HPS&ST NEWSLETTER

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SEPTEMBER 2019

The HPS&ST NEWSLETTER (previously HPS&ST NOTE) has been published for about 30 years in print or electronic form. It began during the editor's 25-year period (1990-2014) as editor of Springer's *Science & Education: Contributions from History and Philosophy of Science* journal and his term as president of the International History, Philosophy and Science Teaching Group and later as president of the Inter-Divisional Teaching Commission of the DLMPST & the DHST.

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 contents page of the HPS&ST NEWSLETTER is emailed monthly to about 8,000 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 teacher education; and/or interests in the promotion of innovative, engaging and effective teaching of the history and philosophy of science. The announcement is sent to many international and national HPS lists and science education lists. The announcement email contains a link to the website where the full newsletter can be read or downloaded as a `pdf`.

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

ISSN: 2652-2837

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Mario Bunge, 100th Birthday

Mario Bunge is expected to celebrate his 100th birthday on 21st September. He was born in Argentina on 21st September 1919. He has held chairs in physics and in philosophy at universities in Argentina, the USA, and since 1966 a philosophy chair at McGill University. He has published 70 books (many with revised editions) and 540 articles; with many translated into one or other of twelve languages.

Bunge has made substantial contributions to an unequalled range of fields: physics, philosophy of physics, metaphysics, methodology and philosophy of science, philosophy of mathematics, logic, philosophy of psychology, philosophy of social science, philosophy of biology, philosophy of technology, moral philosophy, social and political philosophy, management theory, medical philosophy, linguistics, criminology, legal philosophy, and education.

He reads and writes in half-a-dozen languages. At age 20 he founded a Workers University (the *Universidad Obrera Argentina*) in Buenos Aires. He is a staunch defender of realism in both philosophy of science and in ethics; and is a champion of the Enlightenment tradition. He rejects pseudoscientism, but champions scientism, claiming that there is no other way to know of the world, including the social world, except scientifically.

Of Bunge's entry to international philosophy in the 1950s and '60s, Alberto Cordero wrote: "No Latin American philosopher had achieved anything comparable before in cosmopolitan philosophy …he was the most universalist of philosophers in the subcontinent".

Bunge's remarkable corpus of scientific and philosophical writing is not inert; it has had significant disciplinary, cultural and social impact. In 1989 the *American Journal of Physics* asked its readers to vote for their favourite papers from the journal in the sixty years since its founding in 1933. Bunge's 1956 'Survey of the Interpretations of Quantum Mechanics' was among the 20 top voted papers. In 1993, the journal repeated the exercise this time Bunge's 1966 paper 'Mach's Critique of Newtonian Mechanics' – joined his first paper in the top 20.

Beyond breadth, Bunge's work is noteworthy for its coherence and systemicity. Through to the mid-twentieth century most significant Western philosophers were systematic philosophers. But in the past half-century and more, the pursuit of systemic philosophy, 'big pictures', 'grand narratives' or even cross-disciplinary understanding has considerably waned. As Susan Haack wrote:

> Our discipline becomes every day more specialized, more fragmented into cliques, niches, cartels, and

> fiefdoms, and more determinedly forgetful of its own history. (*Scientism and its Discontents*, 2016, p.39).

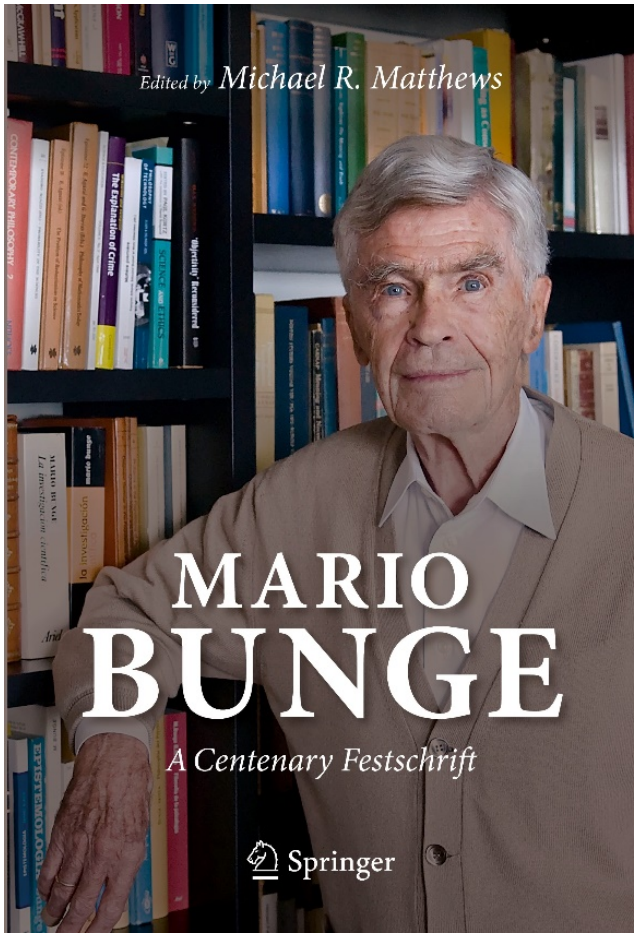
The disciplinary norm has shrunk from scientifically-informed philosophers with wide systemic concerns, to those preoccupied with narrow-focus pursuits.

