of science, technology and medicine; archivists, librarians and curators of scientific collections; digital humanities scholars; and researchers in computer science and linguistics with an interest in the history of their fields.

We welcome proposals for short papers (15 minutes maximum) on themes including:

- The historical context of AI as a disruptive technology, compared to earlier technological disruptions such as printing, telegraphy, mechanical calculation and the electronic computer.

- The emergence of large language models in relation to the histories of linguistics, computer science, statistics and information theory; earlier 'AI moments', their promises and their failures.

- AI tools for the history of science, including handwritten text recognition and transcription, transcription of oral sources, parsing and structuring of catalogues, correspondence and observational records, translation, and corpus- scale analysis with critical attention to accuracy, verification and error.

- The impact of AI on the activities of historians of science, including teaching and assessment, publishing, peer review, authorship and research integrity.

- Scientific collections as training data, and the consequences of digitisation choices for what AI systems can and cannot 'know' of the scientific past.

- Archival silences, including the underrepresentation of women and others outside scientific elites and the ways machine-readable corpora may reproduce, amplify or help remedy to them.

- The responsibilities of memory institutions as intermediaries between the scientific record and the systems now trained upon it.

Please submit proposals (not exceeding 300 words, including a biographical note of c.50 words) for 15-minute papers to library@royalsociety.org by **18 October 2026**, with the subject line 'proposal for AI conference paper'. Selected papers will be considered for publication in *Notes and Records*.

Financial support will be available, based on need, to help speakers cover expenses related to attendance, including accommodation, transport and care costs. We welcome papers from all stages of research careers.

CALLS & EVENTS

International Society for the History, Philosophy and Social Studies of Biology, 18–23 July 2027, Buenos Aires, Argentina

ISHPSSB invites submissions for its **2027 conference**. The ISHPSSB brings together scholars from various disciplines, including history, philosophy, and social studies of biology as well as life scientists. The biennial meetings are known for innovative, disciplinary and transdisciplinary sessions, and for fostering informal, cooperative exchanges and ongoing collaborations. Diverse formats are encouraged, as well as traditional sessions, individual talks and posters. Some hybrid participation will be possible. The society is keen to receive submissions from historians (as well, of course, as philosophers, sociologists and anthropologists) of biology and biomedicine, broadly understood.

Submission **deadline** is **15 October 2026**.

CALLS & EVENTS

Max Planck Institute Summer Academy Science Imagines Its Future

Organizers: Lorraine Daston (MPIWG/University of Chicago), David Kaiser (Massachusetts Institute of Technology), and Erika Milam (Princeton University)

The Max Planck Institute for the History of Science (MPIWG) seeks ten Early Career Fellows (graduate students, postdocs, assistant professors or the equivalent) to participate in two summer academies to be held in Berlin on June 14–18, 2027 and June 26–30, 2028, with the support of the Balzan Foundation.

Early Career Fellows will be given the opportunity to present their own work at the Summer Academies as well as to interview senior scholars and scientists on the topic. They will also play a central role in planning the second Summer Academy in 2028. Travel and accommodation costs will be covered.

Applications should be submitted by **November 1, 2026**.

Full details: **HERE**

CALLS & EVENTS

Conference: Objectivity across the Sciences The Hong Kong University of Science and Technology, 23–25 June 2027

Submissions welcome for abstracts for the conference “Objectivity across the Sciences,” to be held on 23–25 June 2027 at The Hong Kong University of Science and Technology.

Keynote Speakers

Stephen John (University of Cambridge) Inkeri Koskinen (University of Helsinki) Jan Sprenger (University of Turin)

Objectivity is an important topic in the philosophy of science with implications for many debates, including scientific confirmation, scientific realism, measurement, values in science, and theory choice. However, defining scientific objectivity is not easy. Its meaning varies radically from different contexts. Objectivity can be a property of a product of science (e.g. scientific claims), or of a process of science (e.g. scientific methods). It can also be a virtue or ideal of scientific practice. This conference aims to examine the notion of objectivity across the natural and social sciences. In particular, it will scrutinise the nature, role, and significance of objectivity in scientific practice. Questions to be addressed include but are not limited to:

Selected papers will be included in an edited volume to be published by Springer (part of the Asian Studies in the Philosophy of Science).

For more information **HERE**

Submission Guidelines Please submit a 500-word abstract for blind review via Oxford Abstracts **HERE** by 31 December 2026.

Contact If you have any questions, please contact Qiyue Zhang **HERE**

CALLS & EVENTS

Workshop: Material Culture in the History of Physics, Deutsches Museum, Feb. 22-26, 2027

Applications are invited for the next international seminar on **Material Culture in the History of Physics** funded by the Wilhelm and Else Heraeus Foundation.

The workshop consists of a self-organized theoretical part, an essay part, and an attendance part, which will take place from **February 22 to 26, 2027 at the Deutsches Museum in Munich**.

Accommodation for five nights will be covered as well as travel expenses up to 100€ for participants from Germany, up to 300€ for students from Europe and up to 1000€ for students from overseas.

The seminar is aimed at M.A. and Ph.D. students in the history of science and physics as well as physics education. We would also like to encourage trainees in science and technology museums including respective university collections to apply.

For further details on the structure of the seminar, deadlines, etc., please see **HERE**.

OPINION

Opinion Page. Modelling and Thought Experimenting: Galileo on Falling Bodies*

PANAGIOTIS KARADIMAS, National and Kapodistrian University of Athens

Karadimas is a Lecturer at the Hellenic Air Force Academy and at the National and Kapodistrian University of Athens where he completed his undergraduate and graduate studies in history and philosophy of science and received his PhD degree. The thesis was titled *Scientific Explanation and Thought Experiments*, supervised by Prof.

Chrysostomos Mantzavinos and advised by Prof. Theodoros Arabatzis and Prof. Stavros Drakopoulos.

His books include: *The Covid-19 Pandemic: A Public Choice View* (Springer 2023), *Rethinking Health and Well-Being: A New Philosophical and Methodological Framework* (Springer 2026), *Thought Experiments, Models and Scientific Explanation* (Springer 2026).

His papers include: 'The Epistemic Impossibility of Economic Calculation' (*Synthese* 2023), 'Endogeneity in Climate-Econometric Modeling: Epistemological and Normative Implications' (*Journal of Environmental Economics and Policy* 2024), 'The Act of Voting: A New Challenge for Behavioral Economics'. (*Economic Affairs* 2025), 'St. Petersburg Paradox, Personality and Military Decision-Making' *Constitutional Political Economy* 2026)

Introduction

In my book *Thought Experiments, Models and Scientific Explanation,* (Karadimas 2026) I made the case that thought experiments are basically indistinguishable from models and that both can be conceptualized as mingled representations, i.e. as representations that entail content that is at once hypothetical and empirical. I moreover argued that this representational schema is capable of giving scientific explanations for it carries scientific information that can be explanatorily relevant in context.

In order to evaluate explanations, we can use a lexicographic structure whereby the representation with the most relevant piece of information can be ordered higher in the ranking. The book excerpt below applies this framework to Galileo's famous thought experiments on falling objects. Galileo offered a hypothetical scenario on falling bodies which, even though is taken to be central to modern physics, it has never been considered as an explanation (at least in the field of philosophy of science).

Galileo's mingled representations—typically taken to be a "thought experiment" in the relevant literature—are therefore examined and presented anew here. It is shown that Galileo's account can offer explanations under several contexts once its representational strategies are considered. The explanations it provides are compared with other competing theories, and mainly with Aristotle's theory and a lexicographic ordering is offered in each case. Moreover, philosophical approaches that explicitly preclude the possibility of Galileo's thought experiment to explain are addressed and it is argued that the opposite conclusion is to be drawn.

