HPS&ST Note
August 2019

Introduction

This HPS&ST monthly note is sent to about 7,900 individuals who directly or indirectly have expressed 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 and more engaging and effective teaching of the history and philosophy of science. The note 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 20+ years.

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

The Note, along with RESOURCES, OBITUARIES, OPINION PIECES and more, are lodged at the website: **http://www.hpsst.com/**

NARST 2020 Conference: Strand 13 (HPS) Submissions (August 15)

The coordinators of Strand 13 of the NARST programme are pleased to invite participation of readers in the NARST2020 Annual International Conference to be held at Portland, USA, on March 15-18, 2020. The proposal submission deadline is **August 15th**.

https://www.narst.org/annualconference/2020conference.cfm

The NARST **Strand 13** is dedicated to historical, philosophical, and social issues of Science and Engineering as related to education. As the Strand 13 Coordinators, we seek to broaden and deepen the voices and perspectives present at the Strand 13 sessions. Therefore, we encourage the submission of proposals with a focus on history, philosophy and sociology of Science and Engineering in the context of:

- Formal and informal learning environments
- Teacher education and teacher professional development

We also encourage you to review for Strand 13, to attend our strand meeting and contribute to our discussions.

If you have any questions, please do not hesitate to contact us.

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IHPST Life-Time Achievement Award to Fabio Bevilacqua

The 15th International IHPST conference took place at the Aristotle University of Thessaloniki, July 15-19, 2019. It was a successful conference organized by Fanny Seroglou and enthusiastic colleagues and students. There were 135 participants from 30 countries; 150 papers were presented; and 3 plenary lectures given.

Details of the 16th conference were announced: July 4-8, 2021, University of Calgary. Conference chair: Glenn Dolphin (glenn.dolphin@ucalgary.ca).

The third IHPST Life-Time Achievement Award was presented by Pierre Boulos (IHPST President) to Fabio Bevilacqua of Pavia University. Recipients of first and second awards had been Michael Matthews (University of New South Wales) and Ian Winchester (University of Calgary).

Fabio Bevilacqua was born in Naples in 1948, after an education based on history, Latin, ancient Greek and literary and philosophical "classics", he graduated with honours in electrical engineering in 1972 with a thesis on the alternative interpretations of unipolar induction by Lorentz and Einstein. Interested in the 'two cultures' problem and in the difference between standard (normal) and advanced (extraordinary) textbooks, from 1973 to 1974, with a scholarship from the *Domus Galileiana* of Pisa, he worked in history and philosophy of science under Ludovico Geymonat at the Department of Philosophy of Milan University.

Pierre Boulos & Fabio Bevilacqua

In 1975 he won a five years research contract at the Department of Theoretical Physics at Pavia University (founded in 1381) and in 1978 with three scholarships (National Research Council and Accademia dei Lincei), began three years of research at Cambridge University where he completed a PhD in History and Philosophy of Science, on the role of the principle of conservation of energy in electromagnetism, under Mary Hesse and Gerd Buchdahl.

In 1981 he became a tenured researcher, in 1987 an associate professor of History of Physics and in 2001 a full professor of history of science at the "A. Volta" Department of Physics in the Science Faculty of Pavia University, where he was elected head of Department (2000-2003).

His main effort has always been to shift from a “conservative” teaching to an “innovative” one, that is to teach alongside “normal” science also important aspects of “extraordinary” science (scientific debates). This led to a personal development of Holton’s and Buchdahl’s three components schemes into a four component one (principles, models, mathematics, experiments) to understand and explain both the static and dynamic aspects of scientific theories.

The lack in the seventies of an institutional framework for this sort of research led to a commitment to build one, locally in Pavia, nationally and internationally. In 1980 he organized a national Conference in Pavia on History of Physics in Education that triggered in 1981 the foundation in Pavia of the *National Group of History of Physics* (1981-94), later to become the *Italian Society of History of Physics and Astronomy* that this year will hold its 39th annual conference. In 1983 he held, with Peter Kennedy of the ICPE-IUPAP, his first international conference on *Using History of Physics on Innovatory Physics Education*. This triggered a series of similar conferences on history of physics and education (München 1986, Paris 1988, Cambridge 1990, Madrid 1992, Szombathely 1994, Bratislava 1996) and on history of physics (Como 1992, Berlin 1995, Paris 1997) and the foundation of the *Interdivisional Group of History of Physics of the European Physical Society* (1987).

Participation in the Tallahassee 1989 Conference organized by Ken Tobin, David Gruender and Michael Matthews resulting in the birth of the IHPST Group led these two trends to join in two parallel 1999 conferences in Como/Pavia on the occasion of the bicentenary celebrations of the invention of the battery by the Pavia Professor Alessandro Volta.

Fabio Bevilacqua has had roles in numerous international, national and local bodies: co-founder, member of the board (2004-2006) and President (2012-14) of the *European Society of History of Science*, vice-secretary (1997-2005) and vice-president (2005-2009) of the *Division of History of Science and Technology of the International Union of History and Philosophy of Science*; president of the *International History, Philosophy & Science Teaching Group* (1999-2001); founder and chairman (1987-1999) of the *Interdivisional Group of History of Physics of the European Physical Society*; for ten years (1986-1996) member of the Scientific Committee of the *Centre de Recherche en Histoire des Sciences et des Techniques de la Cité des Sciences et de l'Industrie - La Villette*, Paris; member of the Program Committee of the American Physical Society's Forum on the History of Physics (2013), member (2012-2018) and then chairman (2018-2019) of the *Scientific Advisory Board of the Max Planck Institute for the History of Science* of Berlin.

After forty years spent in Milano-Pavia in 2013 Fabio Bevilacqua retired to the Chianti area of Tuscany where he lives and renovates an old rambling farmhouse with his Australian wife Leitha who he met while she also was a Cambridge student, and whose inspiration and help have always been essential, and with his books and two dogs. Their two children, Alexander, an historian of ideas in the US, and Catherine, a human rights researcher, visit often, during their endless world vagaries.

Book Reviewing for the *British Journal for the History of Science*

The latest list of books received – up to June 2019 – by the *British Journal for the History of Science* for review, accessible through the link below. The topics are incredibly varied and

reflect the diverse and exciting scholarship emerging across histories of science, technology and medicine.