Bunge with his multi-disciplinary competences and wide-ranging intellectual concerns has defied this trend. His philosophical system was laid out in detail in his monumental eight-volume *Treatise on Basic Philosophy* (1974-1989). Individual volumes were devoted to Semantics, Ontology, Epistemology, Systemism, Philosophy of Science, and Ethics. His *Political Philosophy: Fact, Fiction and Vision* (2009) was originally planned as its ninth volume.

Bunge has applied his systems approach to issues in logic, mathematics, physics, biology, psychology, social science, technology, medicine, legal studies, economics, and science policy.

Bunge's life-long commitment to Enlightenment-informed, socially-engaged, systemic philosophy is manifest in his being asked in 2017 by the *Academia Argentina de Ciencias Exactas, Físicas y Naturales* to draft its response to the crisis of anthropogenic global warming. Bunge authored the *Manifesto* which was signed by numerous international associations. Guided by his own systematism he wrote: *since climate is not regional but global, all the measures envisaged to control it should be systemic rather than sectoral, and they should alter the causes at play – mechanisms and inputs – rather than their effects. …*

Bunge is one of the most accomplished, informed, wide-ranging philosophers of the modern age. He is one of just two philosophers in the American Association for the Advancement of Science's *Science Hall of Fame* (the other being Bertrand Russell).



To recognise Bunge's 100th birthday and his enormous life-long contribution to Latin American and then international philosophy and philosophy of science, Springer have published a 41-chapter, 830-page Festschrift contributed to by scholars from 14 countries. The chapters cover ten fields to which he has contributed (physics, philosophy, psychology, social science, mathematics and more).

Matthews, M.R. (ed.) 2019, *Mario Bunge: A Centenary Festschrift*.
ISBN: 978-3-030-16672-4; 828pp.

If institutions purchase the e-book, then all staff and students can download all chapters as pdf files. Further they can buy the paperback book for USD25/EUR25.

16th DLMPST Congress, Prague, August 5-10, Report

The 16th International Congress on Logic, Methodology and Philosophy of Science and Technology was superbly organised at the Czech Technical University in Prague, August 5-10.

There were approximately 700 participants of which, encouragingly, about 300 were undergraduate or graduate students.

Plenary lectures were given by: Heather Douglas (Michigan State University), Joel D. Hamkins (University of Oxford), and Sandra D. Mitchell (University of Pittsburgh).

Additionally there were 21 invited lectures: Anna Alexandrova, Atocha Aliseda Llera, Christina Brech, Alex Broadbent, Anna Brożek, Franz Dietrich, Valentin Goranko, Hans Halvorson, Gerhard Heinzmann, Gürol Irzık, Tarja Knuuttila, Jan Krajíček, Sabina Leonelli, Maryanthe Malliaris, Michael Matthews, Jonathan Okeke Chimakonam, Dunja Šešelja, Ray Turner, Heinrich Wansing, and Sang Wook Yi.

The 17th DLMPST Congress will be held July 24-29, 2023, University of Buenos Aires.

Information from Pablo Lorenzano (pablo@unq.edu.ar) or Eleonora Cresto (eleonora.cresto@gmail.com)

A photo record of congress can be seen here.

Teaching HPS to Science Students

One panel discussion, organised and chaired by Joeri Witteveen (University of Copenhagen) was devoted to the teaching of HPS to science students. The following questions were addressed:


Heather Douglas


Joel D. Hamkins


Sandra D. Mitchell

1. What makes teaching science students different from teaching philosophy students and how should we (historians and philosophers) adapt to an audience of practitioners of a field of study that we are reflecting on?

2. How can the teaching of philosophy of science to science students benefit from recent developments in integrated HPS, practice-oriented philosophy of science, and socially relevant philosophy of science? Based on particular examples, panel members will discuss how these can be packaged and processed to make them suitable for teaching.