Galileo's Case Study

Two concerns should be tackled when we examine case studies in science: first, why do we need case studies by and large, and second, why do we need the case study in question. As for the first, it seems obvious that case studies can make a philosophical stance specific, so we need them for illustration purposes. Indeed, a case study serves as an exemplar and shows how a philosophical theory finds a detailed application and they are thus often necessary. This is important for philosophers of science, for the branch cannot simply discuss philosophical concepts without exploring whether they bear resemblance to science.i

As for the second though, the answer should be given on a case-by-case basis, for it cannot be said in advance which accounts should be used for illustration and which have to be excluded from the discussion. Widely discussed scientific examples that seem to have reached a standoff, may lead to unexpected conclusions when examined in a new framework. The converse also holds: Neglected projects or accounts not considered at all may either trigger philosophical and scientific insights or may provide proving ground for clarification or for application of theories, of concepts and of philosophical ideas.

I would like here to discuss the well-known Galileo's account on falling bodies which is typically considered a "thought experiment" while sometimes many call it a "model" too. But since it is "well-known" and hence widely discussed, one may doubt the need to examine it further. Indeed, the characterization "widely discussed" is an understatement for this construction since scholars have elaborated on itii and it is actually the first thought experiment that springs to mind whenever we come to discuss thought experiments in science.

As indisputable as it is that many philosophers have used it in defense of their own philosophical accounts, no one, at least to the best of my knowledge, has examined it in view of its representational strategies and of the possibility to offer explanations through them. In fact, quite the contrary has happened: Lipton for example argues that Galileo's thought experiment does not provide explanation but only understanding (Lipton 2009).

I obviously take issue with this view and a case study on this thought experiment is the best way to show first and foremost how Galileo's thought experiment can provide explanations and also to oppose Lipton's and others' non-explanatory view of thought experiments.

Galileo's representational mingling can explain events in the sense that it can address why-questions under certain contexts. But Galileo's mingled representations cannot be examined on their own right. Galileo questioned Aristotle's theory on falling objects, so Aristotle's theory and its consequences will inevitably be part of this case study. I will start with a presentation of the main aspects of Aristotle's cosmology and more especially with his views on falling bodies. I will then present Galileo's thought experiment in terms of its representations and of how they can be used as an explanatory relevance relation.

Aristotle's Theory

Aristotle famously constructed the geocentric model according to which the earth is stable and the planets, as well as the sun, rotate around it. Aristotle discriminated conceptually between the Earth as an astronomical object that stands motionless at the center of the universe and the earth as an element (γῆ). Four elements have a special role in Aristotle's cosmology: the Earth (γῆ), the Water, the Air and the Fire. In fact, Aristotle regarded all bodies of the universe as a mixture of these four elements in different proportions. So, a stone contained mostly the element of earth (γῆ) and in lesser quantities the other three elements.

All these elements have moreover a tendency to reach their natural place: Since Earth (as an object) already resides at the center of the universe, then a stone reaches the bottom of it and similarly does water. The Air and the Fire on the contrary, are moving away from the center. Thus the heavier elements, such as the Earth (γῆ) and the Water move downwards and the lighter ones move upwards. Corollary to this is that that the objects consisted mostly of Earth (γῆ) and Water must seek to reach their natural place at the center of the universe i.e. the center of the Earth (the object).

Aristotle held that heavy objects fall faster than lighter ones. For example a heavy stone falls faster than a lighter one and this is to be put down to the greater proportions of the element of Earth (γῆ) that the heavy ball is consisted of. This part of Aristotle's physics is mainly presented in the work *On the Heavens* where he declares that a given weight moves a given distance in a given time; a weight which is as great and more, moves the same distance in a less time, the times being in inverse proportion to the weights. For instance, if one weight is twice another, it will take half as long over a given movement (Aristotle, 1908, 10).

But apart from the weight of an object he regarded the resistance of the medium through which it falls as a factor determining its speed. For example, a stone should fall faster in the air than in the water. Thus the speed of a falling object has been directly proportional to its weight and inversely proportional to the falling medium i.e. the resisting force. As Holton and Brush put it, one can think of the weight of the object and the resistance provided by the medium as two opposing forces. There is motion only if the weight exceeds the resistance and the greater the weight in proportion to its resistance, the greater the speed.

Aristotle's theory leaves no room for the existence of vacuum. In fact it seems that the existence of vacuum is inconceivable. This is not an arbitrary assessment but it was based on the following rationale: if the density of the medium vanishes, then according to the postulate that the speed is inversely proportional to the resisting force, then a

heavy object would have to fall in vacuum with infinite velocity which does not happen and so vacuum is not even a possibility.

From a modern perspective, this may seem absurd, though according to Aristotelians it was exactly that anomaly that consolidated their view that vacuum simply cannot exist (Holton and Brush 2005, 78-79).

This is a brief overview of Aristotle's physics with special attention given to his theory of falling bodies. Aristotle offers a well-grounded empirical theory which unsurprisingly prevailed for centuries. However, several limitations have been pinpointed over the centuries and most emphatically by Galileo.

Galileo's Representational Mingling

Galileo was not the only scientist who criticized Aristotle's theory and he was not even the first one,iii though admittedly is the most prominent among the critics. The best part of his criticism is developed through his mingled representations on falling objects. In this construction, Galileo not only debunks Aristotle but also proposes his own theory on falling objects.

Galileo presented his thought experiment in his *Two New Sciences* (Galileo 1638/1952) through a dialogue. This is a linguistic representational tool and is the unique one since both the *–of* representation and the *–as* representation are represented almost exclusively by it, with the exception of some numbers that occasionally split in the text.iv

He portrays three fictitious persons and two of them *as* representing the theses *of* real-world persons. The third one is an imaginary figure who, as it has happened with Darwin's demon and Maxwell's demon, it has certain features attributed to it by Galileo.

There are three interlocutors which are: Salviati, who presents Galileo's opinion, Simplicio who is an Aristotelian and Sagredo who is neutral and has been attributed the feature of being a philomath. The disagreement between Salviati and Simplicio reflects Galileo's opposition to Aristotle.

We saw that Aristotle predicts that heavier bodies fall faster than lighter ones and that their falling speed is directly proportional to their weight and inversely proportional to the resisting force i.e. the medium. Galileo's spokesman, Salviati, calls us to imagine a heavy body, say a heavy stone, to fall in the air with 8 degrees of speed and a lighter stone to fall through the same medium with 4 degrees of speed. If we join them together we have an even heavier stone which is expected to fall with more than 8 degrees of speed in the air. But the lighter stone will partly retard the speed of the heavier and the heavier will partly speed up the lighter. Therefore this bigger stone moves slower than the first heavy ball. So, from the initial postulate that heavy balls fall faster than lighter ones we conclude that heavy bodies fall slower than lighter ones.

It seems therefore that Aristotle's main prediction "the speed of fall is proportional to its weight" leads to a situation according to which the mass of a body is independent of its falling speed (Galileo 1638/1952, 63), which is incompatible with Aristotle's physics. The representation *of* how bodies behave is expressed by a fictitious person i.e. Salviati. So, Salviati presents the observational results according to which bodies of different weights fall at *almost* the same time through the same mediumv or even do not fall at all, as it happens for example when a piece of wood, say a plank, is placed in the water. It does not sink even though it falls rapidly through the air (Galileo 1638/1952, 64-65, 69).

These results, as presented by Galileo's representational mingling, provide a serious challenge to Aristotle's view that the speed of a falling body is proportional to its weight and inversely proportional to the resisting force.

Salviati then asked what would happen if we eliminate the effects of the resisting force. He argues that in such a scenario all bodies would *all fall at the same speed regardless of their weight*. Galileo's *–as* representation therefore involves as well a hypothetical condition in which no medium intervenes. Other forces that act upon bodies, such as air friction, are to be imaginary and no more taken into account. To gain a better grip on the counterfactual rejection of an intervening medium we should consider this to be Galileo's response to the slight differences in the speed of falling bodies, as those were observed in nature. vi

Koertge wittily conceptualizes Galileo's attitude towards the resisting force, by claiming that the differences in the speed of falling bodies were in fact "accidents" (and hence not trustworthy data). Friction or resistance for example, hinder and

impede the motion of falling bodies and if we are to attain knowledge about falling bodies such accidents should be abstracted away from our picture (Koertge 1977, 392). These accidents therefore were due to the resistant medium. And as Galileo observed, the less dense the medium is, the slightest the difference in speed turns out to be. Thus in the air heavier bodies fall faster than lighter ones but only in the narrowest of margins and not proportionately to their weights.