Please do contact me if any of these catch your eye and you are interested in writing a review for the journal. We are particularly keen to encourage postgraduate and early-career researchers to make contributions, and also warmly invite suggestions for double-book reviews and extended essay reviews.

https://www.cambridge.org/core/journals/british-journal-for-the-history-of-science/information/books-received

Very best wishes

Dr James Stark
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History of Electricity (A.K.T. Assis) Volume

The book:

A. K. T. Assis, *The Experimental and Historical Foundations of Electricity* (Volume 2, Apeiron, Montreal), 327 pages, ISBNs: 9781987980196 (softcover) and 9781987980202 (pdf).

is freely available in PDF format, in English, Portuguese and Russian, at:

http://www.ifi.unicamp.br/~assis/Electricity-Vol-2.pdf
http://www.ifi.unicamp.br/~assis/Eletricidade-Vol-2.pdf
http://www.ifi.unicamp.br/~assis/Electricity-in-Russian-Vol-2.pdf

This work deals with the most fundamental aspects of physics. The book describes the main experiments and discoveries in the history of electricity. It deals with attractions and repulsions, positive and negative charges, conductors and insulators, electrification by friction/contact/induction, the triboelectric series, electrification of adhesive tapes, distribution of charges in conductors, electric equilibrium and the instrument which indicates potential difference, electric shielding, the power of points, sparks and electric discharges in air, electrets and the temporal preservation of the electrification of bodies, the mysterious non-electrostatic forces, etc.

This work explains how to build several instruments: versorium, electric pendulum, electroscope, charge collector, circuit tester, electrophorus, the Leyden jar and capacitors, etc. We reproduce some experiments of Stephen Gray, Du Fay, Franklin, Volta, Kelvin, Faraday etc.

All experiments are clearly described and performed with simple, inexpensive materials. These experiments lead to clear concepts, definitions and laws describing these phenomena. Historical aspects are presented, together with relevant quotations from the main scientists. A large bibliography is included at the end of the work.

The printed book, in English, Portuguese and Russian, can be ordered through Amazon:

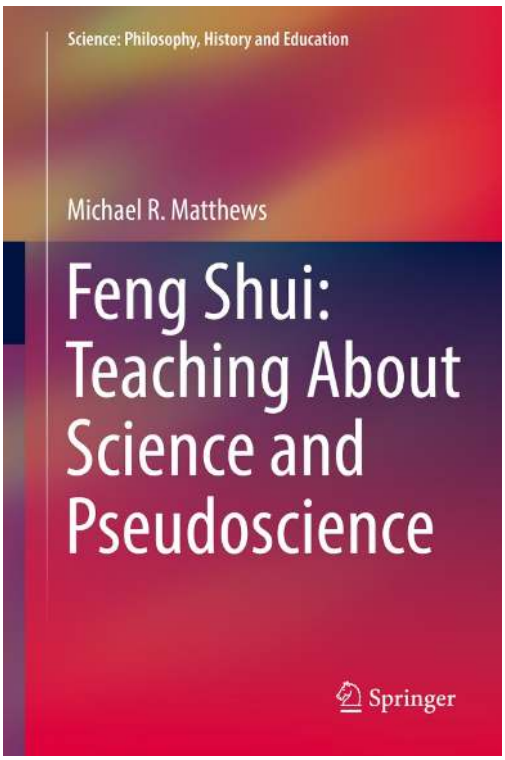
http://www.amazon.com/dp/1987980107
http://www.amazon.com/dp/1987980093
http://www.amazon.com//dp/1987980190

Feng Shui: Teaching About Science and Pseudoscience (Springer 2019)

This 14-chapter, 360-page book, complete with 840 references, provides a richly documented account of the historical, cultural, philosophical and practical dimensions of feng shui.

It argues that where feng shui is entrenched educational systems have a responsibility to examine its claims, and that this examination provides opportunities for students to better learn about the key features of the nature of science, the demarcation of science and non-science, the characteristics of pseudoscience, and the engagement of science with culture and worldviews.

The arguments presented for feng shui being a pseudoscience can be marshalled when considering a whole range of comparable beliefs and the educational benefit of their appraisal.



Feng shui is a deeply-entrenched, three-millennia-old system of Asian beliefs and practices about nature, architecture, health, and divination that has garnered a growing presence outside of Asia. It is an integral part of architecture and construction in nearly all south-east Asian cities and numerous cities around the world. It is part of a comprehensive and ancient worldview built around belief in chi (*qi*) the putative universal energy or life-force that animates all existence, the cosmos, the solar system, the earth, and human bodies. Harmonious living requires building in accord with local chi streams; good health requires replenishment and manipulation of internal chi flow; and a beneficent life for descendants is enhanced when folk are buried in conformity with local chi directions. Traditional Chinese Medicine is based on the proper manipulation of internal chi by acupuncture, tai-chi and qigong exercise, and herbal dietary supplements.

Appraisals:

Matthews has produced another tour de force that will repay close study by students, scientists, and all those concerned to understand science, culture, and the science/culture nexus.
Harvey Siegel, Philosophy, University of Miami, USA

With great erudition and even greater fluidity of style, Matthews introduces us to this now-world-wide belief system.
Michael Ruse, Philosophy, Florida State University, USA

The book is one of the best research works published on Feng Shui. It opens up vast horizons for viewing science in new perspectives. It is an outstanding contribution to the fields of the history of science, philosophy of science and science education.
Wang Youjun, Philosophy, Shanghai Normal University, China

The history is fascinating. The analysis makes an important contribution to science literature.
James Alcock, Psychology, York University, Canada

This book provides an in-depth study of Feng Shui in different periods, considering its philosophical, historical and educational dimensions; especially from a perspective of the 'demarcation problem' between science and pseudoscience.
Yao Dazhi, Chinese Academy of Sciences, China

By broadening the context of HPS&ST *research to Chinese culture, this book is an important resource for science curriculum designers, teacher educators, researchers and teachers.*
Sibel Erduran, Education, University of Oxford, United Kingdom

A terrific book. It cogently explicates how fengshui is a pseudoscience, and why it is of momentous importance in teaching about science and pseudoscience in our time.
Bangping Ding, Education, Capital Normal University, China

The book is an introduction to the fruitful topic of feng shui for science educators and science teachers who have interests HPS and STS.
Chen-Yung Lin, Education, National Taiwan Normal University, Taiwan

Michael R. Matthews, *Feng Shui: Teaching About Science and Pseudosciene,* Springer 2019 (xx+340 pp, 840 references), ISBN 978-3-030-18821-4

Contents and details at:

https://www.springer.com/gp/book/9783030188214
(20% discount code: **bAR5MHyHqm55qyX**)

IHPST Latin America Regional Conference (2018) Abstracts

The proceedings of the 4th IHPST-Latin America Regional Conference (September 2018) have been published and are available at the conference website:

http://ihpstla2018.wixsite.com/brasil/proceedings-eng

Journal Thematic Issue: What are the Philosophical and Interdisciplinary Foundations of STEM Education?

