HPS&ST NEWSLETTER

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MAY 2022

The HPS&ST NEWSLETTER is emailed monthly to about 10,000 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 internatitioal 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 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 NEWSLETTER (publications, conferences, opinion pieces, &.) are welcome and should be sent direct to the editor: Michael R. Matthews, UNSW (m.matthews@unsw.edu.au).

The NEWSLETTER, along with RESOURCES, OBITUARIES, OPINION PIECES and more, are available at the website: https://www.hpsst.com/

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Report:Science Education in an Age of Misinformation

Jonathan Osborne, Daniel Pimentel, Stanford University, and Ten Colleagues

This report funded by the Gordon and Betty Moore Foundation was published in May. It addresses the topic of misinformation and how science educators should respond. The following is offered as a summary of its main points.

True knowledge is a collective good. Today the internet provides access to an interconnected sea of information that was simply unimaginable even 20 years ago. The common assumption is that this is a good thing as the internet offers us answers to questions about everything from how to fix a broken bicycle to our concerns about health issues. In addition, it has brought together isolated individuals to pursue their common interests.

Nevertheless, there is an increasing concern about the way the internet can be used to spread false information. Whether it is misinformation (information offered in good faith but flawed) and, worse, disinformation (information offered by those who are well aware that it is flawed or inaccurate)—much of it undermines trust in science. The widespread acceptance of unfounded claims such as the idea that vaccines cause autism, that the Earth is flat, or that climate change is a hoax are of grave concern. For, while true knowledge is a collective good, flawed or fake knowledge can be a danger—both individually and collectively. For instance, the idea that vaccines are harmful endangers not only the lives of those who hold this idea, but the whole community that depends on a high level of vaccination to ensure its health.

One characterization of this phenomenon is that we are living in a 'Post-Truth' society—one which diminishes or denies the role of facts in public life. And while there have always been individuals who have advanced false information and conspiracy theories, or blurred the line between opinion and fact, the internet and social media provide platforms which disseminate lies at much greater speed, outstripping the communication of truth. In addition, they offer the tools to disguise lack of expertise and to monetize its dissemination, thus shaping human behavior at a global scale.

Much of this false information either attempts to undermine well-established science, or alternatively, to cloak ideas in the superficial trappings of science to make fallacious arguments. By using scientific jargon with links to journal articles and evidence, or by cherry-picking the evidence, the user is invited to evaluate the evidence for themselves, appealing to the notion that everyone can be intellectually independent. In short, do your own research. In this manner, purveyors of disinformation simply exploit a misplaced belief in our own capabilities to erode confidence in well-established scientific findings. The reality, however, is that we are all dependent on expertise. Only experts within the same domain can evaluate the claims of other experts.

In addition, the information landscape has been fundamentally transformed. On the internet, information is often not curated by professional gatekeepers. Young people are likely to get their information from YouTube and Tik Tok. While some of the channels on these platforms are credible sources of information, many of them are not. In such cases, it is difficult to know what decisions we should make. Knowing whom to trust, why they can be trusted, and how much they can be trusted is an essential life skill.

Two things must be done to address this challenge. First, scientists and both formal and informal science educators must contribute to building the knowledge and capabilities required for digital media and information literacy, particularly in the sciences. Second, they must develop an understanding of the importance of consensus in science and, in particular, the *social practices* the scientific community uses to vet knowledge claims to produce trustworthy knowledge. Currently, science education from elementary to undergraduate rarely, if ever, explains to its students how the sciences ensure that the knowledge they produce

can be trusted. This omission does science a disservice and enables misinformation to spread, providing a space for the purveyors of disinformation to undermine the authority and legitimacy of reliable scientific knowledge.

This report lays out how science education can meet its responsibility to provide all students with the competences needed to navigate this sea of false and questionable information without becoming lost, confused, and, more importantly, deceived. In so doing four questions are explored:

Why do students need the ability to evaluate scientific expertise and information?
What evidence is there that young people struggle to evaluate information effectively?
Why is it an urgent priority for scientists and science educators to develop students' competency to evaluate information?
What can be done by scientists and science educators to develop the competency to evaluate scientific information and expertise?

Along with many others, we share the view that, left unchecked, the poison of misinformation is a fundamental threat to our societies. Trust in the institutions of our democracies is at its lowest ever. Resolving disagreement depends on a belief in objectivity and the ability to reason using trustworthy evidence.

Ironically, what reliable scientific knowledge points to is invoked ever more strongly by teenage environmental activists such as Greta Thunberg, and by movements such as Extinction Rebellion in Europe—movements which are demanding that national leaders pay attention to what science has to say. It should not be left to the youth of today to make the case for why scientific evidence might matter. Scientists and science educators need to explain and justify how, when, and why science can be trusted. We urge scientists, science educators, and policy makers to recognize and attend to our arguments, to prioritize them in their discussions and communications with each other and with outsiders. Developing the competency to obtain, evaluate, and communicate, information must be a focus of science classrooms, teacher training, teacher professional development, and the assessment of science. We cannot bemoan the plethora of misinformation if we are not prepared to defend what we hold dear. In short, to explain why science matters and why and when it should be trusted.

The full report (51 pages) can be downloaded at:

https://sciedandmisinfo.sites.stanford.edu/

Global History and Culture Centre, Annual Conference, University of Warwick, 9-10 June 2022

The History of Science and the 'Big Picture'

Keynote

Professor Clapperton Chakanetsa Mavhunga (MIT)

Website and Registration

https://warwick.ac.uk/fac/arts/history/ghcc/event/bigpicture/

The history of science lacks a sense of the 'big picture'. Nearly three decades ago, James Secord identified this problem in an influential special issue of *The British Journal for the History of Science*. At the time, the history of science was dominated by localised case studies—quantum mechanics in Weimar Germany, phre-

nology in 1830s Edinburgh, experimental philosophy in seventeenth-century London, and so on. These case studies, localised in time as well as space, were important for challenging the post-war consensus that modern science was universal. However, as Secord noted, this proliferation of case studies also undermined any sense of the 'big picture'—how and why science changed over the longue durée, and how science moved between different parts of the world. "The striking lessons of recent research need to be applied to longer time spans, a broader range of participants, and wider regional and global perspectives," argued Secord in 1993.

Despite Secord's argument, the history of science is still dominated by localised case studies. It still lacks a sense of the 'big picture', even if in recent years the field has started to move beyond its Eurocentric focus. There are now many excellent national and regional studies of the history of science in Latin America, Asia, Africa, the Middle East, and the Pacific. Yet it is still not entirely clear what these individual case studies add up to. Localism, as the historian of science Peter Galison noted, has its own limits. And although some 'big picture' histories of science have been written since 1993, they are hard to reconcile with each other, and tend to be heavily skewed towards the history of ideas.

This conference, sponsored by the Global History and Culture Centre at the University of Warwick, will bring together leading international scholars to reflect on what 'big picture' histories of science might look like today. We hope that a dialogue between historians of science and the broader historical discipline will facilitate new ways of thinking beyond individual case studies. The meeting will invite participants to reflect on what recent trends in historical scholarship, such as global history and environmental history, might offer for 'big picture' histories of science.

Speakers

Sophie Brockmann (De Montfort University)
Michael Bycroft (University of Warwick)
Pratik Chakrabarti (University of Houston)
Gianamar Giovannetti-Singh (University of Cambridge)
Aleksandra Kaye (University College London)
Clapperton Chakanetsa Mavhunga (MIT)
Jahnavi Phalkey (Science Gallery Bengaluru)
Dagmar Schäfer (Max Planck Institute for the History of Science)
James Secord (University of Cambridge)
John Tresch (Warburg Institute)
Camilo Uribe Botta (University of Warwick)
Duygu Yildirim (European University Institute)

Conference: Hypothesis in Science. On the 550th anniversary of the birth of Nicolaus Copernicus

19-21 October 2022, Nicolaus Copernicus University, Toruń, Poland

Keynote Speakers:

Stephen Barr (University of Delaware, USA)
Niccolò Guicciardini (University of Milan, Italy)
Paweł Kawalec (Catholic University of Lublin, Poland)
Emily Sullivan (Eindhoven University of Technology, Netherlands)
Peter Vickers (Durham University, United Kingdom)
K. Brad Wray (Aarhus University, Denmark)

The conference welcomes formal and informal contributions on any aspects of hypothetical reasoning in science. Topics of interest include, but are not limited to the following:

- Historical Issues in Formulation of Hypotheses
- Predictive and Explanatory Power of Hypotheses
- Formal Aspects of Hypothetical Reasoning
- New Trends Disrupting Hypothesis Driven Science

Deadline for submissions: 31 May 2022.
Authors will be informed about the acceptance of their contributions before June 15, 2022.