3. What kind of teaching materials are useful for teaching HPS to science students? Many history and philosophy of science textbooks are written without an audience of scientists in mind, but some newer textbooks are particularly written for training scientists.

4. What is the added value of having someone trained in HPS teach a course history and philosophy of a scientific subject.

5. What are the best practices for co-teaching a philosophy of science course with a scientist?

6. What, if any, are the essential ingredients for a course in HPS for scientists? Should a brief twentieth-century history of philosophy of science from (say) logical empiricism to Feyerabend be part of any philosophy of science course, or should developments in the particular science under discussion be leading in the selection of topics?

The outcomes of the panel discussion will be used in a project led by the University of Copenhagen to inventory, organise, and disseminate teaching materials and information about best practices on teaching philosophy of science to science students. To this end, we aim to open a web portal for philosophy of science teachers in the near future.

Mieke Boon Hasok Chang Hans Halvorson Mikkel Johansen Roy Wagner

AAPT 2019 Millikan Medal Awarded to Tom Greenslade

Tom Greenslade was awarded the 2019 Robert A. Millikan Medal by the American Association of Physics Teachers (AAPT). This award recognizes educators who have made notable and intellectually creative contributions to the teaching of physics.

Greenslade is a Professor Emeritus of Physics at Kenyon College. In nominating him for this honor his colleagues noted that he has been making "Notable and intellectually creative contributions to the teaching of physics for more than 50 years. Many of these contributions have been in the form of articles published in *The Physics Teacher* (TPT). His total number of papers in TPT (the earliest in 1969, the most recent in 2019) far exceeds that for any other author. In addition, he has made many hundreds of oral presentations at physics meetings and in other professional settings on a wide variety of topics related to physics teaching. He is a widely recognized expert on the history of physics, especially early teaching apparatus, and shares his vast knowledge and expertise with the broader physics education community in numerous ways."

Regarding his receipt of the Millikan Medal, Greenslade said, "I am pleased to follow in the footsteps of my graduate school advisor Peter Lindenfeld (1989) and my long-time Kenyon College colleague Franklin Miller, Jr. (1970)".

Tom Greenslade with his 'at home' historic instruments collection.

Greenslade received his A.B. in 1959 in physics from Amherst College and his doctorate in experimental low temperature physics from Rutgers University in 1965. From 1964 to 2005 he was a member of the Kenyon College physics faculty. When he retired, Kenyon awarded him a D.Sc. A member of the American Association of Physics Teachers since 1959, Greenslade was recognized with the association's Distinguished Service Citation and in 1987 he was listed as one of the 75 most influential physicists and physics teachers by the American Association of Physics Teachers. He won first prize in the Association's Apparatus Competition in 2007. In 2014 AAPT recognized his life-time of contributions by making him a Fellow of the American Association of Physics Teachers. He is also a fellow the American Physical Society.

Greenslade has been generous in sharing his vast knowledge and expertise with the broader physics community in a variety of other ways. He maintains a website, "Instruments for Natural Philosophy" that includes some 1850 pictures of early physics apparatus along with descriptions and references, and he answers many queries from historians and collectors.

His collection of about 775 pieces of physics teaching apparatus from the 1850-1950 era is housed in a wing of his 1857 house in Gambier. Visitors range from children to professors of physics; make an appointment and visit. His large collection of old, primarily 19th century, textbooks and early equipment catalogues, preserve original descriptions of historically important laboratory and demonstration apparatus.

8th Integrated History and Philosophy of Science Conference (&HPS8), Virginia Tech, Blacksburgh VA, July 15-17, 2020

The Committee for Integrated History and Philosophy of Science invites the submission of individual paper and poster abstracts for "&HPS8", the 8th conference in the series Integrated History and Philosophy of Science. We seek contributions that genuinely integrate the historical and philosophical analysis of science (i.e., the physical sciences, life sciences, cognitive sciences, and social

sciences), or discuss methodological issues surrounding the prospects and challenges of integrating history and philosophy of science. For information about Integrated History and Philosophy of Science and previous conferences, see here.

Recent scholarship in history and especially in philosophy of science has shown that scientific practice can best be characterized as a pluralistic endeavor. Might the field of integrated history and philosophy of science (HPS) also need a pluralistic framework for the analysis of the full sweep of science in past and present, combining philosophical analysis and historical evaluation of science? How might we build disciplinary knowledge without disciplinary methodological unification? The organizers especially welcome contributions investigating problem-centered and pluralistic methodologies for integrated HPS. The organizers also welcome submissions in any area of integrated HPS.