Science & Education Journal invites papers investigating the interdisciplinary underpinnings of STEM (short for science, technology, engineering and mathematics) and STEM education. The interdisciplinary underpinnings can include historical, philosophical and sociological approaches. In recent years there has been increasing emphasis on STEM education in international curriculum and policy documents (National Science and Technology Council, 2013; The Royal Society Science Policy Centre, 2014). A key argument in the proposals for STEM education is that science, technology, engineering and mathematics workers play a pivotal role in economic growth and STEM education produces critical thinkers, scientifically literate professionals and citizens, and enables the next generation of innovators. The infusion of "engineering practices" in the Next Generation Science Standards in the USA signals curriculum policy level argument for STEM teaching and learning that integrates related domains to science teaching and learning. Furthermore, there has been plethora of journals, research centres and community organisations that have made STEM a central educational goal, and many funding agencies are supporting research and development efforts to make STEM education effective.

But what exactly does STEM mean? Is the concept of "STEM" authentic? Is there a particular nature to STEM or are there disciplinary variations across science, technology, engineering and mathematics? What are the epistemic, cognitive, cultural and social underpinnings of STEM and what do they imply for STEM education? The journal invites theoretical and empirical papers that address related questions that include but are not exclusive to the following:

- What are the community practices of professionals in STEM fields and what do these practices imply for STEM education?
- What is the impact of incorporating STEM practices in education on learners and teachers?
- What professional development programmes can be designed to improve pre-service and in-service teachers' understanding of the nature of STEM and STEM disciplines?
- What are the epistemological aims and values of science, technology, engineering and mathematics? Do these aims and values overlap or are they distinct in each discipline?
- Are the arguments for the collective and interdisciplinary teaching of science, technology, engineering and mathematics justified from an epistemological point of view?
- What informal learning opportunities are there to encourage understanding of the historical, philosophical and sociological accounts of STEM?
- What are the implications of potential epistemological variation in the STEM disciplines for teaching and professional development of teachers?
- What can scholarship in history, philosophy, sociology and related meta-perspectives on science contribute to policy studies on STEM education?

Editorial team
The following editorial team will manage the review process for this special issue:

Editor-in-Chief: Sibel Erduran, University of Oxford, United Kingdom
Associate Editor: Olivia Levrini, University of Bologna, Italy
Associate Editor: Maurício Pietrocola, University of São Paulo, Brazil
Book Reviews Editor: Gábor Áron Zemplén, Budapest University of Technology and Economic, Hungary

Deadline for submission of papers: October 30th, 2019

Submission procedure
Instructions for the preparation and submission of manuscripts can be accessed at the following website:

https://www.springer.com/education+%26+language/science+education/journal/11191?detailsPage=pltci_1060572

Proceedings of the International Congress on the History of Science in Education, Vila Real, Portugal

The Congress on History of Science in Education has held at Universidade de Trás-os-Montes e Alto Douro, Portugal, May 30-June1. There were 200 presentations and about 250 participants.

The 200pp Abstracts Book (Portuguese/English) is available at:

https://www.utad.pt/gform/wp-content/uploads/sites/25/2018/06/RESUMOS-ABSTRACTS.pdf

Opinion Page: *The Problem of Scientific Bias: The 1919 Astronomical Confirmation of Einstein's Theory* (Daniel J. Kennefick)

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Einstein is our preeminent modern sage. This enormous fame descended upon him as a result of the 1919 eclipse expedition, as Einstein himself admitted when he wrote, “The English expedition of 1919 is ultimately to blame for this whole misery, by which the general masses seized possession of me” (*Collected Papers of Albert Einstein*, vol. 13, doc. 1263). The great New Zealand physicist Ernest Rutherford concurred and later said to Arthur Eddington, “You are responsible for Einstein’s fame” (Chandrasekhar 1987, 115).

Arthur Eddington, Frank Dyson and Contrary Results

According to Subrahmanyan Chandrasekhar, who was present in the Senior Common Room of Trinity College, Cambridge, in 1933 when Rutherford said these words to Eddington, the context was some British dissatisfaction that Einstein’s fame exceeded that of Rutherford’s, even though Rutherford was the principal founder of nuclear physics. But such is the way of it. Rutherford himself, according to Chandra, attributed the drama of the eclipse expedition, with its message of postwar reconciliation, to Einstein’s sudden rise to great fame. Chandra goes on to quote James Jeans, who divided credit for the eclipse expeditions equally between Eddington and Frank Watson Dyson, the Astronomer Royal, on the occasion of Dyson receiving the Gold Medal of the Royal Astronomical Society.

Yet here too there was room for only one scientist’s name to remain in the public consciousness. Eddington, the founder of stellar astrophysics, quickly became the only name, besides Einstein’s, associated with the eclipse experiment. Interestingly, this tendency to ignore Dyson is even found among scientists and historians, who have wondered if Eddington’s alleged bias in favor of Einstein’s theory influenced the data analysis of the Sobral plates.

The Sobral photographic plates were taken in Brazil by Dyson's assistants from the Royal Observatory, Greenwich during and after the eclipse. Precise measurements of star positions on the plates were required to test Einstein's light deflection prediction. Modern criticism of their analysis has included multiple claims that the decisions taken at the time were influenced by Eddington's bias in favor of Einstein's theory. However archival evidence shows that these decisions were taken by Dyson, who did not share Eddington's views on General Relativity. Eddington had, in all probability, nothing to do with their analysis. His work was confined to analysis of his own plates taken on Principe.

If we do acknowledge that Eddington may have been biased, what does this mean? Can a biased person do good science?

To better understand the role of bias in experimental science, let us compare Eddington with other eclipse experimenters. Bias, after all, may be a widespread phenomenon. An obvious counterpart to Eddington is Heber Curtis, who performed the 1918 Goldendale experiment. Curtis was biased the opposite way from Eddington, against Einstein and for nineteenth-century physics. Perhaps, as a result, he reported his measurements as favoring the result that light is entirely unaffected by gravity. Is this evidence that science is often merely an expensive means of confirming one's own prejudices?

It is true that Campbell did not, in the end, feel that Curtis' data was good enough to publish and that later on, Campbell's own measurements of the 1922 eclipse favored Einstein. But this could be simply an example of the bandwagon effect. Undoubtedly, the existence of the British expeditions played a role in dissuading Campbell from publishing the suspect 1918 results, and working in 1922, he may have been concerned with replicating the result already made famous by previous expeditions. It is not just theory that can bias an experimenter. As anyone who has performed a laboratory experiment in school or college knows, one is expected to replicate the same result as others have done before. Recovering a different result may not be taken as evidence of an exciting new moment in science. It is more likely to be taken as evidence of an incompetent experimenter.

Experiments as Puzzle Solving

What scientists are trying to do, in performing an experiment, is get the right answer. In this respect it is like doing a crossword puzzle. Most of us know the right answer to a crossword puzzle will be published in the next day's newspaper and keep trying until we get it. Even if we do not have a copy of the relevant newspaper, we may ask a friend for the solution. We try to agree with the result that everyone else got. Similarly, engineers strive to make their devices perform exactly like all other devices of similar type. Research scientists do not have this luxury. If you are the first ever to perform an experiment, you do not know what the correct answer is. You are essentially trying to guess what answer others will get in the future and agreeing with that!