Programme committee:
Tomasz Jarmużek (Nicolaus Copernicus University, Poland) – Chair
Otávio Bueno (University of Miami, USA)
Raffaella Campaner (University of Bologna, Italy)
Hasok Chang (University of Cambridge, United Kingdom)
Carl F. Craver (Washington University in St. Louis, USA)
Włodzisław Duch (Nicolaus Copernicus University, Poland)
Grzegorz Karwasz (Nicolaus Copernicus University, Poland)
Dominique Lambert (University of Namur, Belgium)
Flavia Marcacci (Pontifical Lateran University, Vatican City)
María del Rosario Martínez-Ordaz (Federal University of Rio de Janeiro, Brazil)
Joke Meheus (Ghent University, Belgium)
Marcin Miłkowski (Institute of Philosophy and Sociology, Polish Academy of Sciences)
Matteo Morganti (University of Roma Tre, Italy)
Piotr Roszak (Nicolaus Copernicus University, Poland)
Javier Sánchez-Cañizares (University of Nawarra, Spain)
Radosław Sojak (Nicolaus Copernicus University, Poland)
Fabio Sterpetti (Sapienza University of Rome, Italy)
Erik Weber (Ghent University, Belgium)

+info: pps@umk.pl

Conference website: https://ppshypothesis.umk.pl/

Thomas Kuhn Centenary Celebration and Conference, 13-15 July 2022, University of Kent, UK

Conference Description

Thomas Kuhn (18 July 1922-17 June 1996) is widely considered as one of the most important philosophers of science in the 20th century. His book The Structure of Scientific Revolutions (SSR) is also regarded as one of the most influential works in the philosophy of science. Kuhn famously introduced the concept of paradigm to analyse the history of science. He also developed the incommensurability thesis. Kuhn's work contributed to the so-called historical turn in the 20th century philosophy of science. Its influence goes beyond philosophy of science and makes a huge impact on history of science, sociology of science, and the social sciences.

2022 will mark the 100th anniversary of the birth of Thomas Kuhn and the 60th anniversary of the publication of SSR. The conference aims to examine Kuhn's contribution to contemporary philosophy of science, revisit his legacy for the history and philosophy of science, and reflect on the prospect of the Kuhnian philosophy of science.

Keynote Speakers

Hanne Andersen (University of Copenhagen)
Theodore Arabatzis (University of Athens)
Alexander Bird (University of Cambridge)
Hasok Chang (University of Cambridge)
Donald Gillies (University College London)
Vasso Kindi (University of Athens)

Programme

Book of Abstracts

Information Here

HPS&ST in Latin America

Announcement

The Revista Brasileira de História da Ciência (Brazilian Journal of History of Science) is calling for papers for a special issue on HPS&ST: *História da Ciência para uma Educação em Ciências do futuro*; La Historia de la Ciencia para una Educación Científica del Futuro; The History of Science for a Science Education of the Future (to access the Spanish and English versions, click in the language option at the right side of the webpage). The journal accepts submissions in Portuguese, Spanish and English.

Events

XX IOSTE Symposium (International Organization for Science and Technology Education) will be held in Federal University of Pernambuco and Mar Hotel Conventions, Recife, Brazil, from July 25th to 29th. The theme of the event will be "Esperançar in uncertain times: the role of science and technology education in/for a changing world", an allusion to Paulo Freire's concept of Esperança ("hope"). The event presents a special strand for submissions of HPS&ST field. Information is available at http://www.ioste2022.com/ .

Seminar

First seminar of the Seminar Cycle of the History, Philosophy and Biology Teaching Lab (LEFHBio), Institute of Biology, Federal University of Bahia, Brazil, with Dr. Kostas Kampourakis, which took place in April 12th 2022. The seminar is available here.
Students' "teleological misconceptions" in evolution education: why the underlying design stance, not teleology per se, is the problem

Link to the paper in which the talk was based is available here.

A&M 20 years: training and performance of researchers in analogies, metaphors and models.

In a virtual event on 01/31/2022 at the Federal University of Minas Gerais (UFMG), Belo Horizonte city - Brazil, we launched our book: *A&M 20 YEARS: Formation and Performance of Researchers in Analogies, Metaphors and Models* (only in Portuguese language). We are getting ready for the physical release, no date set yet. This first edition has DOI – 10.22350/9786559173730 and ISBN – 978-65-5917-373-0. Freely accessible, it is available on the Fi publishing company website at https://www.editorafi.org/373aem20 .

The research group on Analogies, Metaphors and Models in Technology, Education, Science and Arts – AMTEC, registered at the National Council for Scientific and Technological Development (CNPq) - http://dgp.cnpq.br/dgp/espelhogrupo/ 11325 - is recognized by the Federal Center for Technological Education - CEFET MG, having its current reference point in the Postgraduate Program in Technological Education: https://sig.cefetmg.br/sigaa/public/programa/portal.jsf?lc=pt_BR&id=302 . Because of the retirement of Prof. PhD. Ronaldo Luiz Nagem in July 2021, Prof. PhD. Alexandre da Silva Ferry, the current coordinator of the Master's Course in Technological Education and AMTEC member, now exercises AMTEC's leadership. Prof. PhD. Ronaldo Nagem took the vice-leadership, offered to him by Prof. MSc. Maria de Fátima Marcelos who, for many years, accompanied him as vice-leader of the group, in which she remains as a researcher.

After two years of virtual activities, the Study Group on Analogies, Metaphors and Models in Technology, Education, Science and Arts - GEMATEC – (https://www.gematec.cefetmg.br/amtec/), linked to the Department of Education from the Federal Center for Technological Education (https://www.dedu.cefetmg.br/) and the Master›s Program in Technological Education, resumed its weekly on-site activities this April/22 for undergraduate students, professors and researchers interested in the subject in different areas of knowledge. Due to the participation of members from other locations during the remote period, some meetings may be held in a virtual or hybrid way.

Book Synopsis: *A&M 20 years: training and performance of researchers in analogies, metaphors and models.*

What is possible to do when one has knowledge about a Universal Law? What has been done and what is being done with the knowledge about the Law of Gravity? It is possible to build huge buildings, move a car, command a ship, fly a plane, leave Earth's orbit... and... What can you do when you have knowledge of the Law of Analogy? Although this knowledge is still at the beginning for us, it is possible for the reader of A&M 20 years: training and performance of researchers in Analogies, Metaphors and Models to have a small idea of the immense possibilities and applicability, for many areas of human knowledge, research and attributes of analogical and/or metaphorical thinking. Going beyond their roles as figures of speech, Analogies and Metaphors - A&M - assume other functions linked to Education, Science, Technology and the Arts together with the models.

The purpose of the book is to celebrate more than 20 years of study and investigation in Analogies, Metaphors and Models (A&M) in the training and performance of researchers in various areas of knowledge. Thus, it expands the visibility and memory of the work developed by the AMTEC Research Group and the GEMATEC Study Group, both linked to the Master's Program in Technological Education of the Federal Center for Technological Education of Minas Gerais - CEFET-MG, based in Belo Horizonte, MG, Brazil. The work proposes to conceptually disseminate the theme in order to promote dialogue between researchers in Education, Technology, Science and other areas, such as the Arts, expanding the network of collaboration and work on the subject.
Organized by researchers Prof. PhD. Ronaldo Luiz Nagem – Post-doc in Science Education at UMINHO/Portugal, Prof. PhD. Siane Paula de Araújo – Post-doc in Technological Education at CEFET-MG/Brazil, Prof. MSc. Maria de Fátima Marcelos – Master in Technological Education by CEFET-MG/Brazil, the book contains three distinct, but communicating parts.