Deadline for submission of paper and poster abstracts: **December 10, 2019**
Notification date: **January 31, 2020**

Please direct any inquiries to Lydia Patton (critique@vt.edu) or Jutta Schickore (jschicko@indiana.edu)

Science, Religion and Big Questions Conference, 22-23 June 2020, University of Oxford

The Learning about Science and Religion (LASAR) Research Centre at Canterbury Christ Church University and the Oxford Argumentation in Religion and Science (OARS) project at the Department of Education at the University of Oxford invite abstracts for papers and seminars that explore Big Questions in the context of education and the science-religion dialogue.

Papers and seminars are invited which will help to characterise, expand and progress the science-religion dialogue in relation to Big Questions. This could be by discussing ways to relate science and religion in general or in the context of a selected Big Question, for example, how science and religion can help us understand what it means to be a person; mapping issues explored in the science-religion dialogue onto contemporary contexts such as the question of personhood in the context of artificial intelligence; or by identifying 'wicked problems' in contemporary life that can be examined through a framework of Big Questions, such as by examining the intersection of mental health and the science-religion dialogue.

Papers should introduce language and constructs that will help educators to understand the terrain. Terms could include epistemic insight, argumentation, theory of knowledge, knowledge domains, sufficient truth, conundrum, apparent contradiction, conflict, ways of relating, interdisciplinary relationships, cross-disciplinary questions, multidisciplinary arenas.

We hope that the conference will provide a compendium of Big Questions that can engage students' and young adults' interest, with explanations for teachers and tutors about their educative value and the importance of giving students access to a range of views about how science and religion relate.

Abstract submissions are invited for either individual short papers (300-500 words) or seminar proposals (600-1000 words). For short papers, speaker(s) will have a maximum of 20 minutes presentation time, followed by up to 10 minutes for questions and discussion.

For seminars, authors are asked to propose three or four presentations that link together with a shared time for questions and discussion.

Please email abstracts as a Word document to Professor Berry Billingsley, lasar@canterbury.ac.uk by **1st February 2020**. Abstracts will be considered on receipt.

Visit http://www.epistemicinsight.com/ for more information about the Epistemic Insight Initiative.

Turning the Mirror: From scientific pluralism to pluralism in HPS, 8-9 January 2020, University of Exeter, UK

Various forms of scientific pluralism are widely accepted by historians and philosophers of science, but what lessons might pluralism about science have for the methods and practice of HPS itself?

We are seeking contributions from three to four postgraduate/early-career participants. As the workshop includes diverse formats, contributions may take any form, from a traditional conference paper, to a roundtable discussion, to some other format entirely. We aim to make some funds available to support participants' travel to Exeter, but will not be able to confirm funding until later in the year.

Please send proposals by **30th September 2019** (max. 500 words) to: Alex Aylward (a.m.aylward@leeds.ac.uk) and Adrian Currie (a.currie@exeter.ac.uk).

Whilst it is clear that HPS enjoys a healthy pluralism of methodologies and approaches, it is less obvious what our attitudes should be towards pluralism in accounts of particular episodes from the scientific past. We hope in this workshop to tackle the above issues head-on. Questions addressed might include (but aren't limited to):

- What is the nature of historiographical/philosophical pluralism in HPS? How does it come about?
- Is it a good thing? Should we cultivate pluralism? How?
- Is it a bad thing? Should we strive for monism? How?
- What are the lessons from the conversation on scientific pluralism for pluralism in studies of science?
- What lessons might be drawn from scientific perspectivism?
- How might insights from the philosophy of history inform the conversation?

Participants:
Agnes Bolinska (University of Cambridge, UK) John Dupre (University of Exeter, UK) Robin Hendry (University of Durham, UK) Ian James Kidd (University of Nottingham, UK) Katherina Kinzel (University of Vienna, Austria) Jouni-Matti Kuukkanen (University of Oulu, Finland) Sabina Leonelli (University of Exeter, UK) Joseph D. Martin (University of Cambridge, UK) Michela Massimi (University of Edinburgh, UK) Staffan Müller-Wille (University of Exeter, UK) Raphael Scholl (University of Cambridge, UK) Kirsten Walsh (University of Exeter, UK)

Center for Philosophy of Science, University of Pittsburgh

Please join us for:

EPISTEMOLOGY OF SCIENCE
A Workshop at the Intersection of Epistemology & Philosophy of Science
September 20-21, 2019

WORKSHOP on Mark Wilson's
"Physics Avoidance"
November 9, 2019

NEUROTECH
An Interdisciplinary Early Career Workshop on Tools and Technology in Neuroscience
January 24-25, 2020

See details about our Visiting Fellows, events, and more on the Center's homepage here.