Undoubtedly, if no previous experimental results exist, there is a temptation to agree with theory. Indeed, this tendency is obvious in the 1919 team's presentation of their results. They repeatedly framed their experiment as being a choice between three theoretical possibilities. Logically, any result for the deflection of light might have been possible, which Eddington himself acknowledged when he wrote, "It is easy to calculate that the total deviation [due to gravity] of [a material body] on passing the Sun, if it grazed the surface, would be 0.″ 87, or half the Einstein deflection. It may happen that the ratio of weight to mass for light is not the same as matter. If so the deflection will be altered in the same proportion. The problem of the eclipse may, therefore, be described as that of *weighing light*" (Eddington 1919, 121). But the theoretical issues at stake were of such significance that it made sense to frame the experiment in such a way as to highlight its theory testing aspect.

Of course, theory often plays an essential role in science. It was theory that predicted the size of the effect. Had theory predicted a much larger gravitational deflection of light, Eddington and Dyson would have approached the experiment differently. Had theory predicted a much smaller deflection, they would never have embarked upon it at all. Theory must guide

experiment because otherwise we would not know which experiments are interesting and achievable! In fact, had Einstein not pointed it out, most twentieth-century astronomers would never have believed that the Sun's deflection of light could even exist.

Finally, let us compare Eddington with Dyson. Dyson's case is different from Eddington's but not because he was neutral. That must be rare. Normally, the very fact that you are performing an experiment at all is because you expect a non-null result. No one went to the trouble of hauling equipment to an eclipse before Einstein came on the scene simply to prove that the stars do not change their positions because the Sun is nearby! Dyson was not neutral, but he appears to have changed his mind during the experimental process. He probably started out at least a little skeptical of relativity, like most astronomers, but he ended up confirming the theory. It is interesting that once he changed his mind, he exchanged one bias for another. For instance, he wanted to average the results from his two instruments to get an answer very close to Einstein's prediction.

Eddington had to persuade him that this was not kosher. Here we see the desire to let theory guide you to the right answer in its purest form. Dyson had no prior bias toward Einstein's theory, but once he decided in Einstein's favor, he was reasonably anxious to let the theory guide him. If you know that your error bars are large and that others will perform more exact experiments later, you may feel anxious for vindication in the future by coming as close as possible to the right result now. Theory is sometimes your only guide as to what that right result might be! And of course, once Dyson had nailed his colors to Einstein's mast, he knew his own reputation was bound up with Einstein's because Campbell's results would render a verdict not only on Einstein's theory but also on Dyson's previous experiment. So he breathed a sigh of relief when it seemed as if no "shadow of doubt" remained about Einstein's prediction, as he wrote to Campbell. Once that happened he canceled plans to repeat the test.

Communication and Appraisal is Essential for Science

Even realists, who believe that science is telling us how the world really is, must acknowledge that we do not have some inborn ability to comprehend the physical world. It takes great acquired expertise to perform scientific experiments. Unfortunately, it is of little use for these experts to do their work without telling the rest of us. By definition, the knowledge they gain about the world must then pass through society to become commonly accepted. If scientific ideas are memes, then we must accept that successful memes are not true— they are simply often repeated. Is it possible that we simply make the science that fits our preconceptions?

It is not that simple, but we can say that we do not live in a world where we are born knowing about atoms but have trouble communicating with each other. Instead, we are born into a world with little correct knowledge about its workings but with excellent abilities to communicate with each other. Science is, by necessity, a social enterprise. Only the people who have performed the difficult experiments have empirical knowledge of the way the world really is. In 1920 only Eddington and a few others had personal knowledge of whether starlight is really affected by the Sun's gravity. It follows that the rest of us must come to accept or reject Einstein's theory through social interaction with people who themselves have interacted with those who performed the measurements. For most of us, it is not observing photons move through spacetime that makes us trust Einstein's ideas. It is the way ideas move through society that makes us believe the "truth."

Ultimately, whether science is socially constructed or determined by the hard facts of reality is irrelevant. What we know is that the hard facts of reality are won with difficulty by people with unusual levels of expertise and skill. How those brave few convince the rest of us about the nature of reality is surely worthy of study, whether we are fooling ourselves about the laws of physics or whether we are on the right track. Indeed, if the social transfer of knowledge in our culture is such as to keep us on the right track, then it is all the more worthy of careful study! It is easy to assume that the study of reality must be straightforward, but it is not. Karl Popper alerted us to the difficulties of confirming a theory. While it is fine for Popper to say that we cannot prove a theory but we can falsify it, we must remember that in practice, falsifying theories is also problematic.

The fact that the light-bending experiment ceased to be performed after 1973 gives us a further clue about the way science is done. The dilemmas of research recede when experimental technology and technique mature.

Precision and the Eclipse Experiments

The eclipse experimenters, however, suffered from a peculiar malaise. Their precision failed to improve with time, undoubtedly because of the difficulties in repeating the experiment. Of course, some observers went to multiple eclipses, but the vagaries of weather and history mostly precluded them from obtaining more than one set of data. For instance, Freundlich traveled on at least six eclipse expeditions but only obtained data once. The 1973 team actually constructed a specialist observatory in the path of totality to try to overcome the problem of using transportable equipment. But they still fell afoul of the lack of repeatability when a technical problem that could have easily been fixed once discovered compromised their measurements.

In spite of it all, we have seen that science can progress even when scientists are handicapped by circumstances. But can it progress when they are biased? Progress in science is not guaranteed, and certainly, scientists sometimes change their minds, or have to backtrack. One can accuse many people in our story of bias, so why has Eddington attracted so much criticism over the decades? Primarily, it is because of his fame, of course, but also because he was perceived to have unscientific biases affecting this particular measurement. Some scientists are outraged, for instance, at the idea that he might have favored relativity because he sought reconciliation between English and German science after the war. But given how unpopular Eddington's antiwar views were, this accusation rings false to me. It is true that pacifism gained in popularity after the war as a reaction to its horrors, but this was not predictable in 1919.

There is a sense that Eddington is in the dock with Einstein on charges of behavior inappropriate for a scientist. Both are theorists accused of being too guided by theory and insufficiently respectful of the role of experiment. When Einstein pitied the dear Lord, who must put nature, his humble creation, to the test against the certainty of Einstein's theory, he reinforced the image of the cocksure theorist who disdains the humdrum work of experimental confirmation. Eddington also, during his career, played to the gallery in this way. Yet we know that Einstein worked hard to encourage astronomers to test his theory. He discovered the possible tests and calculated his theory's predictions. He published papers and wrote letters to leading astronomers to publicize what would need to be done. He

collaborated with Freundlich and others and helped raise funds for their efforts. He did everything practical that was required.