The first one, entitled *Guarda-Chuva de Ideias* (*Umbrella of Ideas*) aims to present a synthesis of the primordial ideas and the main concepts and applications regarding the theme.

The second one presents a compendium of 10 articles produced by active researchers from AMTEC related to inter-institutional research projects, master's dissertations, results of scientific works from the Group and/or disciplines offered in the Master's Course in Technological Education. Finally,

The third one refers to a catalog of abstracts of theses, dissertations and scientific initiation research developed and defended by AMTEC members from its creation to the present edition of the book.

In the preface, Prof. PhD. Dácio Guimarães de Moura points out that the AMTEC and GEMATEC groups highlight the concept of analogy formulated by the Argentine thinker Carlos B. González Pecotche, who distinguished it as a Universal Law that acts naturally in the development of the human mind, as well as in the learning and construction of knowledge. This conception gives A&M an enormous hierarchy in the set of cutting-edge issues in the fields of theories of knowledge and psychology of human development, which is fundamental in this book.

Do you have any contributions about HPS&ST in Latin America?

Do you have any contributions about HPS&ST in Latin America? If you have any information about events, publications, research groups, books about HPS&ST in Latin American and want to submit a brief note to be published in the HPS&ST Newsletter, please contact first Nathan Lima here or secondly Michael Matthews here.

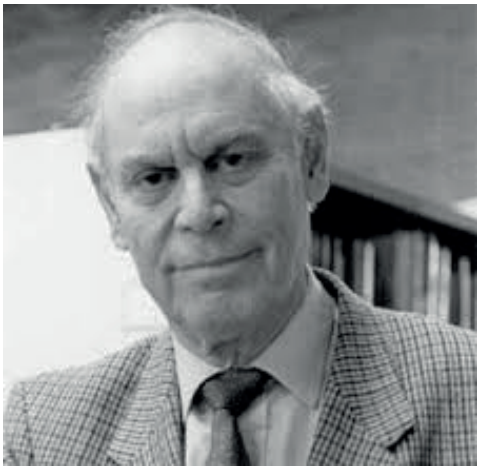
Gerald Holton turns 100

Gerald Holton, born 23 May 1922, is an American physicist, historian of science, and educator, whose

professional interests also include philosophy of science and the fostering of careers of young men and women. He is internationally known in education for his formative role in creating, with Fletcher Watson and James Rutherford, the Harvard Project Physics curriculum and materials for senior high school. The HPP course embodied the highest and best thought through ideals of a liberal education in science.

He is Mallinckrodt Professor of Physics and Professor of the History of Science Emeritus at Harvard University. His contributions range from physical science and its history to their professional and public understanding, from studies on gender problems and ethics in science careers to those on the role of immigrants. These have been acknowledged by an unusually wide spectrum of appointments and honors, from physics to initiatives in education and other national, societal issues, to contributions for which he was selected, as the first scientist, to give the tenth annual Jefferson Lecture that the National Endowment for the Humanities describes as, "the highest honor the federal government confers for distinguished achievement in the humanities".

Holton was one of a number, in Greater Boston, of research physicists who were also serious historians and philosophers: Abner Shimony and Robert Cohen at Boston University, Steven Weinberg at MIT, and many others. Each recognised the importance of understanding physics, and more generally science, within the wider frame of history, philosophy and culture. Each was committed, broadly speaking, to the Enlightenment project of using science and reason to advance human knowledge and welfare.



Life story. A poignant 16 minute interview, on the occasion of Holton being awarded the 2021 BBVA Foundation Frontiers of Knowledge Award in the Humanities is available here. It begins with his 1938 rescue, with 10,000 other predominantly Jewish children, on the UK Quaker sponsored *Kindertransports*. The interview ranges through his declining, on Quaker-inspired grounds, an invitation to join other US physicists in the Manhattan Project of atomic bomb research, his high-pressure physics research at Harvard, his research on and admiration for Einstein, women in science, and much else.

Thomas Kuhn. An informative personal account of the shared Harvard Physics and General Education experiences of Holton and Thomas Kuhn is available HERE. They were both born in 1922, both completed Harvard physics PhDs and both contributed to the Harvard General Education programme. But they had opposing views over the possibility of objectivity and rationality in science, with Holton affirming both and Kuhn denying both. The contrast can be seen in each of the books that followed their Harvard General Education teaching: Holton's *Introduction to Concepts and Theories in Physical Science* (1952) and Kuhn's *The Structure of Scientific Revolutions* (1960).

Publications available. Fifty-four of Holton's books

and articles are available gratis from the Harvard University's Digital Access Scholarship Harvard (DASH) site here

Opinion Piece: Gerald Holton's Contribution to Physics Education

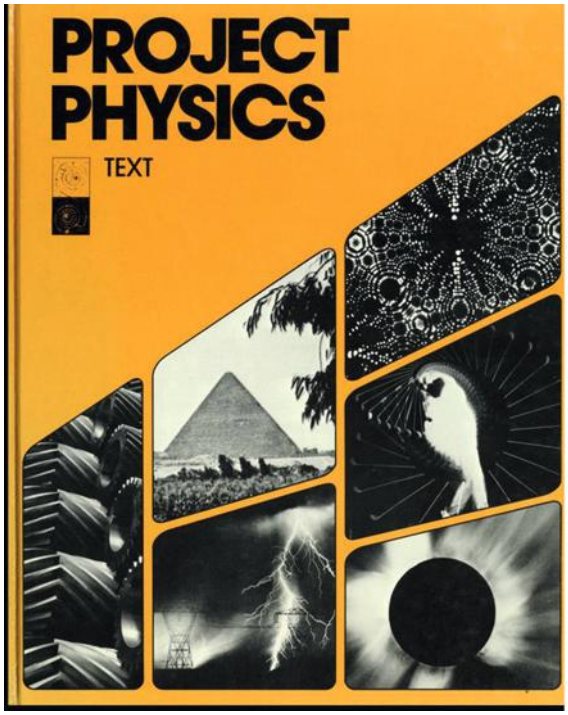
Peter Garik, Physics & Education, Boston University

Peter Garik graduated in physics and mathematics from SUNY at Stony Brook; MSc in physics from Cornell; PhD in theoretical physics from Cornell.

He has researched the teaching of quantum concepts in general chemistry using computer stimulations and the use of teaching the conceptual history of physics with in-service physics teachers. He prepares pre-service science teachers to work in high need school districts and works with in-service teachers in such districts to engage their students in hands-on investigations of the environment.

Gerald Holton's 100th Birthday (23 May 2022) is a fitting time to write about one of his most enduring contributions to science education, the Project Physics Course. Project Physics (Rutherford, Holton & Watson 1981) provided students a humanistic approach to physical science. A principal legacy of the project is the evidence that science education conceived as part of a liberal education can provide students with meaningful achievement with respect to science content as well as a more positive attitude towards physics than traditional instruction. More broadly, from Holton's writings, we come to understand that his humanistic approach to education extends to the gender gap through his contribution to *Who Succeeds in Science?* (Sonnert & Holton 1995), and his contribution to *A Nation at Risk* (Gardner 1983) which addressed the needs of all students in the United States.