Notwithstanding these vexing minor differences in the speed of falling bodies, Galileo seems to have been convinced that we are led inexorably to think how bodies would move should they be free of all resisting forces.vii Such a state of affairs that was excluded formally from Aristotelian physics and so had been the conclusion that all bodies fall at equal speed.

Woodward's Pathway

One way to view Galileo's account is through James Woodward's theory of counterfactual causality (Woodward 2021). That is, it can be used to explore possible causal connections in the world. As we just saw, Galileo's bashing of Aristotle's physics hinges on the paradoxical conclusion that Aristotle's premises lead us to.

The core of Aristotle's theory can be translated in Woodwardian terms of variables. So, let:

- Variable *W* be Aristotle's statement: "The speed of a falling body is proportional to its weight"

- Variable *M* be Aristotle's statement: "The speed of a falling body is inversely proportional to the resisting force provided by the medium"

- Variable *H* be Aristotle's conclusion that "Heavier bodies fall faster"

Thus we have - $W+M \rightarrow H$

Recall now that the best part of Woodward's theory of explanation demands that we should be looking for invariant relationships between variables. A variable is invariant if it remains stable when other variables are altered. Galileo first altered *W*. In fact, he denied *W* based on the Aristotelian paradox that it is not always the case that heavy bodies fall faster than lighter ones. He then changed the value of *M* by counterfactually assuming that *no medium interferes* and hence there is no resisting force to check the speed of the falling body.

Galileo's conclusions can be presented in terms of variables:

- *S*: "The speed of falling objects is not proportional to their weight"

- *V*: "Bodies fall in vacuum and thus there is no resisting force"

We are in a state in which Galileo altered both the Aristotelian variables *W* and *M* and replaced them with *S* and *V* respectively. The question is: Do the variables $S+V$ lead to *H*? Galileo says no. Since bodies fall in vacuum, then there is obviously no resisting force and thus the resisting force no more determines the speed of the objects. Thus the relation $W+M$ no longer leads to *H* and hence *H* is not an invariant variable.

Galileo's thought experiment therefore replaces *H* too. If $S+V$ hold, nothing impedes free fall and we are led to variable *S'*:"all bodies fall at the same speed regardless of their weight".

In brief we have:

1) $W+M \rightarrow H$ *2) S* instead of *W 3) V* instead of *M* 4) *H* no more stands 5) If *S* and *V* is the case, then *S'* holds.

We see therefore that this thought experiment can be treated as demonstrating whether causal relationships in the world are to be established or disputed. While this is a useful philosophical tool to approach Galileo's account, it does not show how really an explanation is achieved, because it does not answer a why-question that is related to a context, it simply showcases that the variable that "heavier bodies fall faster than lighter ones" does not remain stable if we alter the premises upon which it was based, which, on its own, does not suggest that we have an explanation.

To see precisely how Galileo's thought experiment explains, we need to pick up on its representations and how the information they carry could be relevant to diverse contexts.

Falling Bodies and Why-Questions

The first task is to present Galileo's mingled representations in propositional form and to describe the piece of information that the mingled propositions bear and then to bring examples of why-questions that they may answer. We have already seen that Galileo's representational tools are not abundant since his *of/as* representations take

place almost solely through linguistic representational tools. However, his representational mingling (*RM*) is informationally rich. It involves the following set of linguistic representations:

Rmi={*ma,…,mn*}, Rmii={*ma',…,mn'*}, Rmiii={*ma",…,mn"*}, Rmiv={*ma"',…mn"'*} whereby their content is:

Rmi={*ma,…,mn*}: The weight of a body is irrelevant to its acceleration. *Rmii*={*ma',…,mn'*}: The thinnest the resistant medium is, the less it impedes the speed of falling objects. *Rmiii* ={*ma",…,mn"*}: Bodies in vacuum, have no resisting force to obstruct their motion. Rmiv={*ma"',…mn"'*}: Bodies falling in vacuum, being free of any resistant force, will fall exactly at equal speed.

These seem to be the most scientifically interesting linguistic representations of this representational mingling. Of course, one may find other mingled representations in Galileo's dialogues which can as well explain events. But I shall restrict my attention to these four. We can take some examples of why-questions to see the extent to which these representations bear relevant information.

In what follows, I will treat these mingled representations as competing answers that all strive to explain the same explanandum and add Aristotle's theory as a competing explanation, to see under what contexts Galileo's representations are more sound than Aristotle's theory and vice versa.

One example entails another theory on falling objects, the one offered by Rabinowitz, in a context whereby it is lighter bodies that fall faster. A lexicographic ordering will be structured to represent the hierarchy in each context. All of Galileo's representations can in principle answer why-questions depending on the information each one of them bears. In other words, they are in principle explanatory and in principle relevant when why-question on falling objects are raised. Whether they are moreover explanatory relevant is determined by the context.

Rabinowitz shows that there are settings in which lighter bodies fall faster than heavier ones. To visualize the context, consider three spheres of masses M>m2>m1 and let the central force interaction act upon them. Let the three masses be in a straight line with M (the earth) an equal distance between m2 and m1 (this would be like dropping m2 and ml simultaneously from equal heights at opposite poles of a spherical earth.) When let go, the three bodies accelerate toward their common center of mass (CM). Since the CM of the system is between the centers of M and m2, m2 will have a shorter distance to fall toward the CM. Since M moves towards m2, M moves away from ml. Thus ml will have a longer distance to fall than m2 to reach M or the CM.

Therefore relative to M, one might be tempted to think that the heavier mass m2 will fall faster than m1. However, all three bodies must reach the CM at the same instant or the CM would move, which is not allowed. Since the lightest mass ml has to go the farthest distance to reach the CM, it must go the fastest relative to the CM. Thus relative to a point fixed in space (the CM) for 3 bodies, the lighter body falls faster that the heavy body for bodies falling concurrently from opposite ends of the earth.

As Rabinowitz states, the fact that lighter bodies fall faster in such a context does not suggest that Einstein's equivalence principle is violated for gravitational and inertial masses are equal and the lightest mass ml goes the fastest in the center of mass three-body system because it is acted by both M and m2, whereas m2 is acted on by both M and ml. The case remains even if the three bodies are not collinear (Rabinowitz 1990, 34-38).

Say now that we ask the question: "Why do lighter bodies fall faster than heavier ones?", under such a context. This question is raised in a context where the measurements of the speed of each body happen not relative to one of the other bodies, but relative to a point fixed in space, the center-of-mass of the system (Rabinowitz 1990, 34-38).

Clearly, the representational mingling bears information that is not explanatory relevant to the topic and hence it fails to explain this and so does Aristotle's theory. Thus under such a context none of these explanations becomes explanatory relevant despite the fact that they are both in principle relevant and in principle explanatory.

Fischbach et. al. (1986) reanalyzed the results of Eōtvōs experiment and they observed some data anomalies that led them to the assumption that there must be some fifth force that causes some lighter objects to fall faster than some heavier ones. Their analysis seems to be closer than any other

explanation proposed so far and even though it does not fully explain, it needs to be ranked higher in the ordering than the other two.

However, since their assumption that there is a fifth force remains undocumented (at least as far as I am concerned), it appears that we cannot claim that the purported fifth force provides an explanation of the fact that under some contexts lighter objects can fall faster and it is I think appropriate to search for an explanation whose information is compatible with the explanatory indexicals of the context.

Such an explanation is offered by Rabinowitz himself who puts the issue down to the fact that "the lightest mass ml goes the fastest in the center of mass three-body system because it is acted by both M and m2". Let the scientific context to bear propositions in principle explanatory and in principle relevant to our explanatory context which are represented by a collection of sets:

- *S* that includes: Galileo's account (*A*), Aristotle's theory (*B*), Fischbach's et.al. reconstruction of Eotvos experiment (C) and Rabinovitz discussion of the issue (D), and explanatory indexicals

- *Ik* { *Ik1, Ik2, Ik3,… Ikn*)

We have made Rabinovitz's account as explanatory relevant which leaves the other possible explanations as in principle relevant.