Study History of Quantum Mechanics in Copenhagen

Are you interested in knowing how the core ideas and concepts of quantum physics were originally formulated? Would you like to have a better understanding of how we got to the sometimes rather counterintuitive quantum mechanics we learn today? Did you ever ask yourself things like: How did Schrödinger derive his famous equation? Why did Heisenberg decide to represent physical quantities by infinite matrices? How was the statistical interpretation of Ψ^2 initially formulated? Why do we speak of the "Copenhagen interpretation," and what were the actual contributions of researchers who worked in Copenhagen?

If YES, then this course is designed for you. Learn more here.

The course will be taught for the first time in February and March 2020 by Christian Joas (Director, Niels Bohr Archive), Helge Kragh (Professor Emeritus, NBI), and Ricardo Karam (Associate Professor, IND). This is an official MSc. course of the University of Copenhagen, so tuition fees may apply depending on the institution you come from.

More information from Ricardo Karam:
ricardo.karam@ind.ku.dk.

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 re-

cent 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).

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 these and other related questions.

Deadline for submission of papers: **October 30th, 2019**.

Instructions for the preparation and submission of manuscripts can be accessed here.

European Philosophy of Science Association Conference and Gratis Article Downloads

The 7th biennial conference of the European Philosophy of Science Association (EPSA19) will take place in Geneva September 10-14. In connection to the conference, Springer has made the topical collection of the *European Journal for Philosophy of Science* with selected papers from the previous conference, EPSA17, freely available online. You can read and download all papers from this topical collection until the end of EPSA19 (**September 14**). You can find the topical collection HERE.

Of special interest to NEWSLETTER readers would be: Philip Kitcher (2019) 'So …who is your audience?'

Abstract: To whom, if anyone, are the writings of philosophers of science relevant? There are three potential groups of people: Philosophers, Scientists, and Interested Citizens, within and beyond the academy. I argue that our discipline is potentially relevant to all three, but I particularly press the claims of the Interested Citizens. My essay is in dialogue with a characteristically insightful lecture given thirty years ago by Arthur Fine. Addressing the Philosophy of Science Association as its president, Fine argued that general philosophy of science was dead, and that all the action lay in the philosophy of the special sciences. I try to identify what was correct about Fine's diagnosis, while supplementing his message by describing fruitful projects that have since emerged. I also hope to share his subversive spirit.

Download article here.

Opinion: *Feng Shui: Philosophical Appraisal and Educational Opportunity*

Michael R. Matthews, School of Education,
University of New South Wales

Feng shui is a set of beliefs and practices arising from an ancient deeply-entrenched Chinese and East-Asian worldview. The ontological core of the worldview is commitment to the reality of an all-encompassing cosmic life-force or energy called chi (*qi*). Feng shui includes medical, health, architecture, construction, design, decoration, burial and divination practices. Its worldview is nat-

uralistic. Its ontology has no supernatural entities nor allows for divine interventions in nature; yet it promotes astrology, divination and fortune telling. The worldview underwrites and justifies the traditional Chinese medicine (TCM) practices of acupuncture and herbal medicine.

Although feng shui practices and worldview have their origin in Asia, both have an increasing international presence. Feng shui medical practices, under the title of 'complementary' or 'alternative' medicine, are routinely taught in Western medical schools; feng shui architecture is likewise taught in many Western architecture faculties. The worldwide web brings hundreds of thousands of feng shui commentary and advice sites into the most remote corners of the world.

There is a surprising asymmetry between the presence, spread and impact of feng shui and its philosophical appraisal; there is little of the latter. There is some exposition, but little appraisal. And there is almost no discussion of the educational opportunities and responsibilities afforded by feng shui for science teachers. This brief piece is a modest beginning contribution to both the philosophical and educational tasks.

Feng Shui and Chi

The naturalistic and 'scientific' core of feng shui is commitment to the existence of a putative all-encompassing special energy or life-force *chi* or *qi* that has existed since the beginning of time; that occupies the entire cosmos – the universe, solar system, earth, and everything on the earth; and that flows through the human body where it moves in defined meridians that can be manipulated by acupuncture treatment. Clearly Chi lives in the borderland of physics, metaphysics and pseudophysics; it moves between the domains depending upon who is appraising it.