Eddington did all this and participated in the observational work. It seems strange that all of this practical involvement in the effort to test the theory is ignored, and we are instead confronted with a playful remark clearly meant in jest. This does not mean that Einstein would immediately have capitulated if Curtis and Campbell had published their 1918 results vindicating Newton's theory. He would have insisted that the theory was correct and that their experiment was wrong, and he would have been justified in doing so. Experimenters are sometimes wrong! It was only over the course of many years that it became clear that relativity's prediction of the light deflection was completely correct. But that does not mean the public were wrong to lionize Eddington and Einstein in 1919. A new result is exciting, even if we acknowledge the possibility that it could later be overturned. When it comes with the dramatic overthrow of a famous theory, it is all the more exciting.

Karl Popper's Epiphany

In this respect it was the fame of the 1919 eclipse experiment that created the problem. Karl Popper was so impressed by Einstein's willingness to put his theory to empirical test that it prompted his, perhaps too hasty, commitment to falsification as the demarcation criterion for science and pseudoscience. Popper's ideas have been highly influential, to the point where they now stigmatize a characteristic aspect of Einstein's approach to science. He was famous in his day for being willing, as a theorist, to challenge the validity of experimental results. He did so against early experiments that appeared to falsify special relativity and again against Dayton Miller's ether drift experiments. One lesson learned from modern science studies is that scientists fight hard for their beliefs. Science is not about being willing to drop one's beliefs at the first sign of trouble. In fact, it depends on advocacy because in the absence of advocates an idea may be prematurely discarded.

We should not show disdain at Eddington and Dyson's skill at artfully presenting their science to the public. It is mistaken to believe that the truth needs no advocate. This need for advocacy applies not only to the public but also within science. Of course, advocacy is often partial and biased. But that is the price we pay for having it. In this respect science is like a court of law. Failing to find an advocate for the innocence of the accused will merely condemn them to conviction. Points of view that are not argued for will go unheard and unconsidered. It was a good thing that a leading theorist was, unusually, involved in the 1919 eclipse expedition because without Eddington, the theorists' insight—that Newton's theory was no longer tenable in its original form—would not have been represented. Without Eddington the importance of the test might not have been properly recognized.

The only issue setting Eddington apart is that his hopes were related to a theoretical tool rather than an experimental one. He hoped that general relativity would prove itself and open up the vistas that Einstein's innovation of metric theories promised. One of the many roles of a theory is as a simple tool for theoreticians. Just as an experimenter may hope that an experimental result will vindicate the use of a favorite tool, so a theorist may hope for the same thing. We need to recognize that the theoreticians' art is just as important as the experimenters' and just as likely to evolve. In essence, Eddington was in that uncomfortable position of being between paradigms. The old worldview had been overthrown. A new one was not yet firmly in place. The eclipse was exciting just to the extent that it might give a clue to the right path forward.

Science and Myth

Does it seem troubling that scientists believe in their theories and that this belief lets them work wonders? Does this reduce science to the status of another myth, something that vanishes when people cease to believe in it? The term *myth* has a pejorative aspect today and is more or less synonymous with falsehood. But it also refers to a way of explaining the world around us, and one of the attractive aspects of myth is the way that good myths are fecund. A myth builds on itself, generating new stories about its characters. Viewed in this way, a myth is a good model for science.

One of the most important attributes of a scientific theory is its fecundity. If it fails to give rise to new questions, new concepts, and new research, then it is of little practical value. In this way relativity has been an extraordinarily fecund theory. It has given birth to ideas about the world that never existed before, such as gravitational waves, black holes, neutron stars, and a cosmology in which the geometry of the universe is not necessarily Euclidean. Some of these ideas were still hidden from view in 1919, but Eddington and Einstein knew enough to see the outlines of great discoveries ahead.

Looking back a century later, we can certainly imagine that they would be proud of the successes of modern gravitational theory, all made possible by the observations of 1919.

Chandrasekhar, Subramanian. (1987), *Truth and Beauty: Aesthetics and Motivations in Science*, University of Chicago Press.
Eddington, Arthur Stanley. (1919), "The Total Eclipse of 1919 May 29 and the Influence of Gravitation on Light." *The Observatory* 42: 119–122.

The foregoing is an edited version of the concluding chapter 15 of Daniel Kennefick *No Shadow of a Doubt*, Princeton University Press, 2019.
https://press.princeton.edu/titles/17193.html

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 in the OPINION folder at the HPS&ST web site: (**http://www.hpsst.com/**).

Previous HPS&ST Note Opinion Pieces (at **http://www.hpsst.com/)**

Ron Good, Louisiana State University, *The Two Darwins*, (June 2019)

Nicholas Maxwell, Philosophy, University College, London *The Metaphysics of Science and Aim-Oriented Empiricism* (May 2019)

Lucie Laplane, Paolo Mantovani, Ralph Adolphs, Hasok Chang, Alberto Mantovani, Margaret McFall-Ngai, Carlo Rovelli, Elliott Sober, and Thomas Pradeu: *Why Science Needs Philosophy* (April 2019)

Thomas J.J. McCloughlin, School of STEM Education, Innovation & Global Studies, Dublin City University, Ireland, *Beware the Greeks: Sources for the History of Gravity in Science Teaching* (March 2019)

Bettina Bussmann, University of Salzburg, Austria & Mario Kötter, University of Muenster, Germany *Between Scientism and Relativism: Epistemic Competence as an Important Aim in Science and Philosophy Education* (February 2019)

Robin Attfield, Philosophy Department, Cardiff University, *Climate Change and Philosophy* (January 2019)

Dhyaneswaran Palanichamy & Bruce V. Lewenstein, School of Integrative Plant Science, Cornell University, *How History can Enable Better Teaching of Statistics in Introductory Biology Courses*

Frederick Grinnell, School of Medicine, University of Texas, *Teaching research integrity – Using history and philosophy of science to introduce ideas about the ambiguity of research practice*

New York Times, Creeping Bias in Research: Negative Results Are Glossed Over (October 2018)

Michael Matthews, School of Education, UNSW, *An Occasion to Celebrate*: *Mario Bunge's 99th Birthday* (September 2018)

Cormac Ó Raifeartaigh, Waterford Institute of Technology, Ireland, *History of Science in Schools.* (July 2018)

Hugh Lacey, Philosophy Department, Swarthmore College, *Appropriate Roles for Ethics and Social Values in Scientific Activity* (June 2018)

Gerald Holton, Physics Department, Harvard University, *Tracing Tom Kuhn's Evolution: A Personal Perspective* (April/May 2018)

Monica H. Green, History Department, Arizona State University, *On Learning How to Teach the Black Death* (March 2018)

Stephen Pinker, Psychology Department, Harvard University, *The Intellectual War on Science* (February 2018)

Michael Ruse, Philosophy Department, Florida State University, *Does Life have Any Meaning?* (January 2018)