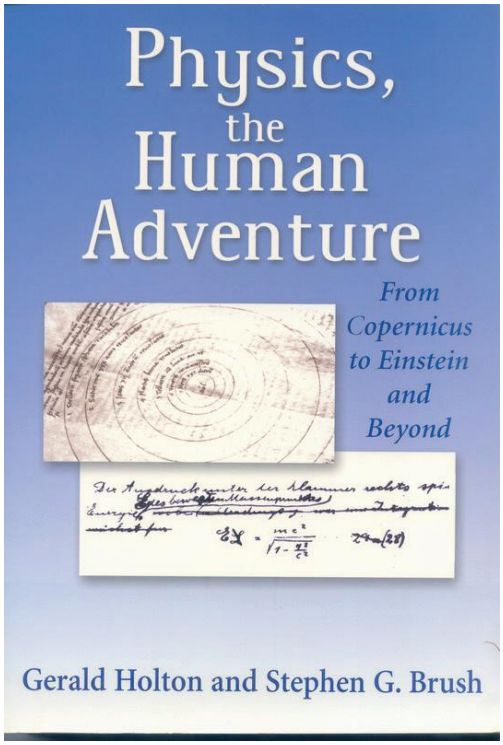
For what follows the humanistic approach can be interpreted as a respect for all learners irrespective of gender, race, ethnicity, and culture, and the recognition of humanity's wonderful capacity to understand the natural world. This interpretation appears to be in harmony with Holton's work as discussed below and operationally with the development of Project Physics



It may be said that the story of Project Physics begins with Holton's course at Harvard for which he wrote the text *Introduction to Concepts and Theories in Physical Science* (Holton 1952/1985/2001). First published in 1952 (revised with Stephen Brush in 1985, revised and re-issued in 2001 as *Physics: The Human Adventure*) it was the outcome of his experience teaching physics and general education in the physical sciences. The Introduction to the text presages what was to come with Project Physics. Holton wrote that he wanted science to be an "integrated and exciting intellec-

tual adventure" for all students in his course, not just those who would go on in science. In particular, his concern was that students should develop a coherent and connected understanding of science and society. Holton cites a metaphor from a section of the Harvard Report on General Education in a Free Society that often science courses provide students with knowledge as if they were isolated bricks.

Those who go on in science build structures of understanding from these bricks. But for the majority of students in a science course, all that they are left with are bricks. Holton's objective in writing his first text was to bind these bricks for all students with the history and philosophy of science and connections to other intellectual endeavors. This followed from his belief that students who do not intend to become scientists "want to see also what place physics has in the total reality, in the context of all intellectual endeavors: and unless we help them, nobody will" (Holton 1964).



It is from here that the history of Project Physics flows as documented by Holton (1968, 1978). In brief, in 1960 Holton was approached by James Rutherford, a Harvard science education graduate student who had been using *Introduction to Concepts and Theories* to teach high school physics in California. Rutherford suggested to Holton that a version appropriate for high school students be written. A sequence of events seeking funding ensued and with the addition of Fletcher Watson (1912-1997), professor of science education at Harvard, the three began work with a small grant from the Carnegie Foundation in 1962 to develop such a curriculum. In October 1963, the NSF called a meeting of scientists to prompt a second high school level physics course to complement that developed by the Physical Science Study Committee (1960). Holton responded to this request and with Rutherford, Watson, and himself at the helm, Project Physics was off to the races as of 1 July 1964 with a large number of contributors developing the text, lab manuals, supplementary reading materials, teachers' materials, and film strips (Holton 1967). All of this was tested through teacher workshops and school trials.

By 1970, Project Physics was being used by roughly 300,000 students nationally thereby reaching roughly 20% of the high school students taking physics (Holton 2003). Internationally, *Project Physics* was translated for use in Italy, Portugal, Japan, China, Australia, and Canada. In each case the translation came with the stipulation that the content be adjusted for the local culture. For Canada there were both an English and a French Quebec version with appropriate shifts in references for the local culture (Holton 1978).

We remember Project Physics today as a beacon for what can be achieved with a science curriculum connected to the history and culture of science. Project Physics was based on Holton's intuition that inclusion of the physical sciences in a liberal education that addressed all students, not just the 20% already motivated to study science, required a coherence and connectedness with culture, and that such connections needed to be made through the history of science. Those of us engaged in science teaching through history and philosophy arrive at this intuition early in our careers. It seems so obvious. Analogously, we are the 20% who are already motivated to engage in this pedagogy. But in the United States with class time short, with the physical sciences taught in high schools targeting performance on standardized exams, and the

introductory college courses offered as service courses at the university level, justification for time to be spent connecting physical science (or any of the sciences) to society and culture is a battle both for time and with our colleagues whose interests are more narrow.

The competition for class time is such that the history and culture of the scientific enterprise almost invariably loses out. Ahlgren and Walberg (1973) make this point in their contrast of Project Physics with the physics curriculum developed by the Physics Science Study Committee (PSSC 1960). The stated content objective of the PSSC was "to develop a physics course that emphasizes the essential intellectual, aesthetic, and historical background of physical science" (PSSC 1957), but the product itself was almost strictly devoted to science content. By contrast, Project Physics explicitly included the history of science in the text, assignments and tests. From this graded inclusion students understood that the teacher valued their learning of the history and culture of science, as well as the physics content *per se*.

When material is added to a course, other material must be displaced. The selection of topics in the Project Physics text delved into the standard concepts of physics (motion, light, waves, electromagnetism), as well as more modern atomic theory and quantum mechanics, but jettisoned some of the more technical exercises of the traditional texts. Despite this shift from more traditional physics content, Project Physics students still performed as well as students in a traditional course on a standardized test (in this case, the New York State Regents exam). Evaluation studies further demonstrated that students who took the course had improved attitudes towards physics as compared to students who took a traditional physics course or PSSC Physics (Ahlgren & Walberg 1973). We might also very reasonably speculate that these students also learned some history and had an improved understanding of how science is done.

As Holton has written, if asked whether the effort of teaching the physical sciences from a humanistic perspective is worth losing what must be displaced of the physics to include the "extras" of history:

> The humanistic approach to science teaching has been tried, and it works. If I were to leave out what you regard as extras, I would be apt to teach *dead* science, and my students would know it. Instead, I shall take on the more difficult task that my sense of obligation to my students requires, and they will thank me for it." (Holton, 2014)

While Project Physics provides those of us who believe in a humanistic approach to science education with talking points based on its success, there are transcendent themes in Holton's writings that speak to the current times when educators are faced with changing student demographics. These are evident in Holton's subsequent contributions to *A Nation at Risk* (Gardner 1983) and to gender equity in the sciences with *Who Succeeds in Science?* (Sonnert & Holton 1995). These promote a broader humanistic approach to educational reform that recognizes that all students should have the opportunity to succeed in science. In *A Nation at Risk*, to which Holton contributed significantly, the humanist expectation of education is succinctly stated in a very Jeffersonian way:

> All, regardless of race or class or economic status, are entitled to a fair chance and to the tools for developing their individual powers of mind and spirit to the utmost. This promise means that all children by virtue of their own efforts, competently guided, can hope to attain the mature and informed judgement needed to secure gainful employment, and to manage their own lives, thereby serving not only their own interests but also the progress of society itself.

These words resonate with me as the broad objectives of my own pedagogical activity. I am a physicist and science educator who prepares pre-service elementary teachers, pre-service science teachers, provides professional development for in-service physics teachers, and works with teachers in grades K-12 to teach science in high need school districts. For my work, I am grateful to Project Physics for validating my belief that teaching the conceptual history of science is a good way to teach the nature of science to teachers (Garik et al 2015; Winrich & Garik 2021) and that in doing so I may at least indirectly affect the attitudes toward science of their students who are our future citizenry.

It is when I work with teachers in a high-need school district with a majority of students from immigrant families, and for whom English is a second language, that the need to find ways to connect science to different cultures becomes essential. Project Physics taught us the value of connecting students to the culture of science, but making such connections meaningful is a two way affair. Here education research and best practice pedagogy have caught up to Holton's prescient intuition for the value of a humanistic approach to science teaching. Culturally relevant/responsive teaching, also referred to as culturally competent teaching, seeks ways to connect students' home and neighborhood cultures with their school studies (Gay 2013) and help all students feel that they belong in science class. Project Physics showed such sensitivity to making connections to students' culture in the stipulation that the translations of Project Physics for other countries make alterations to fit the local culture, and in the promotion of gender inclusiveness in such ways as with the pictures in the frontispieces of the Project Physics Readers of young women studying.

Embedding students' culture in science instruction does not conflict with a humanistic science curriculum that includes the history of science ideas and the contributions of great scientists of the past. That provides a general affirmation of humanity's capacity to understand the natural world. Culturally responsive teaching further engages students by providing connections with their own culture and identity to help them recognize that they too can contribute to our understanding of Nature. The global growth of science over the past fifty years, as well as research that has recognized uncredited women scientists, has made this easier with ever more stories of women and scientists of color making contributions in all the sciences.