Simon Brown, author of *The Feng Shui Bible*, gives an account of chi that can be found in thousands of popular books on the subject:

> Chi is the subtle charge of electromagnetic energy that runs through everything, carrying information from one thing to another. The chi flowing through your body predominantly carries your thoughts, beliefs and emotions. At the same time some of your chi is floating off, while you are also drawing in new energy. … Your energy field connects you to everything else, whether you like it or not. The secret to making this energy work is understanding the process and finding out how you can make it help you in life. (Brown 2005, p.24)

Chi belief has been engrained in Chinese culture – Confucian, Daoist, Buddhist and other variants for at least three thousand years. The practice of directing and controlling personal chi (*qi*) is called *qigong* (*gong* meaning work/effort). Feng shui belief bears upon most aspects of everyday life: the design of domestic, commercial and government buildings; the siting and orientation of graves; personal fortune telling and divination; choosing auspicious times for marriage, commencement of building construction, opening a restaur-

ant, launching a public company, going on holidays, and much more.

Chi is perhaps best known for its utilization in Traditional Chinese Medicine (TCM). It is invoked in practices such as herbal medicine, acupuncture, yoga, and qigong exercise. All of these are efforts to promote, harness and direct life forces. In China 240 universities offer degree programmes in TCM; 18 countries have included acupuncture in their medical insurance schemes; countless Western medical schools have TCM under the name of 'complementary' or 'alternative' medicine'. The Tianjin-based Quanjian herbal company was worth $2.8 billion in 2015; it had 10,000 staff in 110 countries; it operated the largest cancer-treatment hospital in the world.

Just like Judaeo-Christian-Islamic religious beliefs, feng shui impinges on daily personal and social life; it informs people's understanding of their place in the cosmos; it is a secular worldview. One commentator has said:

> Based on ancient Chinese philosophical traditions, feng shui has developed for over two millennia to include knowledge, rituals, aphorisms, and superstitions from throughout China. As such, it is central to any understanding of Chinese cultural history, life, and psychology, as well as that of many other East Asian cultures that also practice Chinese feng shui. (Puro 2002, p.108)

A study of feng shui in Korea commenced with the statement: 'The importance of geomancy [divination or foretelling the future] in understanding the East Asian cultural landscape and cultural ecology is difficult to overemphasize' (Yoon 2006, p.xiii).

Dr Yan Xin, a former TCM practitioner who worked in different Chinese and US universities is a celebrity super-Qigongist with an international reputation for healing thousands of patients at a distance by generating and casting his own qi over them. Some of his lectures, including in the US, were attended by tens of thousands. In 1986 he was attached to the Qigong Cooperative Research Group at Tsinghua Technical University in Beijing, and claimed that:

> the mind power or Qi emitted by a trained Qigong master can influence or change the molecular structure of many test samples, including those of DNA and RNA, even if these test samples are 6 to 2,000 kilometers away from the master. Qi can also affect the half-life of radioactive isotopes and the polarization plane of a beam of light as emitted from a Helium-Neon laser.

Much has been written on the history, philosophy, and practice of feng shui (Bruun 2008). But despite feng shui's significant historical, cultural and economic footprint, there has been little critical philosophical appraisal of the theory and practice. Feng shui is surprisingly ignored in the considerable philosophical discussion of pseudoscience (Pigliucci & Boudry 2013). And there has been no effort to examine how feng shui might be handled as a topic in schools, specifically in science programmes.

This is a pity on both counts. Any philosophical examination of feng shui will lead directly to important and engaging issues about the role of metaphysics in science, realism vs instrumentalism, ontological versus methodological naturalism, the function of empirical evidence in theory appraisal, the demarcation of science from non-science, and more specifically the demarcation of science from pseudoscience.

Feng shui has long migrated from Asia and has an increasing international commercial, domestic,

and personal presence. Feng shui is a billion-dollar international growth industry. As a writer in the American Institute of Architects newsletter commented: 'Feng Shui is no longer just an ancient Chinese secret. While slow to take root outside of its original heartland, it is now global and transcends culture and politics' (Knoop, 2001). The Amazon Kindle site lists over one thousand feng shui books in English alone; there are many times this number on second-hand book sites; there are countless thousands, if not hundreds of thousands, of commercial feng shui web sites; hundreds of thousands, likely millions, of people throughout the world daily visit these sites and to varying degrees regulate or inform their life by what they read and purchase.

Feng shui is but one component of the wide spectrum of chi or life-force based Eastern beliefs, therapies, health practices and medicine. Over some two to three thousand years, under different philosophical and cultural influences, many versions of chi-based practice have evolved. Along with feng shui, others are: Qigong, Falun Gong, Tai Chi, and Jin Shin Jyutsu. They all combine chi (*qi*) with *gong*, meaning work, practice, or exercise.