Second in the ordering comes Fischbach's hypothesis on the fifth force,viii third Galileo's mingled representations and fourth Aristotle's theory. Galileo's construction is ranked higher in the ordering because in this context the equivalence principle is presumed, a postulate which is not within Aristotle's cosmology. So, we have *Ik1* : *D>C>A>B*.

Suppose now that we ask: "Why do heavier bodies fall faster than lighter ones?". The topic of this question is that heavier objects do fall faster. This question makes sense only under a context of resistant media i.e. under the context of the common atmospheric conditions, as known in earth. This question has two in principle relevant answers. The one is Aristotle's i.e. heavier bodies fall faster since their speed of fall is proportional to their weight and inversely proportional to the resisting force.

For example, Rovelli (2015) praises Aristotle's physics and claims that when new theories arrive, we should not necessarily see them as rejecting altogether the old ones, but as building upon them while restricting their scope of applicability at the same time. He holds that Aristotle's theory has advantages and disadvantages as Newton's and Einstein's theories have.

That is, Aristotle is still right in certain respects in the same way Newton and Einstein have been right and conversely he is wrong in the way Newton and Einstein can be found wrong. He thus concludes that his theory is by no means irrelevant to the later developments in physics and that we can speak of an old theory in modern terms.

Thus, when it comes to explanation and we are working under a context of intervening media, Aristotle is right, in the sense that heavier objects do fall faster, even though the speed is not proportional to its weight and inversely proportional to the resisting force. At face value Aristotle's theory is explanatory relevant and Galileo's account in principle relevant.

My takeaway is that this is the case if we take Galileo's representations as *–of* ones and not as mingled ones i.e. if we treat it, as modern physicists do, as an empirical theory. In that case, as Rovelli mentions, Aristotle's theory is more relevant than Galileo's and, as I say here, it is placed higher in the ordering.

However, if we analyze the representational strategies of Galileo's thought experiment and the information these mingled representations bear, we may end up with a different lexicographic ordering because we will see that a second almost equally strong answer is offered. The one that is given from Galileo's *Rmii*={*ma',…,mn'*}representation i.e. that heavier bodies fall faster but their speed is not proportional to their weight it is just impeded by the resistant medium and the less dense the medium is the less it impedes the motion.

Thus heavier bodies fall only slightly faster than lighter ones. Therefore, the explanatory indexicals (such as facts about terrestrial conditions) make *Rmii* explanatory relevant while Aristotle's theory is ranked second and remains in principle relevant. *Ik1* : *Rmii> B*

The conflict between Galileo's and Aristotle's approaches appears when one asks "Why does a stone weighting 5kg fall with greater speed in the air than in the water?" under a context in which these media impede the motion of objects. Again, Aristotle is in principle relevant since his theory

predicts that the same body falls faster in the air than in water. Galileo's mingling puts forward one more time *Rmii*={*ma'*,…,*mn'*} which is also in principle relevant. The explanatory indexicals here make *Rmii* explanatory relevant because it is a fact that air is thinner than water and so it is more relevant to say that water impedes much more the motion than the air. So again we have: *Ik1* : *Rmii*> *B*.

Consider now the question "Why is the motion of bodies not obstructed?" The context of this question cannot be that of the terrestrial environment. This question would be raised under context of no resistant force or under a context in which only gravity acts upon them i.e. presumably in the laboratory during an experiment. Here *Rmiii* ={*ma"*,…,*mn"*}seems to fit and to explain the topic by stating that bodies in vacuum have no resistant force. Thus vacuum explains the absence of impediments to the motion of objects. Rmiv={*ma'"*,…*mn'"*}is also a possible candidate since it bears information relevant to vacuum and to falling bodies.

However, some pedantry is needed here in order to distinguish between *Rmiii* and *Rmiv*. Even though *Rmiv* does bear information relevant to vacuum and to falling bodies, we are by no means interested in falling bodies when we ask: "Why is the motion of bodies not obstructed?". We are simply interested to know the reason that enables bodies to move free of any resistance and *Rmiii* proposes vacuum as an explanation without any irrelevant reference to falling objects. Thus it is the explanatory indexicals i.e. the fact that vacuum exists in that context that makes *Rmiii* explanatory relevant and *Rmiv* in principle relevant. The ordering in that context goes as follows: *Ik1* : *Rmii*> *Rmiv*> *B*.

Now assume that we ask "Why do bodies fall at exactly the same speed?" Of course this question makes sense in a context where bodies fall in vacuum, such as in experimental settings. Then Rmiv={*ma'"*,…*mn'"*}seems to be a preferable explanation since it gives special information relevant to vacuum and to its effect on falling bodies. Thus *Ik1* : *Rmiv*> *Rmiii*> *B*.

Hopefully these examples show how Galileo's mingled representations and the linguistic representations they offer bear sets of information which can be used to explain particular events i.e. to answer why-questions and how it performs when competing explanations appear, such as, among others, Aristotle's theory.

The context under which a why-question emerges makes clear which is the task at hand i.e. for what kind of information we are looking for and which representation bears information that better satisfies it. Thus a proposition that explains very well another proposition under one context may fail to explain it under another.

Galileo's thought experiment (as well as Aristotle's theory which appears as a competing explanation) gives representations whose information can be used in diverse contexts and can be favored against other in-principle explanatory and in-principle relevant propositions but they can also fail to explain and thus remain in principle relevant under other contexts.

Conclusions

Galileo's thought experiment manifests itself through mingled representations which can be treated as explanations that answers why- questions. The mingled representations Galileo uses bear information able to offer answers to why-questions under certain contexts. Different contexts require different piece of information and thus the representations Galileo offers can give

Endnotes

i At the same time, caution is required for, as scholars have argued, it is not a foregone conclusion that by discussing case studies, all philosophical or scientific uncertainties are resolved (Scholl & Sauer 2016).

ii Koyre (1943; 1968) should be credited as the first who stressed Galileo's inclination to thought experiments by describing him as a Platonist shcolar. For discussion on Galileo's thought experiment on falling bodies see (Atkinson and Peijnenberg 2004; Brown 1991; 2000; 2004; Camilleri 2015; Gendler 1998; McAllister 1996; Norton 1991; 1996; Oh 2014; 2016; Palmerino 2018; Palmieri 2005; 2018).

iii Philoponus for example, in his commentaries on Aristotle's physics, conceived as problematic the Aristotelian postulate that the speed of fall is

proportional to its weight (Philoponus 1887). For further discussion on Philoponus see (Cohen and Drabkin 1948).

iv See for example (Galileo 1638/1952, 74, 97). I follow Crew's and de Salvio's translation which has not amended the original representations, as they were first presented in Galileo (1638).

v See Galileo who criticizes Aristotle by offering several empirical representations. According to Galileo (masked up as Salviati), an iron ball of ten hundred pounds falling from a height of one hundred cubits reaches the ground before a one-pound ball has fallen a single cubit. Salviati says that they arrive at the same time.

You find, on making the experiment, that the larger outstrips the smaller by two finger-breadths, that is, when the larger has reached the ground, the other is short of it by two finger-breadths; hence we need not hide behind these two fingers answers only relevant to particular contexts. In some cases they do explain very well, whereas in other some of them may be only in principle relevant or even explanatorily irrelevant. No matter how successful the explanations may turn out to be, it can barely be denied that it is in principle able to offer explanations since its representations carry scientific information and appear to perform fairly well under several contexts.

the ninety-nine cubits of Aristotle and miss the general conclusion according to which Aristotle was mistaken (Galileo 1638/1952, 64-65). vi McAllister when discussing Galileo's commitment to thought experiments makes an interesting point by mentioning that if the phenomenon is so subtle that no concrete occurrence can be produced in which the phenomenon can be produced in accident-free form, the phenomenon may be displayed only in an abstract occurrence: that produced in a hypothetical representation, as part of a thought experiment. This view explains why Galileo, in the case of some phenomena, withdrew from the sphere of sense data (McAllister 2004, 1168). vii Galileo describes in some detail the impact the falling medium has in each case on falling objects and to make his counterfactual case without any intervening media. He claims that when we are trying to investigate what would happen to movables very diverse in weight in a medium quite devoid of resistance, so that the whole difference of speed existing between these movables would have to be referred to inequality of weight alone. Hence just one space entirely devoid of air-and of every other body, however thin and yielding-would be suitable for showing us sensibly that which we seek. Since we lack such a space, we better observe what happens in the thinnest and least resistant media, comparing with what happens in less thin and more resistant.