Reading the list of contributors to Project Physics (Holton 1967) and to PSSC Physics (PSSC 1957), the names and genders tell a story of white males of European descent dominating the development of the curriculum. One might imagine Holton constituting a committee in 2022 to develop a humanistic physical science curriculum and how its membership would reflect the gains made in the participation of women and the many ethnic groups/persons of color in the United States in the sciences. Such a modern committee would have no difficulty adopting the humanist approach of Project Physics while finding ways to broaden the course's appeal to a larger audience with sensitivity to the need for the inclusion of women and students of color. This would address concerns raised in *A Nation at Risk* (Gardner 1983) as quoted by Holton (2003b):

> Our concern, however, goes well beyond matters such as industry and commerce. It also includes the intellectual, moral, and spiritual strengths of our people which knit together the very fabric of our society. ... A high level of shared education is essential to a free, democratic society.

Project Physics arose out of a need to engage students in physics courses at a time when enrollment in high school physics had dropped precipitously, a time when the national interest appeared to be served by increasing the scientific knowledge of high school graduates, and the post-Manhattan Project time when leading scientists were concerned about the citizenry's understanding of the scientific enterprise. Project Physics addressed these issues by humanizing physics education with a resultant improvement of student attitudes, while maintaining ambitious standards for physics learning.

It is now more than 50 years after the completion of the first draft of Project Physics. The world has changed since then, but the needs of science education, and physics education, have not changed greatly. In an age of alternative facts and disinformation there has never been a greater need for science education. When as educators we make our arguments for improving science education, we should rely on the lessons learned from Project Physics and Gerald Holton's insights into students' needs for connections between the culture of science and their own identity.

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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 **here**.

Previous HPS&ST Note Opinion Pieces **here**.

Varia

- The Fourth International Conference of the German Society for Philosophy of Science (GWP.2022), which was originally scheduled for March 2022, will **now take place from 15th-17th of August 2022**, at Technische Universität Berlin. The line-up of talks and contributed papers/ symposia remains unchanged (no new CfP will be necessary). For more information, see https://www.wissphil.de/gwp2022/

- To mark the 140th anniversary of Darwin's death in 1882, the Darwin Online project has transcribed c.100 items from the Darwin family's collection of letters and telegrams received from relatives, friends, contemporaries and institutions. The messages expressed grief and sorrow, offered condolences and tributes to the scientific figure they saw as having transformed our understanding of the living world. Many of these messages contain intimate and personal reminiscences by the writer- providing never before published details about Darwin and his contemporaries.
  http://darwin-online.org.uk/whatsnew.html

- The Antiquarian Horological Society (www.ahsoc.org) is delighted to announce the online publication of an open-access edition of its 2016 publication, *The Life and Travels of James Upjohn*, edited by John Leopold and Roger Smith.

With a full set of facsimile images of the original 1784 manuscript alongside a transcription, this important volume offers Upjohn's first-hand insight into the state of the British and Continental watch trade in the mid-eighteenth century.

Alongside the original text, Leopold and Smith's scholarly interpretation, together with maps showing Upjohn's journeys and a full index, complete the volume, which is available here: www.ahsoc.org/resources/public-resources/ (scroll to 'Books and manuscripts').

- Mark Young: 2022, 'From Epistemology to Policy: Reorienting Philosophy Courses for Science Students', *European Journal of Philosophy of Science* Vol. 12

  Open Access: HERE

- Michael Matthews, 'Thomas Kuhn and Science Education' here

- Michael Matthews, 'Indigenous Knowledge in the Science Curriculum: The New Zealand Experience' here

- ***European Journal for Philosophy of Science*** Open Access Articles (139) here

- ***Science & Education*** Open Access Articles (88) here

PhD Award in HPS&ST: 'NOS & Critical Realism', Robyn Yucel, Deakin University

Candidate's name and email:
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Institution:
Deakin University, Melbourne, Australia

Supervisor:
Professor Liz Johnson

Thesis title:
'Nature of Science' in Undergraduate Curriculum: A Critical Realist Exploration

Abstract:

This study, guided by critical realism, explores the phenomenon of NOS in Australian undergraduate science curricula. The research is conducted over three phases, framed by Roy Bhaskar's critical realist ontology

of the *empirical*, the *actual* and the *real* domains. In the domain of the *empirical*, I explore what is already visible about NOS in undergraduate science degree programs in Australia, identifying units of study in 2011 and 2018 dedicated to teaching seven themes related to NOS. In the domain of the *actual*, I use semi-structured interviews to explore Australian science academics' experiences of (i) NOS in scientific practice and (ii) NOS in teaching and learning. Through theoretical redescription, I interpret scientists' worldview commitments through a critical realist framework and demonstrate that the dual commitments of ontological realism and epistemological fallibilism are not contradictory. This challenges the prevailing view in the science education literature that scientists hold confused, contradictory, and naive views about NOS.

In NOS teaching and learning, I identify a disconnect between science academics' recognition of the value of NOS for students and its absence in the curriculum. This disconnect becomes the focus in phase 3 of the research in the domain of the *real*. In this phase, I use Margaret Archer's morphogenetic approach to identify a structural situational logic of *protection* acting as a barrier to curriculum change and a cultural situational logic of *opportunity* to reframe the undergraduate science curriculum to simultaneously serve multiple purposes.

This study contributes to existing science education scholarship through the novel application of Bhaskar's critical realism to NOS, thus making a case for greater inclusion of the voices of scientists in conceptualising NOS for science education. The study also contributes to research in the field of higher education curriculum by conceptualizing curriculum change through careful application of Margaret Archer's morphogenetic approach.

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Thesis available at Deakin library thesis repository.

https://dro.deakin.edu.au/view/DU:30167707

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

Recent HPS&ST Research Articles

Archila, P.A., Truscott de Mejía, AM. & Restrepo, S. (2022). Using Drama to Enrich Students' Argumentation About Genetically Modified Foods. *Sci & Educ,* 1-34. https://doi.org/10.1007/s11191-022-00346-y

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Recent HPS&ST Related Books

Bod, R. (2022). *World of Patterns: A Global History of Knowledge* (Trans., Leston Buell). Baltimore, MD: Johns Hopkins University Press. ISBN: 142-1-44344-9

> "The idea that the world can be understood through patterns and the principles that govern them is one of the most important human insights—it may also be our greatest survival strategy. Our search for patterns and principles began 40,000 years ago, when striped patterns were engraved on mammoths' bones to keep track of the moon's phases. What routes did human knowledge take to grow from these humble beginnings through many detours and dead ends into modern understandings of nature and culture? In this work of unprecedented scope, Rens Bod removes the Western natural sciences from their often-central role to bring us the first global history of human knowledge.
>
> "Having sketched the history of the humanities in his ground-breaking *A New History of the Humanities*, Bod now adopts a broader perspective, stepping beyond classical antiquity back to the Stone Age to answer the question: Where did our knowledge of the world today begin and how did it develop? Drawing on developments from all five continents of the inhabited world, *World of Patterns* offers startling connections. Focusing on a dozen fields—ranging from astronomy, philology, medicine, law, and mathematics to history, botany, and musicology—Bod examines to what degree their progressions can be considered interwoven and to what degree we can speak of global trends.
>
> "In this pioneering work, Bod aims to fulfill what he sees as the historian's responsibility: to grant access to history's goldmine of ideas. Bod discusses how inoculation was invented in China rather than Europe; how many of the fundamental aspects of modern mathematics and astronomy were first discovered by the Indian Kerala school; and how the study of law provided fundamental models for astronomy and linguistics from Roman to Ottoman times. The book flies across continents and eras. The result is an enlightening symphony, a stirring chorus of human inquisitiveness extending through the ages." (From the Publisher)

More information at: https://www.press.jhu.edu/books/title/12442/world-patterns

Breckinridge, J. B. & Pridgeon, A.M. (2022) *With Stars in Their Eyes: The Extraordinary Lives and Enduring Genius of Aden and Marjorie Meinel*. Oxford, UK: Oxford University Press.
ISBN: 97-8-019-091567-4