Chi and TCM were given huge exposure in the West with the publication of Fritjof Capra's *The Tao of Physics* (Capra 1984). This book was first published in 1975, it went through three editions, was published in 23 languages, and sold over a million copies. For decades it was a 'must have' book on countless undergraduate bookshelves. Capra wrote:

> Traditional Chinese medicine, too, is based on the balance of yin and yang in the human body, and any illness is seen as a disruption of this balance. The body is divided into yin and yang parts. Globally speaking, the inside of the body is yang, the body surface is yin; the back is yang, the front is yin; inside the body there are yin and yang organs. The balance between all these parts is maintained by a continuous flow of ch'I, or vital energy, along a system of 'meridians' which contain the acupuncture points. (Capra 1984, p.98)

Ken Tobin, a former president of the National Association for Research in Science Teaching and a hugely cited education researcher embraced chi-related medical practice, saying:

> The underlying theory relates to *Qi*, universal energy, and its flows through the body. In the case of humans there are 26 pairs of safety energy locks (SELS) through which *Qi* flows, providing the life source to the body … When a body is disharmonized, energy can be blocked at or close to the SELs, thereby disrupting one or more of the flows needed to distribute the life force to different parts of the body. (Tobin 2015)

That a person so prominent in the international science education community can talk so easily, confidently and without hesitation about life forces, chi flows, SELS, and energy blockages – underscores the degree of penetration of feng shui thinking beyond its Asian homeland.

Two philosophers identify chi as the foundation of Chinese cosmology and medicine:

> *Qi* is one of the most important and widely interpreted concepts in Chinese intellectual history. As a shared notion underlying all schools, *qi* is believed to be a dynamic, all-pervasive, and all-transforming force animating everything in the universe. The air one breathes, the force that drives the flow of blood, the food one eats, the strength of one's mind, the flow of one's thoughts, the deepest urges of one's heart–all of these are understood in terms of *qi*.

> Thus *qi* extends across realms that might otherwise be divided in the spiritual, mental, or physical. (Wang & Ding 2010, p.42)

In the Confucian and Daoist (Taoist in the earlier Wade-Giles translation) Chinese traditions philosophy and science were not separate enterprises. It is not that the first influences the second, or that the second corrects the first; there is no such dramatic separation. Traditional Chinese science (natural philosophy) was a part of, or interwoven with, religion and philosophy. This is just how it also was in the West until the Scientific Revolution began to make separations possible. The subsequent Western preoccupation of demarcating one from the other, and examining their interaction, is alien to the Chinese tradition. When the issue does arise, the answer is even more complex than that given in the West. Ole Bruun writes:

> The concept of *qi*, which may be translated into 'breath' or 'breath of nature', is fundamental to Chinese natural philosophy. It is strongly indicative of an organic predisposition in Chinese thinking in general, as opposed to the mechanistic orientation that became dominant in European natural philosophy after the Middle Ages. (Bruun 2008, p.108)

Failing the Test

It is noteworthy that the putative universal life-force, chi or *qi*, has not featured in the history of modern science, and has never been identified in any reputable science laboratory. Despite chi beliefs and practices having a 3,000+ years history, there is no instrument that indicates chi's presence, its flow, or measures its intensity. There is no standard chi unit comparable to the standard units for every quantity measured in science: there is nothing equivalent to a standard metre, kilogram, ohm, calorie, watt or joule. There is no 'chi-counter' equivalent of the Geiger counter; indeed, there is simply no chi meter at all. In the whole constellation of chi talk, theory and practice, there are no standards. The remarkable chi claims have never been confirmed in any reputable laboratory test or reported in any mainstream science journal.

Western science has seen some brief efflorescence of life-force type thinking such as Franz Mesmer's *animal magnetism* or Henri Bergson's *élan vital* but these never persisted; the constructs were shown to have no ontological reference. The Benjamin Franklin chaired eighteenth century French Royal Commission (which included Antoine Lavoisier) comprehensively examined Mesmer's claims, theory and practice and:

> [we] concluded unanimously about the question of the existence and utility of magnetism, that nothing proves the existence of animal magnetism; that this non-existent fluid is consequently useless. (Franklin et al. 1784/2014, p.37)

This 'failure to find' situation is altogether odd as the foundational energy-centric commitment of feng shui should have practitioners lining up at the doors of science laboratories for vindication. The very first reaction to Simon Brown's above claim, made also by countless others *Chi is the subtle charge of electromagnetic energy that runs through everything* would be to demonstrate: When? Where? How much? In a world desperate to find alternate energy sources and less expensive healthcare, one might expect everyone would be seeking scientific endorsement of chi. But this has not happened. This repeated 'failing the test' situation coupled with continued unchanged pronouncements, is a powerful indicator that chi talk, although sounding scientific, is pseudoscientific.