If, Galileo' argument goes, we find in fact that movables of different weight differ less and less in speed as they are situated in more and more yielding media, and that, finally, despite extreme difference of weight, their diversity of speed in the most tenuous medium of all, though not a perfect vacuum, is found to be very small and almost inappreciable, then we are justified in believing it highly probable that in a vacuum all speeds would be entirely equal (Galileo 1638/1952, 64-65, 69, 72). viii In case a fifth force becomes a credible scientific proposition the ordering can be altered since the

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* This Opinion Essay is a preprint of the following work: Karadimas, P. Thought Experiments, Models and Scientific Explanation, 2026, Springer. It is the version of the author's manuscript prior to acceptance for publication and has not undergone editorial and/or peer review on behalf of the Publisher. The final authenticated version is available online at: https://doi.org/10.1007/978-3-032-16145-1 "

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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.

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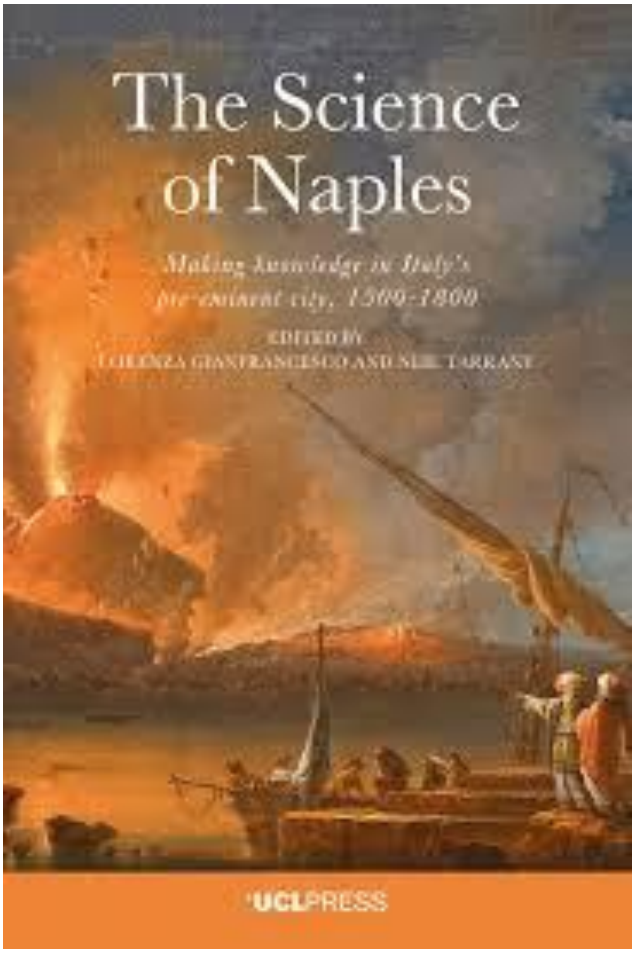
PUBLICATIONS

Featured Open-Access Book

Lorenza Giannfrancesco & Neil Tarrant (eds) *The Science of Naples: Making knowledge in Italy’s pre-eminent city, 1500-1800*, UCL Press, 2024.



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PUBLICATIONS

Recent HPS&ST Related Books

Baldwin, M. (2026). *In referees we trust? How peer review became a mark of scientific legitimacy*. Cambridge, MA: The MIT Press. ISBN 9780262054744. [Open Access]

"*In Referees We Trust?* investigates the origins of the peer review system, a system that is often considered the essential mechanism that protects the trustworthiness of scientific research. Melinda Baldwin traces the first refereeing systems to journals affiliated with scientific societies in the early nineteenth century and follows refereeing as it spread from Britain to the United States. She finds that the refereeing system was not immediately embraced by all scientific journals; many institutions deliberately eschewed refereeing and were not seen as less reliable because of that choice.

"The book shows that the modern link between peer review and scientific legitimacy was forged during the Cold War, as legislators and other government stakeholders began to question the need for scientists' advice on how to award federal grant money. Scientists argued that if grant money was awarded without their expert opinions—in other words, without review by a grant applicant's scientific peers— the US government would be violating a core principle of science itself. That argument was so successful that the idea of "peer review" as a cornerstone of science took hold and spread, elevating peer review from an optional process to a system intended to ensure the quality and trustworthiness of all of science." (From the Publishers)

More information HERE

Brooks, R. (2026). *Darwin and the queer origins of life: A history of sex and science*. New Haven, CT: Yale University Press. ISBN 9780300287202.

"What did Darwin and Linnaeus really think about sex? In print, their descriptions of animal courtship painted a comfortingly traditional picture: males were belligerent show-offs, females were choosy and skittish, and the two came together in unions

curiously akin to human marriage. But in truth, the forefathers of evolutionary science were acutely aware that this was not the whole story. The reality was far more messy and ambiguous.

“In this iconoclastic history, Ross Brooks shows how queerness was at the heart of evolutionists’ thinking about the natural world. From hermaphroditic slugs and sex-changing birds to male pigeon lactation, pregnant male seahorses, and bisexual pigs, Darwin and his fellow naturalists were privately in awe of nature’s sexual diversity. These encounters fundamentally shaped their understanding of plants, animals, and humans, even if they were never fully acknowledged in their published writings.

“Brooks radically exposes us to the hidden queerness of Georgian and Victorian science— and shows how nature has always been more sexually diverse than we’ve been told.” (From the Publishers)

More information HERE

Dunmur, D. (2026). *The man upstairs: Frederick Lindemann, scientific adviser to Winston Churchill*. Oxford, United Kingdom: Oxford University Press. ISBN 9780198966425.

“As a scientist and politician, the life story of Frederick Lindemann provides a unique insight into the impact of science on the most dramatic period of Europe's history: the development of the atomic bomb and two catastrophic world wars. Lindemann was a professor of physics at the University of Oxford from 1919 to 1954, as well as a close friend and adviser to Winston Churchill. Being a former pupil of Niels Bohr, one of the pioneers of quantum theory, and having previously worked with Albert Einstein, Lindemann was personally acquainted with some of the greatest physicists of the twentieth century. He was admitted to the House of Lords in 1941, during the Second World War.

“*The Man Upstairs: Frederick Lindemann, Scientific Adviser to Winston Churchill* explores the science and politics of Lindemann during a period of the most consequential developments in science, from the identification of quantum theory to the cataclysmic discovery and use of atomic weapons. Raised in England by a German father and American mother, Frederick's teenage and university education was in Germany.

“He later returned to England after his early career in Berlin was disrupted by the First World War, and his youthful sentiments were split between his Germanic origins and loyalty to his adopted home. These internal conflicts developed into a hatred of Germany and a tortured personality which dominated his dealings with others in his social and professional life.

“Lindemann's time at university in Berlin was interrupted by the onset of the First World War, but he used his scientific contacts to secure an academic position at the University of Oxford in 1919. Here he became attracted to the highest circles of English society. He was the only Oxford professor to have a chauffeur- driven Rolls Royce, and soon became a close friend of Winston Churchill. As Churchill's science guru, Lindemann was increasingly involved in politics leading up to the Second World War and, following the onset of hostilities, became a member of the War Cabinet. Here, his life in science defines the perspective, and Lindemann's contributions to science are critically examined, including some contemporary opinions which have heralded him as ‘the most influential scientist of the 20th Century.” (From the Publishers)

More information HERE

Evangelista, L. R. (2026). *The history of early and classical physics*. Cham, Switzerland: Springer. ISBN 9783032206527. [Textbook]

“This textbook takes readers on a comprehensive journey through the history of physics, highlighting key discoveries that not only deepened our understanding of the natural world but also enabled humanity to master it. Beginning with the ancient civilizations of the Fertile Crescent, Egypt, and India, the exploration then moves to the Greek intellectual revolution, where early thinkers like the Pre-Socratics and scholars of Alexandria laid the foundations of scientific thought. It examines Aristotle’s early theory of motion and the first attempts to understand the cosmos.