Mario Bunge, Philosophy Department, McGill University, *In Defence of Scientism* (December 2017)

Susan Haack, Philosophy and Law Departments, University of Miami, *The Future of Philosophy, the Seduction of Scientism* (November 2017)

Nicholas Maxwell, University College London, *What's Wrong with HPS and What Needs be Done to Put it Right?* (June 2017)

Heinz W. Drodste, Universität Düsseldorf, *An Interview with Mario Bunge*

Nicholas Maxwell, University College London, *The Crisis of Our Times and What to do About It.*

Eric Scerri, UCLA, *Bringing Science Down to Earth*

Robert Nola, University of Auckland, *Fake News in the Post-Truth World,* (February 2017)

Michael D. Higgins, President of Ireland, *The Need to Teach Philosophy in Schools* (December 2016)

Philip A. Sullivan, University of Toronto, *What is wrong with Mathematics Teaching in Ontario?* (July 2016)

Gregory Radick, Leeds University, *How Mendel's legacy holds back the teaching of science* (June 2016).
Matthew Stanley, New York University, *Why Should Physicists Study History?*

PhD Theses in HPS&ST Domain: Veli Virmajoki, University of Turku

Name: Veli Virmajoki
E-mail address: vevirm@utu.fi
Institution: University of Turku, Finland
Supervisors: Jouni-Matti Kuukkanen; Joseph Almog; Olli Koistinen
Title: *Cementing Science. Understanding Science through Its Development*

Abstract: I defend the present-centered approach in historiography of science (i.e. study of the history of science), build an account for causal explanations in historiography of science, and show the fruitfulness of the approach and account in when we attempt to understand science.

The present-centered approach defines historiography of science as a field that studies the developments that led to the present science. I argue that the choice of the targets of studies in historiography of science should be directly connected to our values and preferences in an intersubjective process. The main advantage of this approach is that it gives a clear motivation for historiography of science and avoids or solves stubborn conceptual and practical problems within the field.

The account of causal explanations is built on the notions of counterfactual scenarios and contrastive question-answer pairs. I argue that if and only if we track down patterns of counterfactual dependencies, can we understand history. Moreover, I define the notions of historical explanation, explanatory competition, explanatory depth, and explanatory resources.

Finally, I analyze the existing historiography of science with the framework built in the previous chapter, and I show that this framework clarifies many first-order (i.e. concerning the history of science) and meta-level issues (i.e. concerning the nature of science in general) that historians and philosophers tackle. As an illustration of the philosophical power of the framework, I explicate the notion of local explanation and analyze the question of whether the developments of science were necessary or contingent.

Web link: https://www.utupub.fi/handle/10024/147334

The HPS&ST Note is an ideal medium for making known submitted and awarded doctoral theses in the HPS&ST domain.

The following details should be submitted to the editor at m.matthews@unsw.edu.au
Candidate's Name and email
Institution & Country
Supervisors
Thesis title
Abstract of 100-300 words

Web link when Theses are required to be submitted for Open search on the web.

Recent HPS&ST Research Articles

ISIS (Vol. 110, N. 2, June 2019)
Focus: Explanation in the History of Science
Editor: Floris Cohen

The Science Teacher (Vol. 86, N. 9, July 2019)
Focus: The History, Practice, and Nature of Science

HoST - Journal of History of Science and Technology (Vol. 13, Issue 1, June 2019)
Special Issue: "Before the Silent Spring: Pesticides in Twentieth-Century Europe"
Invited Editor: José Ramón Bertomeu-Sánchez https://tinyurl.com/yxp6y5tn

Science Education (Vol. 103, Issue 4, July 2019)
Special Issue: "Epistemic Tools in Science Education"
Editors: David Stroupe, Jean Moon, and Sarah Michaels

Science & Education (Vol. 28, Issue 3-5, July 2019)
Special Issue: Nature of Science
Guest Editorial: Norman G. Lederman, Fouad Abd-El-Khalick, and Mike U. Smith

American Journal of Physics (Vol. 87, Issue 7, July 2019)
Theme Issue: Energy.
Editors: Dawn Meredith and Nancy Ruzycki

Chen, Y.-C., Benus, M. J., & Hernandez, J. (2019) Managing uncertainty in scientific argumentation. *Science Education*, 1-42. doi: 10.1002/sce.21527 online first

Choi, A., Seung, E. & Kim, D. (2019) Science Teachers' Views of Argument in Scientific Inquiry and Argument-Based Science Instruction. *Research in Science Education*, 1-18. doi: s11165-019-9861-9 online first

Macalalag, A.Z., Johnson, J. & Lai, M. (2019) How do we do this: learning how to teach socioscientific issues. *Cultural Studies of Science Education*, 1-25. doi: 10.1007/s11422-019-09944-9 online first

Oh, P.S. (2019) Features of Modeling-Based Abductive Reasoning as a Disciplinary Practice of Inquiry in Earth Science: Cases of Novice Students Solving a Geological Problem. *Science & Education*, 1-27. doi: 10.1007/s11191-019-00058-w online first

Pierson, A. E., & Clark, D. B. (2019) Sedimentation of Modeling Practices: Dimensions of Co-operative Action at a Classroom Scale. *Science & Education*, 1-29. doi: 10.1007/s11191-019-00050-4 online first

Short, S. D., Lastrapes, K. A., Natale, N. E., & McBrady, E. E. (2019) Rational engagement buffers the effect of conservatism on one's reported relevance of the theory of evolution. *Journal of Research in Science Teaching*, 1-22. doi: 10.1002/tea.21559 online first

Witteveen, J, (2019) Natural Selection and Contrastive Explanation. *Philosophy of Science, 87*(3), 412–430.

Recent HPS&ST Related Books

Belhoste, Bruno (2019) *Paris Savant: Capital of Science in the Age of Enlightenment*. Oxford, UK: Oxford University Press. ISBN: 9780199382545

"Novelist Honoré de Balzac was the first to use the phrase "Paris savant" to refer to the dynamic Parisian scientific and intellectual community of the late 18th century. The Academy of Sciences was highly active during this time and was a meeting place for intellectual and scientific elite, who worked together toward the diffusion of scientific knowledge into Parisian society. The Royal Observatory was a headquarters for French astronomy, as well as the great geodesic project to map all of France. The Royal Mint hosted courses in chemistry and mining, and the Arsenal near the Bastille housed the laboratory of Lavoisier, the most celebrated chemist of the age.
"This book is the English translation of Bruno Belhoste's Paris Savant: Encounters in Enlightenment Science, originally published in France in 2011. Belhoste discusses how the Parisian scientific community came into its important place in the French Enlightenment, focusing on the Academy of Sciences. Chapters cover subjects such as what role Parisian geography played in the movement, the contributions of French scientists to industrial and urban improvement, and how the Academy of Sciences clashed with the revolutionary crisis, resulting in its closing in 1793. The translation includes a prologue for English readers." (From then Publishers)