> "Aden B. Meinel and Marjorie P. Meinel stood at the confluence of several overarching technological developments during their lifetimes, including postwar aerial surveillance by spy planes and satellites, solar energy, the evolution of telescope design, interdisciplinary optics, and photonics. Yet, their incredible stories and their long list of scientific contributions have never been adequately recognized in one place. In this book, James Breckinridge and Alec M. Pridgeon correct this oversight by sharing the story of this powerful duo.
>
> "The book follows their lives and covers large scientific developments between World War II to the Cold War. James B. Breckinridge, a previous advisee and later colleague to the Meinels, and historian and scientist Alec M. Pridgeon collected more than 200 hours of oral interviews with those who worked closely with the Meinels and some who built their careers around the findings made possible by their work. The book shares and analyzes the work done by the Meinels, and it also includes incredible insights from an unpublished Meinel autobiography." (From the Publisher)

More information at: https://tinyurl.com/yc6ns4wv

Hankinson, R., & Havrda, M. (Eds.). (2022). *Galen's Epistemology: Experience, Reason, and Method in Ancient Medicine*. Cambridge: Cambridge University Press. ISBN: 978-1-009-07267-0

"Determining what has gone wrong in a malfunctioning body and proposing an effective treatment requires expertise. Since antiquity, philosophers and doctors have wondered what sort of knowledge this expertise involves, and whether and how it can warrant its conclusions. Few people were as qualified to deal with these questions as Galen of Pergamum (129–ca. 216). A practising doctor with a keen interest in logic and natural science, he devoted much of his enormous literary output to the task of putting medicine on firm methodological grounds. At the same time he reflected on philosophical issues entailed by this project, such as the nature of experience, its relation to reason, the criteria of truth, and the methods of justification. This volume explores Galen's contributions to (mainly scientific) epistemology, as they arise in the specific inquiries and polemics of his works, as well as their legacy in the Islamic world." (From the Publisher)

More information at: https://tinyurl.com/bddbscrz

Heering, P. (eds) (2022). *Kanonische Experimente der Physik: Fachliche Grundlagen und historischer Kontext* [Canonical experiments in physics: scientific background and historical context] Springer Spektrum: Berlin. https://doi.org/10.1007/978-3-662-64646-5_8

"In 14 case studies, this book provides a deeper understanding of canonical experiments in physics and offers background information on material and practical aspects as well as the respective historical context. It discusses how exactly these experiments were carried out and what the scientific reasons were for the choice of instruments used. It also presents why the respective researchers conducted these experiments and how these results could be accepted.

"While a number of these experiments and their methods, such as the Geiger-Müller counting tube or Young's double-slit experiment, are familiar to physics teachers and (prospective) physicists in terms of their functional principle, this book provides the background to understand the challenges that arise during experimentation and that can also make up the appeal of experimental work. It clarifies why researchers conduct research, what motivates them and how scientific practices change over time. The case studies brought together here thus contribute to understanding physics not as a canon of knowledge but as a culturally shaped process carried out by people. The book is thus particularly suitable for students (both of the subject and of teaching) as well as teachers at universities and (high) schools." (Translation by the author)

More information at: https://link.springer.com/book/10.1007/978-3-662-64646-5#about

Matlin, K. S. (2022). *Crossing the Boundaries of Life: Günter Blobel and the Origins of Molecular Cell Biology.* Chicago, IL: Chicago University Press.
ISBN: 978-0-226-81934-1

"The difficulty of reconciling chemical mechanisms with the functions of whole living systems has plagued biologists since the development of cell theory in the nineteenth century. As Karl S. Matlin argues in *Crossing the Boundaries of Life*, it is no coincidence that this long-standing knot of scientific inquiry was loosened most meaningfully by the work of a cell biologist, the Nobel laureate Günter Blobel. In 1975, using an experimental setup that did not contain any cells at all, Blobel was able to target newly made proteins to cell membrane vesicles, enabling him to theorize how proteins in the cell distribute spatially, an idea he called the signal hypothesis. Over the next twenty years, Blobel and other scientists were able to dissect this mechanism into its precise molecular details. For elaborating his signal concept into a process he termed *membrane topogenesis*—the idea that each protein in the cell is synthesized with an "address" that directs the protein to its correct destination within the cell—Blobel was awarded the Nobel Prize in Physiology or Medicine in 1999.

"Matlin argues that Blobel's investigative strategy and its subsequent application addressed a fundamental unresolved dilemma that had bedeviled biology from its very beginning—the relationship between structure and function—allowing biology to achieve mechanistic molecular explanations of biological phenomena. *Crossing the Boundaries of Life* thus uses Blobel's research and life story to shed light on the importance of cell biology for twentieth-century science, illustrating how it propelled the development of adjacent disciplines like biochemistry and molecular biology." (From the Publisher)

More information at: https://press.uchicago.edu/ucp/books/book/chicago/C/bo151028314.html

McDonough, J. K. (2022). *A Miracle Creed: The Principle of Optimality in Leibniz's Physics and Philosophy*. Oxford, UK: Oxford University Press.
ISBN: 978-0-197-62907-9

"A rival to Isaac Newton in mathematics and physics, Gottfried Wilhelm Leibniz believed that our world—the best of all possible worlds—must be governed by a principle of optimality. This book explores Leibniz's pursuit of optimality in five of his most important works in natural philosophy and shows how his principle of optimality bridges his scientific and philosophical studies. The first chapter explores Leibniz's work on the laws of optics and its implications for his defense of natural teleology. The second chapter examines Leibniz's work on the breaking strength of rigid beams and its implications for his thinking about the metaphysical foundations of the material world. The third chapter revisits Leibniz's famous defense of the conservation of vis viva and proposes a novel account of the origin of Leibniz's mature natural philosophy. The fourth chapter takes up Leibniz's efforts to determine the shape of freely hanging chains—the so-called problem of the catenary—and shows how that work provides an illuminating model for his thinking about the teleological structure of wills. Finally, the fifth chapter uses Leibniz's derivation of the path of quickest descent—his solution to the so-called problem of the Brachistochrone—and its historical context as a springboard for an exploration of the legacy of Leibniz's physics. The book closes with a brief discussion of the systematicity of Leibniz's thinking in philosophy and the natural sciences." (From the Publisher)

More information at: https://tinyurl.com/2tkajttx

McLeish, T. (2022). *The Poetry and Music of Science: Comparing Creativity in Science and Art*. [New in Paperback]. Oxford, UK: Oxford University Press.
ISBN: 978-0-192-84537-5

"What human qualities are needed to make scientific discoveries, and which to make great art? Many would point to 'imagination' and 'creativity' in the second case but not the first. This book challenges the assumption that doing science is in any sense less creative than art, music or fictional writing and poetry, and treads a historical and contemporary path through common territories of the creative process. The methodological process called the 'scientific method' tells us how to test ideas when we have had them, but not how to arrive at hypotheses in the first place. Hearing the stories that scientists and artists tell about their projects reveals commonalities: the desire for a goal, the experience of frustration and failure, the incubation of the problem, moments of sudden insight, and the experience of the beautiful or sublime.

"Selected themes weave the practice of science and art together: visual thinking and metaphor, the transcendence of music and mathematics, the contemporary rise of the English novel and experimental science, and the role of aesthetics and desire in the creative process. Artists and scientists make salient comparisons: Defoe and Boyle; Emmerson and Humboldt, Monet and Einstein, Schumann and Hadamard. The book draws on medieval philosophy at many points as the product of the last age that spent time in inner contemplation of the mystery of how something is mentally brought out from nothing. Taking the phenomenon of the rainbow as an example, the principles of creativity within constraint point to the scientific imagination as a parallel of poetry." (From the Publisher)

More information at: https://tinyurl.com/2nfktv9f

Nahin, P. J. (2022). *Hot Molecules, Cold Electrons: From the Mathematics of Heat to the Development of the Trans-Atlantic Telegraph Cable*. New York: NY: Princeton University Press. ISBN: 978-0-691-20784-1

"Heat, like gravity, shapes nearly every aspect of our world and universe, from how milk dissolves in coffee to how molten planets cool. The heat equation, a cornerstone of modern physics, demystifies such processes, painting a mathematical picture of the way heat diffuses through matter. Presenting the mathematics and history behind the heat equation, *Hot Molecules, Cold Electrons* tells the remarkable story of how this foundational idea brought about one of the greatest technological advancements of the modern era.