“The medieval period is explored through two major themes: the persistence of motion and the Principle of Inertia, from Aristotle to Galileo, and the motion of the heavens, culminating in Copernicus’ radical shift. Bridging the medieval and modern eras, the book focuses on the period between Copernicus and Newton, delving into the works of Kepler, Galileo, Descartes, Huygens, and

Newton. The journey culminates with the Newtonian Synthesis, encapsulating centuries of inquiry into a unified framework.

“This textbook is designed for a one-semester history of physics course and serves as a foundational resource for introductory courses in the history and philosophy of science. It’s also suitable as supplementary material for students in biology, chemistry, mathematics, and related fields, as well as for philosophy and humanities courses at both undergraduate and graduate levels. The content is structured for a standard four-hour weekly course but can also be adapted for graduate programs in humanities-related fields.” (From the Publisher)

More information HERE

Harpham, G. G. (2026). *The ends of race: The rise and fall of a scientific myth*. Princeton, NJ: Princeton University Press. ISBN 9780691291628.

“The attempt to define the concept of race in the eighteenth and nineteenth centuries is often described as a corrupt “pseudo-science,” but in this strikingly original account, Geoffrey Galt Harpham describes the inquiry into race as a serious scientific project undertaken by some of the leading figures of the time. In a “skeletal history” of this project, Harpham tracks the rise and fall of racial science, focusing on the central role played by craniology, or the study of skulls, in key debates in Germany, the United States, and France.

“Emerging at the end of the eighteenth century as a way of thinking about human variation, the concept of race became entangled in an extraordinarily wide range of scientific, philosophical, theological, and political debates about issues ranging from the place of humanity in the natural world to the rationales for colonization and slavery. But at the end of the nineteenth century, a number of prominent scientists came together to announce the failure of the century-long attempt to define race or even to locate racial markers in the human body—only to see the concept taken up by others, including W.E.B. Du Bois, who sought to preserve the concept as essential to the nonscientific ends of solidarity and identity.

“With this probing and vivid narrative account of the scientific inquiry into human variation, Harpham provides a new way of approaching the history of race, introduces a host of previously little-known figures, explores the larger contexts and inner dynamics of the discourse on race, and questions the ends that the concept of race serves today.” (From the Publishers)

More information HERE

Horwitz, A. V. (2026). *Darwin’s descendants: Evolutionary theories of human behavior and their critics*. Baltimore, MD: Johns Hopkins University Press. ISBN: 9781421455204

“Evolutionary explanations of human behavior have been perennial sources of contention ever since they originated over 150 years ago. In *Darwin's Descendants*, Allan V. Horwitz traces the debates that began with Darwin's earliest critics and shows how similar tensions animate conversations in classrooms, laboratories, and public culture today.

“Rather than treating biological and sociocultural explanations as rival camps, Horwitz examines how each perspective highlights different aspects of the traits, instincts, and norms that shape human life. Through vivid cases that reveal the interplay of inherited predispositions and cultural forces, he shows how instincts such as incest avoidance and emotional expression are behaviors with deep evolutionary roots.

“Other patterns, including the cultural celebration of courage or the dramatic decline in fertility across modern societies, reveal moments when social values outpace biological tendencies. Still others, such as widespread obesity or contemporary expectations around physical attractiveness, emerge from intricate mismatches between ancient adaptations and twenty-first-century environments. Across these examples, Horwitz shows how conflicts over human evolution have continually reflected concerns about morality, politics, gender, and identity.

“*Darwin's Descendants* explains why evolutionary frameworks attract both enthusiastic supporters and sharp detractors, and why questions about nature and culture remain so charged more than a century and a half after the publication of *On the Origin of Species*. Horwitz presents a compelling account of how biological and cultural explanations converge and diverge as we seek to understand ourselves.” (From the Publishers)

More information HERE

Jay, M. (2026). *Wireheads: An unnatural history of technology in the brain*. New Haven, CT: Yale University Press. ISBN 9780300278880.

"As humanity and technology become ever more tightly interwoven, Wireheads explores the final and most intimate frontier: the brain, and the electronic devices, magnetic signals, implants, and computer interfaces that promise to merge it with the world of the machine. Will these technologies eventually direct our thoughts and behaviour—or are they doing so already? Will they maintain us in states of artificial bliss, or connect us to higher intelligences, or replace the world of our senses with simulated realities?

"Mike Jay, acclaimed author of *Psychonauts*, now traces the tangled, paranoid history of these real and fantastical brain technologies. From the fictions of H. G. Wells and Philip K. Dick to *The Matrix*, the CIA's Cold War experiments and Elon Musk's Neuralink, scientists and visionaries have long chased the dream of neural enhancement and control, with wildly varying degrees of success.

"Encompassing covert military operations and psychedelic art, moral philosophy and cybernetic theory, Jay has assembled a thrilling narrative out of our attempts to understand and rewire the brain—and a brilliant meditation on what it means to be human in a posthuman age." (From the Publisher)

Klein, A. (2026). *Earthly models: Ethnographic encounters in interdisciplinary sustainability research.* Bielefeld, Germany: transcript publishing. ISBN 9783837683769.

"Models of floods, disease, lakes, and fish don't arrive ready-made – they're patched together from code, data, software, theory, habits, and disagreement. Anja Klein follows that patchwork in action through fieldwork with two interdisciplinary research groups: a project in Accra tracking diarrhea and flood risk under climate change, and a Stockholm- based group building simulation models of social-ecological systems. How do materiality, difference, and complexity get handled in the daily work of modeling? What gets to be included and what is left out and why?

Moving between ethnography and equations, the study traces moments of frictions and surprise that shape what a model can or cannot say about the world. In a grounded account of ›earthly modeling‹, the volume shows the potential of working across ethnography and simulation for knowing better our planet in crisis." (From the Publishers)

More information HERE

Pievani, T. (2026). *Multiplicity: A scientist's journey into evolutionary space*. Cambridge, MA: The MIT Press. ISBN 9780262054638.

"In 1976, a young engineering student from Princeton, Frances Arnold, happened upon Jorge Luis Borges's short story "The Library of Babel" while in Madrid. The tale recounts a vast honeycomb of a library that contains all the answers to the mysteries of humanity. Little did Arnold know that the story would change the course of her life—and the course of science.

"In *Multiplicity,* Telmo Pievani explores her journey and the significance—and scientific potential—of Borges's legendary library and others like it. The famous evolutionist John Maynard Smith, for instance, had fantasized about the existence of a similar enormous library full of proteins rather than books. And in 1995 the philosopher of mind Daniel Dennett would devise a library no less confounding: one that collects all possible genomes, or all possible combinations of the nucleotide bases of DNA. Why? Because by comparing all the proteins, genomes, and plants and animals that exist and have existed throughout evolution, what is finally revealed is possibility—what doesn't exist but could.

"For Arnold, the concept of such a library ultimately led to the discovery of the directed evolution of enzymes: a way of using nature's own method to produce new and better enzymes. The revolutionary idea transformed protein chemistry and biotechnology and earned her the Nobel Prize in Chemistry in 2018. With literary echoes ranging from Borges to Italo Calvino, this slim book tells her brilliant story." From the Publishers

More information HERE

Rashed, R. (2026). *Ibn al-Haytham: The emergence of scientific modernity*. Abingdon, United Kingdom: Routledge. ISBN 9781032323497.

"*Ibn al-Haytham: The Emergence of Scientific Modernity* offers the first comprehensive monograph on one of the most brilliant figures of the medieval intellectual world.

"Spanning his groundbreaking contributions in mathematics, optics, astronomy, and natural philosophy, this book portrays Ibn al-Haytham as he was seen in his own time: a man of universal learning whose methods, sources, and intellectual reputation resonated far beyond his era. Moving beyond the familiar terrain of his Kitāb al-Manāẓir (Book of Optics), it places his achievements in a much wider context, examining his lesser-studied writings on geometry, mechanics, and scientific method.