More information at: **http://tinyurl.com/yy6xsq3p**

Frischmann, Brett & Selinger, Evan (2019) *Re-Engineering Humanity*. Cambridge, UK: Cambridge University Press. ISBN: 9781107147096

"Every day, new warnings emerge about artificial intelligence rebelling against us. All the while, a more immediate dilemma flies under the radar. Have forces been unleashed that are thrusting humanity down an ill-advised path, one that's increasingly making us behave like simple machines? In this wide-reaching, interdisciplinary book, Brett Frischmann and Evan Selinger examine what's happening to our lives as society embraces big data, predictive analytics, and smart environments. They explain how the goal of designing programmable worlds goes hand in hand with engineering predictable and programmable people. Detailing new frameworks, provocative case studies, and mind-blowing thought experiments, Frischmann and Selinger reveal hidden connections between fitness trackers, electronic contracts, social media platforms, robotic companions, fake news, autonomous cars, and more. This powerful analysis should be read by anyone interested in understanding exactly how technology threatens the future of our society, and what we can do now to build something better." (From the Publisher)

More information at: **https://tinyurl.com/y3nx8cbx**

Garson, Justin (2019) *What Biological Functions Are and Why They Matter*. Cambridge, UK: Cambridge University Press. ISBN: 9781108472593

"Biological functions are much discussed but little understood. Justin Garson appeals to the explanatory depth of functional explanations to develop a powerful general theory of functions. This book will serve as a reference point for future debate." David Papineau, King's College London

"Garson does a superb job of explaining just how central a philosophical understanding of functions is to a wide array of discussions in philosophy and science. These discussions include how to count junk DNA in the ENCODE project, how to

classify traits and individuate mechanisms, how different kinds and levels of biological explanations relate to each other, the nature of health and disease, the nature of mental disorder, and even the fundamental basis of thought itself. In addition to being an excellent introduction to these issues, this book gives us a fresh, lively and comprehensive presentation of Garson's distinctive contributions." Karen Neander, Duke University, North Carolina

More information at: **https://tinyurl.com/y2ntx36q**

Grapí, Pere (2019) *Inspiring air: A history of air-related science*. Wilmington, DE: Vernon Press. ISBN: 978-1-62273-738-3

"Eudiometers were instruments originally devised for checking the 'goodness' of common air. Seeking to be more than just a chronological inventory of eudiometers, this book presents a unique retrospective of these fascinating apparatuses from the end of the eighteenth century to the mid-nineteenth century.
"By paying particular attention to the experimental procedures involved over the course of the test, this book aims to understand and explore how eudiometers function, to describe the materials used in making them and the different reagents employed in each eudiometrical test. Importantly, eudiometers were employed within a variety of spheres including human and animal health, gas analysis, chemical theory, plant and animal physiology, atmospheric composition, chemical compound composition, gas lighting, chemical revolution and experimental demonstration.
"Finally, this book looks to redress the existing imbalance in the history of chemistry regarding the attention given to theoretical aspects of chemistry in comparison to chemical practice and apparatus. The few existing accounts of chemical devices written in the past century have not been sufficiently helpful for the understanding of experimental practice in chemistry. Until now no work that deals exclusively with eudiometers and gas analysis from a historical standpoint has been published. Thus, this book will not only cast new light on the subject but will also contribute to further research on the history of chemical instruments." (From the Publisher)

More information at: **https://vernonpress.com/book/803**

Grote, Mathias (2019) *Membranes to Molecular Machines: Active Matter and The Remaking of Life*. Chicago, IL: The University of Chicago Press Books. ISBN: 9780226625157

"According to the dominant narrative in the history of biology, the most important developments in the last half of the twentieth century centered on DNA and genetics. In Membranes to Molecular Machines, Mathias Grote argues that this history omits other areas of the life sciences not illuminated by the spotlight of the DNA saga. One such area is what Grote calls the 'materialization' of membrane machines. Using the fascinating story of bacteriorhodopsin as a case study, he follows the discovery of the protein through its structural determination by electron microscopy to the description of its function as a light-stimulated proton pump. Along the way, he reviews the development of the biological membrane concept from early models to reconstitution studies, and impressively exploits interviews and the personal archives of leading investigators to construct his account. In this way, he produces a fuller and more accurate view of the history of biology in the twentieth century."- Karl Matlin, University of Chicago and the Marine Biological Laboratory

"Membranes to Molecular Machines is a masterful study of the hidden origins in chemical practice and an explanation of much of today's molecular biology. As Mathias Grote sheds light on how scientists unraveled molecular mechanisms related to energy, metabolism, and cognition, he expands the scope of our historical understanding and crucially enriches our theoretical armory. In giving scientists' investigations of active biomolecules center stage, and in arguing for a materialism based on chemical concepts and practices, Grote draws the lines of the historiography of the modern life sciences anew."- Carsten Reinhardt, Bielefeld University

More information at: **http://tinyurl.com/yy3whf9c**

McCartney, Mark, Whitaker, Andrew & Wood, Alastair (Eds.) (2019) *George Gabriel Stokes: Life, Science and Faith*. Oxford, UK: Oxford University Press. ISBN: 9780198822868

"George Gabriel Stokes was one of the most important mathematical physicists of the 19th century. During his lifetime he made a wide range of contributions, notably in continuum mechanics, optics and mathematical analysis. His name is known to generations of scientists and engineers through the various physical laws and mathematical formulae named after him, such as the Navier-Stokes equations in fluid dynamics. Born in Ireland into a family of academics, clergymen and physicians, he became the longest serving Lucasian Professor of Mathematics at Cambridge.
"Impressive as his own scientific achievements were, he made an equally important contribution as a sounding board for his contemporaries, providing good judgement and mathematical rigour in his wide correspondence and during his 31 years as Secretary of the Royal Society where he played a major role in the direction of British science. Outside his own area he was a distinguished public servant and MP for Cambridge University. He was keenly interested in the relation between science and religion and wrote at length on their interaction. Stokes was a remarkable scientist who lived in an equally remarkable age of discovery and innovation.
!This edited collection of essays brings together experts in mathematics, physics and the history of science to cover the many facets of Stokes's life in a scholarly but accessible way to mark the bicentenary of his birth." (From the Publishers)

More information at: **http://tinyurl.com/y2zrbyq4**

Rosenbaum, Paul R. (2019) *Observation and Experiment: An Introduction to Causal Inference*. Cambridge, MA: Harvard University Press. ISBN: 9780674241633

"In the daily news and the scientific literature, we are faced with conflicting claims about the effects caused by some treatments, behaviors, and policies. A daily glass of wine prolongs life, or so we are told. Yet we are also told that alcohol can cause life-threatening cancer and that pregnant women should abstain from drinking. Some say that raising the minimum wage decreases inequality while others say it increases unemployment. Investigators once confidently claimed that hormone replacement therapy reduces the risk of heart disease but today investigators confidently claim it raises that risk. How should we study such questions?