"Paul Nahin vividly recounts the heat equation's tremendous influence on society, showing how French mathematical physicist Joseph Fourier discovered, derived, and solved the equation in the early nineteenth century. Nahin then follows Scottish physicist William Thomson, whose further analysis of Fourier's explorations led to the pioneering trans-Atlantic telegraph cable. This feat of engineering reduced the time it took to send a mes-

sage across the ocean from weeks to minutes. Readers also learn that Thomson used Fourier's solutions to calculate the age of the earth, and, in a bit of colorful lore, that writer Charles Dickens relied on the trans-Atlantic cable to save himself from a career-damaging scandal. The book's mathematical and scientific explorations can be easily understood by anyone with a basic knowledge of high school calculus and physics, and MATLAB code is included to aid readers who would like to solve the heat equation themselves.

"A testament to the intricate links between mathematics and physics, *Hot Molecules, Cold Electrons* offers a fascinating glimpse into the relationship between a formative equation and one of the most important developments in the history of human communication." (From the Publisher)

More information at: https://tinyurl.com/2p8ze4zs

Schilling, G. (2022). *The Elephant in the Universe: Our Hundred-Year Search for Dark Matter*. (Foreword by Avi Loeb). Cambridge, MA: Harvard University Press.
ISBN: 978-0-674-24899-1

"When you train a telescope on outer space, you can see luminous galaxies, nebulae, stars, and planets. But if you add all that together, it constitutes only 15 percent of the matter in the universe. Despite decades of research, the nature of the remaining 85 percent is unknown. We call it dark matter.

"In *The Elephant in the Universe*, Govert Schilling explores the fascinating history of the search for dark matter. Evidence for its existence comes from a wealth of astronomical observations. Theories and computer simulations of the evolution of the universe are also suggestive: they can be reconciled with astronomical measurements only if dark matter is a dominant component of nature. Physicists have devised huge, sensitive instruments to search for dark matter, which may be unlike anything else in the cosmos—some unknown elementary particle. Yet so far dark matter has escaped every experiment. Indeed, dark matter is so elusive that some scientists are beginning to suspect there might be something wrong with our theories about gravity or with the current paradigms of cosmology. Schilling interviews both believers and heretics and paints a colorful picture of the history and current status of dark matter research, with astronomers and physicists alike trying to make sense of theory and observation.

"Taking a holistic view of dark matter as a problem, an opportunity, and an example of science in action, *The Elephant in the Universe* is a vivid tale of scientists puzzling their way toward the true nature of the universe." (From the Publisher)

More information at: https://www.hup.harvard.edu/catalog.php?isbn=9780674248991

Scull, A. (2022). *Desperate Remedies: Psychiatry's Turbulent Quest to Cure Mental Illness*.
Cambridge, MA: Harvard University Press.
ISBN: 978-0-674-26510-3

"For more than two hundred years, disturbances of the mind—the sorts of things that were once called "madness"—have been studied and treated by the medical profession. Mental illness, some insist, is a disease like any other, whose origins can be identified and from which one can be cured. But is this true?

"In this masterful account of America's quest to understand and treat everything from anxiety to psychosis, one of the most provocative thinkers writing about psychiatry today sheds light on its tumultuous past. *Desperate Remedies* brings together a galaxy of mind doctors working in and out of institutional settings: psychologists and psychoanalysts, neuroscientists, and cognitive behavioral therapists, social reformers and advocates of mental hygiene, as well as patients and their families desperate for relief.

"Andrew Scull begins with the birth of the asylum in the reformist zeal of the 1830s and carries us through to the latest drug trials and genetic studies. He carefully reconstructs the rise and fall of state-run mental hospitals to explain why so many of the mentally ill are now on the street and why so many of those whose bodies were experimented on were women. In his compelling closing chapters, he reveals how drug companies expanded their reach to treat a growing catalog of ills, leading to an epidemic of over-prescribing while deliberately concealing debilitating side effects.

"Carefully researched and compulsively readable, *Desperate Remedies* is a definitive account of America's long battle with mental illness that challenges us to rethink our deepest assumptions about who we are and how we

think and feel." (From the Publisher)

More information at: https://www.hup.harvard.edu/catalog.php?isbn=9780674265103

Strickland, L., & Lewis, H. R. (2022). *Leibniz on Binary: The Invention of Computer Arithmetic*. Massachusetts, MA: The MIT University Press.
ISBN: 978-0-262-54434-4

"The polymath Gottfried Wilhelm Leibniz (1646–1716) is known for his independent invention of the calculus in 1675. Another major—although less studied—mathematical contribution by Leibniz is his invention of binary arithmetic, the representational basis for today's digital computing. This book offers the first collection of Leibniz's most important writings on the binary system, all newly translated by the authors with many previously unpublished in any language. Taken together, these thirty-two texts tell the story of binary as Leibniz conceived it, from his first youthful writings on the subject to the mature development and publication of the binary system.

"As befits a scholarly edition, Strickland and Lewis have not only returned to Leibniz's original manuscripts in preparing their translations, but also provided full critical apparatus. In addition to extensive annotations, each text is accompanied by a detailed introductory "headnote" that explains the context and content. Additional mathematical commentaries offer readers deep dives into Leibniz's mathematical thinking. The texts are prefaced by a lengthy and detailed introductory essay, in which Strickland and Lewis trace Leibniz's development of binary, place it in its historical context, and chart its posthumous influence, most notably on shaping our own computer age" (From the Editors)

More information is available at: https://mitpress.mit.edu/books/leibniz-binary

Thagard, P. (2022). *Balance: How It Works and What It Means*. New York, NY: Columbia University Press.
ISBN: 978-0-231-55607-1

"Living is a balancing act. Ordinary activities like walking, running, or riding a bike require the brain to keep the body in balance. A dancer's poised elegance and a tightrope walker's breathtaking performance are feats of balance. Language abounds with expressions and figures of speech that invoke balance. People fret over work-life balance or try to eat a balanced diet. The concept crops up from politics—checks and balances, the balance of power, balanced budgets—to science, in which ideas of equilibrium are crucial. Why is balance so fundamental, and how do physical and metaphorical balance shed light on each other?

"Paul Thagard explores the physiological workings and metaphorical resonance of balance in the brain, the body, and society. He describes the neural mechanisms that keep bodies balanced and explains why their failures can result in nausea, falls, or vertigo. Thagard connects bodily balance with leading ideas in neuroscience, including the nature of consciousness. He analyzes balance metaphors across science, medicine, economics, the arts, and philosophy, showing why some aid understanding but others are misleading or harmful. Thagard contends that balance is ultimately a matter of making sense of the world. In both literal and metaphorical senses, balance is what enables people to solve the puzzles of life by turning sensory signals or an incongruous comparison into a coherent whole.

"Bridging philosophy, psychology, and neuroscience, *Balance* shows how an unheralded concept's many meanings illuminate the human condition." (From the Publisher)

More information at: https://cup.columbia.edu/book/balance/9780231205580

Verburgt, L.M. (2022). *A Prodigy of Universal Genius: Robert Leslie Ellis, 1817-1859*. Cham: Springer.
ISBN: 978-3-030-85260-3

"This open access book brings together for the first time all aspects of the tragic life and fascinating work of the polymath Robert Leslie Ellis (1817–1859), placing him at the heart of early-Victorian intellectual culture.