Through a systematic analysis of these works, the book demonstrates how Ibn al-Haytham's experimental rigor, mathematical formalism, and critical engagement with earlier Greek and Arabic sources foreshadowed core principles of the European Scientific Revolution. It shows how his insistence on verification through observation and reasoning forged a distinctive approach that inspired thinkers from medieval Cairo to Renaissance Europe.

"An essential resource for historians of science, Islamic studies scholars, and anyone interested in the intellectual foundations of modernity, this volume restores Ibn al-Haytham to his rightful place as a pioneering figure in the history of ideas and a bridge between classical learning and the birth of modern science." (From the Publisher)

More information HERE

Verhaegh, S. (2026). *Logical Positivism: An American History*. Oxford University Press. ISBN: 9780197537961.

"*Logical Positivism: An American History* tells the remarkable story of a group of European philosophers and scientists who fled fascism and reshaped American philosophy. Drawing on extensive archival materials, it traces the conflicted reception of their ideas—at once hailed as a model of scientific clarity and condemned as a sterile and reductive approach to philosophy.

"Rather than treating logical positivism as a purely European export, this book argues that it was a product of transatlantic exchange. It reconstructs the rise of an American network of scientists and philosophers whose ideas were defined by twentieth-century revolutions in logic and physics; and it shows how their encounters with European émigrés gave rise to a new 'analytic' conception of philosophy that has dominated the field ever since.

"Combining narrative reconstruction with innovative digital humanities methods, this book illuminates the intellectual, institutional, and cultural conditions that enabled logical positivism's ascent. It offers a fresh perspective on the history of U.S. philosophy, showing how

a movement defined by global crises and intellectual controversy became engrained in American thought and philosophical practice." (From the Publisher)

More information HERE

Shoshitaishvili, B. (2026). *Our planetary mirror: Earth science and the reimagining of humanity*. Chicago, IL: University of Chicago Press. ISBN 9780226852140.

"How can we explain humanity's unique relationship to the Earth? In Our Planetary Mirror, cultural theorist Boris Shoshitaishvili considers the three major ways earth scientists have answered this question in recent years: the noosphere (humans as a layer of thought and culture covering the earth), the Anthropocene (humans as a geological force), and the Gaia hypothesis (humans as part of a superorganism comprising life on Earth).

"To explore how these concepts extend beyond contemporary science, Shoshitaishvili traces the metaphors at the heart of each framework through their ancient predecessors, including Babylonian myth, Greek philosophy, Aztec metaphysics, and medieval European theology. Using this approach, Shoshitaishvili develops fresh responses to pressing global issues such as geoengineering, artificial intelligence, and the balance between cosmopolitanism and a world of intensified nationalism." (From the Publishers)

More information 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.js.mauricio@uac.pt) for inclusion in these sections.

PUBLICATIONS

Metascience Journal, Current Issue Contents

Metascience is a review journal which publishes high quality, comprehensive reviews of books in the fields of history and philosophy of science, and science and technology studies.

Editor-in-Chief: Gregory Radick, School of HPS, University of Leeds

Because many of the books reviewed in *Metascience* are of interest to readers of the HPS&ST newsletter, as a service to readers, the Contents of current issue (35 no.2) are reproduced here.

BOOK SYMPOSIUM

Public Engagement with Science: Defining the Project by Angela Potochnik and Melissa Jacquart, with commentaries by Karen Kovaka, Elis Jones & Sabina Leonelli, and Roger Highfield, plus a response from the authors

REVIEWS AND ESSAY REVIEWS

David Ludwig, "Western science: obituary for an awkward label?" (Reviewing *Is science Western?: an inquiry* by Gregory W. Dawes)

Ahmed Aarab, "Challenging decline narratives about the sciences in Islamic societies" (Reviewing *The sciences in Islamicate societies in context: patronage, education, narratives* by Sonja Brentjes)

Norah Woodcock, "Who taught Aristotle about women?" (Reviewing *Aristotle's gynecology: facts, evidence, and early medicine* by Mariska Leunissen)

Michael Bycroft, "What is the point?" (Reviewing *The world as we know it: from natural philosophy to modern science* by Peter Dear)

Ofer Gal, "The institutional geography of science in early modern London" (Reviewing *Metropolitan science: London sites and cultures of knowledge and practice, c. 1600-1800* by Rebekah Higgitt, Jasmine Kilburn-Toppin and Noah Moxham)

Luca Sciortino, "The long shadow of Vico's *Verum Factum* principle" (Reviewing *Vico and the maker's knowledge tradition: praxis and history* by Maurizio Esposito)

Adrian Wilson, "There was no such thing as the Enlightenment and this is a book about it" (Reviewing *The Enlightenment: an idea and its history* by J.C.D. Clark)

Mark V. Barrow, "Tracing extinction's long shadow" (Reviewing *The great auk: its extraordinary life, hideous death and mysterious afterlife* by Tim Birkhead and *Vanished: an unnatural history of extinction* by Sadiah Qureshi)

Sophie Forgan, "'True to myself': Tyndall as public intellectual and polemicist" (Reviewing *The correspondence of John Tyndall, volume 13*, edited by Michael D. Barton et al. and *The correspondence of John Tyndall, volume 14*, edited by Gowan Dawson et al.)

Joris Mercelis, "Chemistry and biography: the view from the middle" (Reviewing *Fifth business* by William H. Brock, *Albin Haller* by Erik Langlinay, and *The papers of Thomas Edison, volume 10*, edited by Paul Israel et al.)

Kristin Johnson, "Mutationist utopias" (Reviewing *The arrival of the fittest: biology's imaginary futures,1900–1935* by Jim Endersby)

Alper Bilgili, "From Dayton to the world: science, religion, and the politics of public controversy" (Reviewing *Science, religion and nationalism* edited by Jaume Navarro and Kostas Tampakis, and *The hundred years' trial* by Alexander Gouzoules and Harold Gouzoules)

Graeme Gooday, "Engineering the modern world" (Reviewing *An engineered world: the role of engineers in global modernity* by Edward Beatty and Israel G. Solares)

Venkatram Harish Belvadi, "Climate and concrete: new perspectives on the Anthropocene" (Reviewing *Climate changed: models and the built world*, edited by Mara Freilich et al.)

Qiyue Zhang and Yafeng Shan, "A long and winding road: Kuhn's evolving philosophy of science" (Reviewing *Thomas Kuhn: From physics to philosophy of science* by Juan V. Mayoral)

Paul E. Griffiths, "In praise of Mary Hesse" (Reviewing *Mary B. Hesse (1924–2016): metaphors, models and the growth of scientific knowledge*, edited by Pietro Gori)

Roger Deulofeu Batllori, "Methods as the hidden engine of science" (Reviewing *The engine of scientific discovery: how new methods and tools spark major breakthroughs* by Alexander Krauss)

Alexandra Karakas, "Is the cost of new knowledge the risk of error?" (Reviewing *Towards the philosophy of error in science* by Douglas Allchin)

Matthew J. Maxwell, Aja Watkins and Andrew Zeppa, "Many methods, many aims: evaluating methods in the philosophy of science" (Reviewing *Methods in the philosophy of science: a user's guide*, edited by Sophie J. Veigl and Adrian Currie)

Raimund Pils, "Scientific realism beyond the single world" (Reviewing *Towards a new scientific realism* by Jan Voosholz)

Subrena Smith, "The case for biological individuality as evolutionary individuality" (Reviewing *The units of life: kinds of individual in biology* by Ellen Clarke)

Campbell Rider, "Biological individuality and autonomy: is eukaryote evolution a problem of functional integration?" (Reviewing *Functional integration: a theoretical enquiry into the biological unit of the individual* by Guglielmo Militello)

Sam M. Scheiner, "Genes, environment, nature, nurture and plasticity: multidisciplinary analyses" (Reviewing *Beyond Lamarckism* by Laurent Loison, *Plasticity in the life sciences* by Antonine Nicoglou, and *Beyond nature and nurture* edited by Javier Pérez-Jara and Íñigo Ongay)

Lisa Gannett, "Race, biology, and society: what diversity does" (Reviewing *The uses of diversity: how race has become entangled in law, politics, and biology* by Jonathan Kahn)

Sam Fellowes, "Schizophrenia, perspectivism and competing perspectives" (Reviewing *The divided mind: a new way of thinking about mental health* by Edward Bullmore)

Roger Smith, "Living the high life" (Reviewing *On drugs: psychedelics, philosophy, and the nature of reality* by Justin Smith-Ruiu)

Douglas Allchin, "Science Studies, public understanding of science, and the long shadow of teleology" (Reviewing *Trusting science* by Kostas Kampourakis and *How we get Mendel wrong, and why it matters* by Kostas Kampourakis)

Qianrong Gong and Angela Potochnik, "An organizational lens on science denial" (Reviewing *Organized science denial: an action plan for solutions*, edited by Elena Bruni and Lianne M. Lefsrud)

K. Brad Wray, "Cole's *Smoother pebbles* rocks" (Reviewing *Smoother pebbles: essays in the sociology of science* by Jonathan R. Cole)

Eva Jablonka, "The thoughtful humanist's guide to science" (Reviewing *Science and humanism: knowledge, values, and the common good* edited by Anjan Chakravartty)

Metascience Open Access articles (57) **HERE**.