"*Observation and Experiment* is an introduction to causal inference from one of the field's leading scholars. Using minimal mathematics and statistics, Paul Rosenbaum explains key concepts and methods through scientific examples that make complex ideas concrete and abstract principles accessible.
"Some causal questions can be studied in randomized trials in which coin flips assign individuals to treatments. But because randomized trials are not always practical or ethical, many causal questions are investigated in nonrandomized observational studies. To illustrate, Rosenbaum draws examples from clinical medicine, economics, public health, epidemiology, clinical psychology, and psychiatry. Readers gain an understanding of the design and interpretation of randomized trials, the ways they differ from observational studies, and the techniques used to remove, investigate, and appraise bias in observational studies. Observation and Experiment is a valuable resource for anyone with a serious interest in the empirical study of human health, behavior, and well-being." (From the Publisher)

More information at: **https://tinyurl.com/y5g29sm7**

Schurz, Gerhard (2019) *Hume's Problem Solved: The Optimality of Meta-Induction*. Cambridge, MA: The MIT Press. ISBN: 9780262039727

"Even if we cannot prove the reliability of induction, we still cannot do better than to rely on it. The case for this claim has never been made more forcefully and with greater insight and clarity than in this book. Drawing on cutting-edge research from machine learning, Gerhard Schurz provides readers with a wealth of new formal results, all geared toward showing the optimality of inductive reasoning. The book is engagingly written and, despite its formal nature, is also accessible to nonspecialists. The book should be read by anyone with an interest in epistemology or the philosophy of science, and indeed by all interested in the foundations of human knowledge." - Igor DouvenCentre National de la Recherche Scientifique (CNRS), Paris

"Can the problem of induction be solved? Following in the steps of Hans Reichenbach, and using modern logical and computational tools, Gerhard Schurz forcefully argues that the problem can be solved provided we focus our attention on the meta-level of competing prediction methods. He proves that his meta-inductive prediction strategy is optimal in the long run among all accessible prediction methods, and then shows that first-order induction should be trusted too. Along the way, Schurz examines all major philosophical stances concerning induction and proves a number of important theorems. Hume's Problem Solved is a tour de force of formal epistemology of science." - Stathis PsillosUniversity of Athens, Greece

More information at: **https://mitpress.mit.edu/books/humes-problem-solved**

Stolz, Daniel A. (2019) *The Lighthouse and the Observatory: Islam, Science, and Empire in Late Ottoman Egypt*. Cambridge, UK: Cambridge University Press. ISBN: 9781316647257

"Daniel A. Stolz's study on the history of astronomy in nineteenth-century Egypt is a piece of superb scholarship. It sheds new light on the questions of science and religion, history of science in a non-European context, and of how science changed

during a period that saw the rise of new forms of scientific training, politics, techniques and readership." Khaled Fahmy, Sultan Qaboos Chair of Modern Arabic Studies, University of Cambridge

"Pace the hallowed historiography of 'invented traditions', Daniel A. Stolz's fine-grained analysis shows how modernities contrapuntally were digested by traditions of knowing. In the 'scholarly astronomy' of the nineteenth-century Egyptian 'ulama' he discovers a living tradition of scientific practices that dynamically engaged with modern Western sciences. Firmly grounded in the archive and analyzed with aplomb, the book inaugurates an entirely new chapter in the historiography of science beyond the West." Projit Bihari Mukharji, University of Pennsylvania

"This eloquent and deeply researched book shows how the technical apparatus and knowledge of modern sciences were drafted into projects of Islamic reform in late Ottoman Egypt around 1900. Science helped redefine communities of knowledge according to diverse and often conflicting geographies of empire and belief, while framing new horizons for historical understanding: practices of worship were modernized even as astronomy was recast within a centuries-old Islamic tradition. Engagingly written, sophisticated and fascinating, Stolz's book is an eye-opening read for historians of science, empire, and religion." John Tresch, University of Pennsylvania

More information at: **https://tinyurl.com/y35crtol**

Authors of HPS&ST-related papers and books are invited to bring them to attention of the Note's assistant editors, Paulo Maurício at **paulo.asterix@gmail.com** or Nathan Oseroff at **nathanoseroff@gmail.com** for inclusion in these sections.

Coming HPS&ST Related Conferences

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August 5-10, 2019, 16th Congress of Logic, Methodology and Philosophy of Science and Technology (CLMPST), Prague, Czech Republic.
For updates and details: **http://clmpst2019.flu.cas.cz/**

August 25-September 1, 2019, Formal Epistemology, Statistics, and Game Theory: Bayes-by-the-Sea, Summer School, Ancona, The Marche –Italy
Details: **s.oreficini@staff.univpm.it**

August 27-30,2019, 12th International Whitehead Conference, University of Brasilia, Brazil.
Details at: **https://www.whitehead2019.org/**

September 2-4, 2019. European Conference for Cognitive Science (EuroCogSci 2019), Ruhr-Universität Bochum, Germany.
More information: **EuroCogSci2019@rub.de**

September 9-12, 2019, XXXIX National Congress of the Italian Society for the History of Physics and Astronomy (SISFA), Pisa
Details: **http://www.sisfa.org/convegni/pisa-2019/**

September 19-21, 2019, Experimental Philosophy Conference, University of Bern, Switzerland.

More information: **https://sites.google.com/view/xphibern2019/**

October 29-30, 2019, 'Scientific Literacy for All' Conference, Beijing Normal University, China
More information at:
http://cicabeq.bnu.edu.cn/shtml/3/news/201903/1102.shtml
Email: **bnukxts@126.com**

October 30 – November 1, 2019, Bucharest Colloquium in Early Modern Science, University of Bucharest.
Details: Ovidiu Babeș (ovidiu.babes@icub.unibuc.ro)

November 5-7, 2019, 'Values in Modelling and Decision Analyses', Society for Decision Making under Deep Uncertainty (DMDU), Delft University of Technology
Information: **http://www.deepuncertainty.org/annual-meetings/2019-annual-meeting/**

December 7-11, 2019, Philosophy of Education Society of Australasia (PESA) Annual Conference, University of Hong Kong
More information: **https://pesa.org.au/conference**

January 3-6, 2020, epiSTEME 8, conference, Mumbai, India
Details: **http://episteme8.hbcse.tifr.res.in**

March 15-18, 2020, NARST Annual Conference, Portland OR, USA
More information: **https://www.narst.org/annualconference/2020conference.cfm**

July 4-8, 2021, IHPST 16th International Conference, University of Calgary, Canada
Details from Glenn Dolphin: **glenn.dolphin@ucalgary.ca**