"Written by a diverse team of experts, the chapters in the book's first part contain in-depth examinations of, among other things, Ellis's family, education, Bacon scholarship and mathematical contributions. The second part consists of annotated transcriptions of a selection of Ellis's diaries and correspondence. Taken to-

gether, *A Prodigy of Universal Genius: Robert Leslie Ellis, 1817–1859* is a rich resource for historians of science, historians of mathematics and Victorian scholars alike." (From the Publiher)

"Robert Leslie Ellis was one of the most intriguing and wide-ranging intellectual figures of early Victorian Britain, his contributions ranging from advanced mathematical analysis to profound commentaries on philosophy and classics and a decisive role in the orientation of mid-nineteenth century scholarship. This very welcome collection offers both new and authoritative commentaries on the work, setting it in the context of the mathematical, philosophical and cultural milieux of the period, together with fascinating passages from the wealth of unpublished papers Ellis composed during his brief and brilliant career." - Simon Schaffer, Department of History and Philosophy of Science, University of Cambridge

More information at: https://link.springer.com/book/10.1007/978-3-030-85258-0#about

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

New Assistant Editor (North America)

Sophia Jeong, an assistant professor of science education in the College of Education & Human Ecology, Ohio State University, has been appointed for a two-year term as HPSST Newsletter Assistant Editor (North America). Her first degree, in Molecular Biology, was from the University of California, San Diego. Then followed a master's degree in Science Teaching from University of Southern California. Her PhD in science education was from University of Georgia.

She has been a teaching assistant in university microbiology and ecology programmes; has taught STEM methods; has supervised doctoral and masters' students. She has presented her research in Strand 13 (HPS) of NARST; she is fluent in Korean.

She can be contacted direct at: **jeong.387@osu.edu**

Coming HPS&ST Related Conferences

June 9-11, 2022, 30th Baltic Conference on the History and Philosophy of Science, University of Oulu, Finland
Details here

June 9-10, 2022, Global History and Culture Centre, Annual Conference, 'History of Science and the 'Big Picture'.
Details here

June 19, 2022, Celebrating the Life, Science, Music, and Legacy of William Herschel (1738-1822), University of York.
Information: Rachel Cowgill

June 30-July 2, 2022, 4th International Conference on Science & Literature, Girona, Spain.
Details from Carlos Manuel Gamez Perez **here**

July 2-4, 2022, Society for Philosophy of Science in Practice (SPSP) Ninth Biennial Conference Ghent University, Belgium, information here

July 3rd-7th, 2022, IHPST 16th International Conference, University of Calgary, Canada
Details **here**

July 13-15, 2022, Thomas Kuhn and the 21st Century Philosophy of Science, University of Kent.
Details **HERE**

July 18-22, 2022, 'Objects of Understanding: Historical Perspectives on Material Artefacts in Science Education', Europa-Universität Flensburg, Germany
Details: Roland Wittje, roland.wittje@gmail.com and **HERE**

August 17-19, 2022 East European Network for Philosophy of Science (EENPS) 2022 Conference, University of Tartu
Details HERE

September 7-10, 2022, 10th European History of Science Society Conference, Brussels.
'Science Policy and the Politics of Science'.
Information **HERE**

September 19-23, 2022, 41st Symposium of the Scientific Instrument Commission, Athens.
Details, George N. Vlahakis, **HERE**.

July 24-29, 2023, 17th DLMPST Congress, University of Buenos Aires
Information: Pablo Lorenzano, **HERE**

HPS&ST Related Organisations and Websites

IUHPST – International Union of History, Philosophy, Science, and Technology

DLMPST – Division of Logic, Mathematics, Philosophy, Science, and Technology

DHST – Division of History, Science, and Technology

IHPST – International History, Philosophy, and Science Teaching Group

NARST - National Association for Research in Science Teaching

ESERA - European Science Education Research Association

ASERA - Australasian Science Education Research Association

ICASE - International Council of Associations for Science Education

UNESCO – Education

HSS – History of Science Society

ESHS – European Society for the History of Science

AHA – American History Association

ACS HIST – American Chemical Society Division of the History of Chemistry

GWMT - Gesellschaft für Geschichte der Wissenschaften, der Medizin und der Technik

ISHEASTME – International Society for the History of East Asian History of Science Technology and Medicine

EASE - East-Asian Association for Science Education

BSHS – British Society for History of Science

EPSA - European Philosophy of Science Association

AAHPSSS - The Australasian Association for the History, Philosophy, and Social Studies of Science

HOPOS – International Society for the History of Philosophy of Science

PSA – Philosophy of Science Association

BAHPS - Baltic Association for the History and Philosophy of Science

BSPS – The British Society for the Philosophy of Science

SPSP - The Society for Philosophy of Science in Practice

ISHPSB - The International Society for the History, Philosophy, and Social Studies of Biology

PES – The Philosophy of Education Society (USA)

The above list is updated and kept on the HPS&ST website **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)

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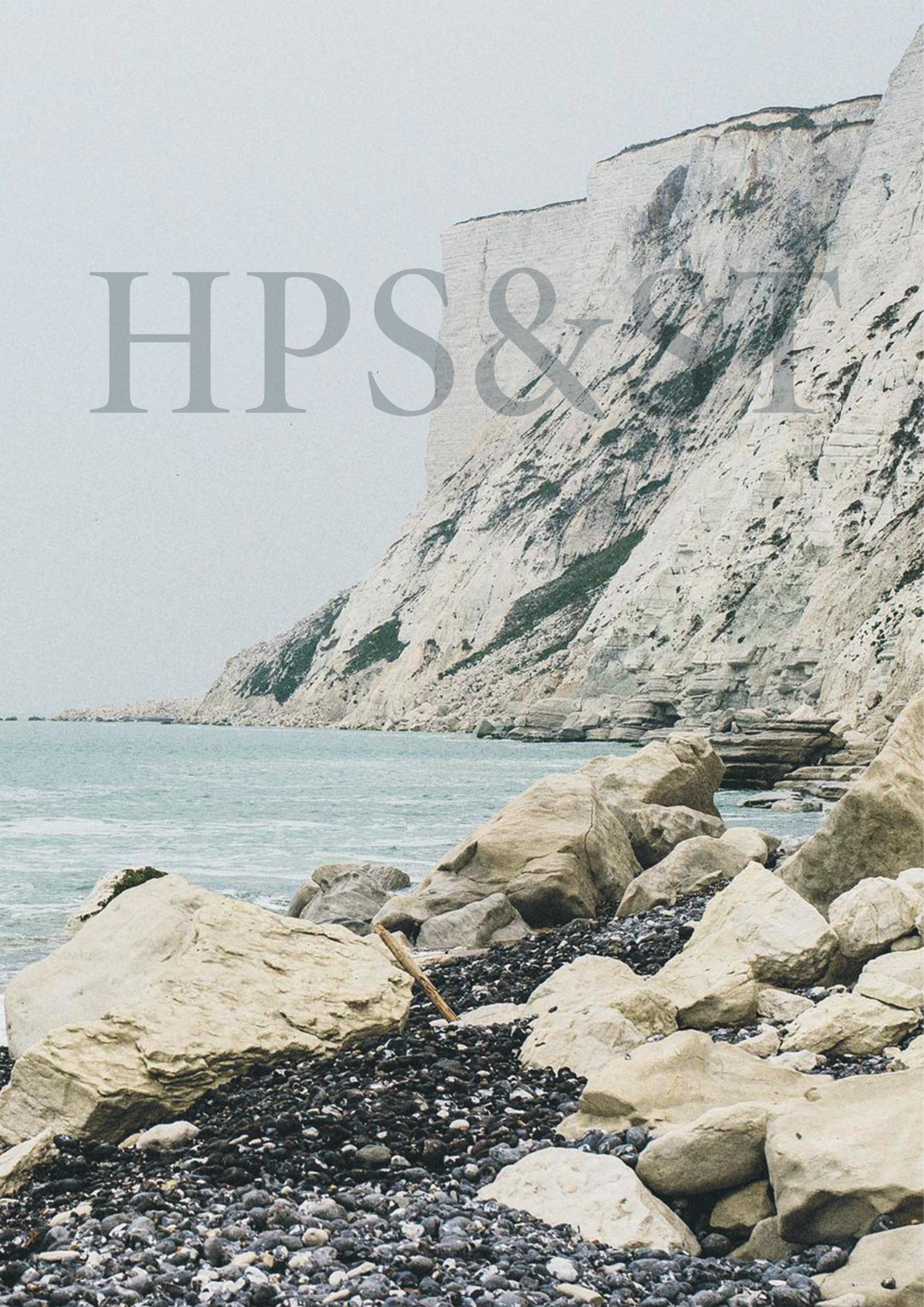
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