PUBLICATIONS

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 so that 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 not be timely 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

21st in the series:

Duschl, Richard A., Hamilton, Richard & Grandy, Richard E.: 1990, 'Psychology and Epistemology: Match or Mismatch when Applied to Science Education?', *International Journal of Science Education* 12(3), 230-243. Reproduced in R.A. Duschl & R.J. Hamilton (eds.) (1992) *Philosophy of Science, Cognitive Psychology, and Educational Theory and Practice*, State University of New York Press, Albany, NY.

Cognitive psychology's descriptions of an individual's knowledge resemble those philosophers' offer of scientific theory. Both offer resources for conceptual change teaching. Yet the similarities mask tensions - philosophers stress rationality and psychologists focus on causal structure. Both domains distinguish two kinds of change in knowledge structures-one common and cumulative, the other rare and noncumulative. The structures facilitate incremental development but resist major revisions. Unless instruction actively induces restructuring, students' knowledge will be confused and incomplete. Knowledge is largely organized by schemata, representing the significant concepts and relations in a domain. But using knowledge also requires procedures for recalling, applying and revising schemata.

Available **HERE**

Readers are welcome to send suggestions, including appropriately-aged own-papers, with bibliographic detail plus pdf file, for the Golden Oldie Award to the Editor.

READING

Good Reads: Galileo and the Needham Question

It is anticipated that each newsletter issue will feature a particular *Good Read* paper; namely one with wide relevance to research and debate in the HPS and ST communities. Being a *Good Read* does not mean conclusions have to be agreed with, or there are no faulty steps in the argument, or an author's particular interpretations cannot be disputed. But a *Good Read* needs be clearly written, well informed, and on a topic interest to a wide spread of HPS and ST scholars. The paper will be archived on the HPSST website.

The inaugural (and repeated) *Good Read* paper is:

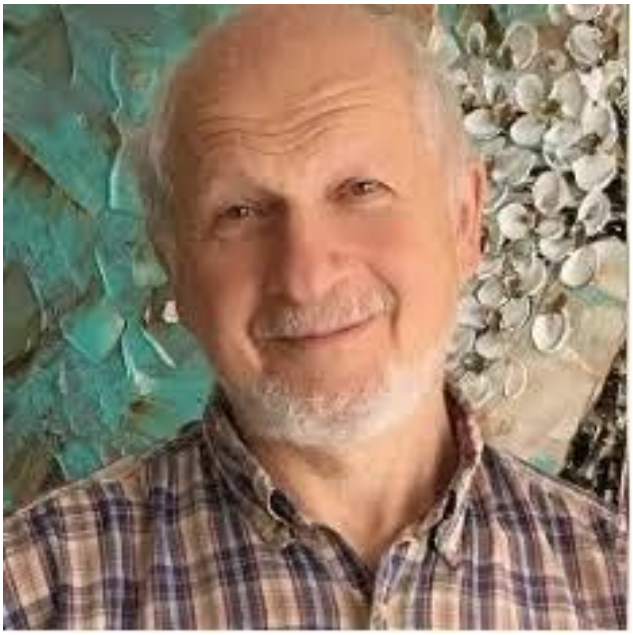
Gorelik, Gennady: 2017, 'A Galilean Answer to the Needham Question', *Philosophia Scientiæ* 21(1),

ABSTRACT To make the Needham question answerable it is extended thus—What hindered Greco-Roman and Medieval science from making the next major step after Archimedes, and what hindered Eastern scientists from contributing to modern physics for centuries after Galileo? To answer this question the key distinction between modern physics and pre-Galilean science is suggested: the right to invent "illogical" fundamental concepts which can be verified by experiments. This right is based on the belief that the Universe is governed by hidden fundamental laws which Man is capable of knowing about. The source of this belief was the biblical worldview which became the basis for European cultures by the time of the Scientific Revolution thanks to book printing and the Reformation.

The paper can be downloaded from *Philosophia Scientiæ* 21(1). Since its beginning in 1996, *Philosophia Scientiæ* has been a peer-reviewed and open-access research journal. It is also archived and downloadable on the HPSST site **HERE**

Gennady Gorelik was born in the Ukraine (1948). He studied physics at Moscow State University being awarded the PhD with a dissertation on 'the interaction of physics and mathematics in forming modern concepts of spatial dimensionality'.

He turned to researching the history and philosophy of Soviet physics. In 1993 he gained a position in Boston University's Centre for the History and Philosophy of Science and wrote substantial biographies of important Soviet physicists: Matvei Petrovich Bronstein (1994), Lev Landau (1997) and Andrei Sakharov (1999). Not surprisingly, this research and writing could be more freely and better done in the USA than in the USSR.



Gorelik's Needham paper canvasses two core subjects in HPS: What was Galileo's distinctive contribution to the Scientific Revolution? And: Why did modern science not take firm root in China until some three centuries following its creation and promotion in Europe? The latter is widely, and correctly, known as the Needham Question.

For science teachers, answering the first question is an important part of understanding the nature of science (NOS), a topic increasingly written into national and provincial science curricula. The second question raises important socio-cultural-philosophical-political issues that recur in debates about multicultural science and the appropriate recognition of indigenous beliefs about nature, sometimes referred to as *ethnoscience*.

One discussion of the Needham Question in science education is Chap.10 of M.R. Matthews (2019), *Feng Shui: Teaching About Science and Pseudoscience*, Springer, Dordrecht. The book is downloadable **HERE**.

Suggestions for future *Good Read* papers are most welcome. Please send bibliographic, accessibility, connections to wider issues and such details of the the newsletter editor.

CALLS & EVENTS

Coming HPS&ST Related Conferences

September 14-15, 2026, Law-based Explanations Conference, London School of Economics Details: **HERE**

November 4-6, 2026,Teaching Science & the Arts: International Symposium, University of La Manouba, Tunis Details: **HERE**

November 5-6, 2026, History of Alchemy and Chemistry Conference, Munich Details: **HERE**

November 19-22,2026, PSA Annual Meeting, San Diego. Details: **HERE**

January 25, 2027, Robert Boyle 400th Anniversary Conference, Royal Society of Chemistry, London Details: Professor Michael Hunter at m.hunter@bbk.ac.uk.

February 22-26, 2027, Workshop: Material Culture in the History of Physics, Deutsches Museum, Details: **HERE**

June 23-25, 2027 Objectivity across the Sciences The Hong Kong University of Science and Technology, Details: **HERE**

July 18-23, 2027. International Society for the History, Philosophy and Social Studies of Biology (ISHPSSB). Biennial congress, Buenos Aires, Argentina. Details: **HERE**

August 23-28, 2027, Congress for Logic, Methodology, and Philosophy of Science and Technology (CLMPST), Kobe, Japan Details: HERE

NETWORK

HPS&ST Related Organisations and Websites

AAAS Section L (HPS) - American Association for the Advancement of Science, Section L, (HPS)

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

MJHoS - Midwest Junto for the History of Science

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)

SHOT - Society for the History of Technology

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

NETWORK

HPS&ST NEWSLETTER PERSONNEL

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Assistant Editor (Publications & Website)	Paulo Maurício