The NOMA (Non Overlapping Magisteria) option

promoted by Stephen Jay Gould and many others (Gould 1999) is not available to chi adherents as clearly chi claims are about regular, causal mechanisms in the world; they are claims within the domain or 'magisteria' of science.

Entrenched disregard of test failure has unfortunate consequences: if citizens are raised to simply accept, without evidence and testing, the foundational claims about chi and its yin/yang governed manifestations, then what other such claims will they accept?

For almost two thousand years crushed rhinoceros horn has been a stable of Traditional Chinese Medicine (TCM) on account of it supposedly containing prodigious amounts of distilled chi. It is estimated that 800-1,000 are slaughtered each year and their horns sold for around USD300,000 each. The White Rhinoceros whose double horns were especially chi-rich has, in the past few decades, been hunted to extinction in the wild. The Chinese government has belatedly banned its import. But the government has skirted around saying that the horn has no chi; such a pronouncement would obviously open up too many other investigations into what does and does not contain chi, and so undermine the ontological foundation of State-endorsed TCM.

If people are routinely accustomed to accept claims without evidence, then the pool of such 'no evidence' claims is open to further expansion and can take in all manner of objectionable, dangerous and abhorrent beliefs. The demand for evidence can be problematic when the claims are about supernatural entities, powers and activities. It might, with some initial plausibility, be argued that believing supernatural claims is independent of, or removed from empirical, 'natural' evidence: to ask for the latter is to misunderstand what the claim is about, it is about supernatural events and processes of which, many maintain, science needs to remain mute. But feng shui and chi claims are precisely not about a supernatural realm but purportedly about the natural realm in which we live.

Historical Critiques

The deleterious flow-on cultural and scientific problems occasioned by feng shui have long been recognised. Matteo Ricci (1552-1610) the Sinophile leader of the famed late-16th century Jesuit mission to China (Laven 2011) wrote in his Travel Journal:

> In choosing a place to erect a public edifice or a private house, or in selecting a plot of ground in which to bury the dead, they study the location with reference to the head and tail and the feet of the particular dragons [chi lines] which are supposed to dwell beneath that spot. Upon these local dragons they believe that the good and bad fortune, not only of the family but also of the town and province and the entire kingdom, is wholly dependent. Many of their most distinguished men are interested in this recondite science and, when necessary, they are called in for consultation, even from a great distance. ... Just as their astrologers read the stars, so their geologists [diviners] reckon the fate, or the fortune of a place, from the relative position of mountains or rivers or fields, and their reckoning is just as deceitful as the reading of the stargazers. (Ricci 1615/1953, p.84)

Ricci appreciated that serious Chinese adoption of European natural philosophy, that is not just its instrumental use for astronomical calculations, would have cultural consequences and that these need to be acknowledged:

> And in truth it thus happened that many, having learnt our mathematical sciences [astronomy],

> laughed at the law and doctrine of the idols [masters], saying that if they taught so much error in natural matters and those of this life, there is no reason to give them credit in supernatural matters and those of the other life. (Rule 1986, p.166)

This comment was directed specifically at Chinese Buddhists, but it has become a perennial issue in all cases of contact between traditional belief systems and modern science: how to maintain traditional authority structures when authorities make claims about the world that younger people who have had some science classes can see are demonstrably false and without foundation? If respect for elders is predicated upon their being custodians of a culture's knowledge, then when that knowledge is seen to be hollow then either respect is lost or other grounds for respect of cultural authorities or norms need to be found.

Two hundred and fifty years after Ricci's account of Chinese natural philosophy and culture, Ernst Johann Eitel (1838-1908), a Lutheran missionary and Sinologist, took the same path (Wong 2000). He published a substantial appraisal of the history, metaphysics and functioning of feng shui *Feng Shui: The Rudiments of Natural Science in China* (Eitel 1873/1987). Eitel recognises that feng shui site selection and medical guidance goes beyond harmless and benign commonsense practices:

> Well, if Feng-shui were no more than what our common sense and natural instincts teach us, Chinese Feng-shui would be no such puzzle to us. But the fact is, the Chinese have made Feng-shui a black art, and those that are proficient in this art and derive their livelihood from it, find it to their advantage to make the same mystery of it, with which European alchemists and astrologers used to surround their vagaries. (Eitel 1873/1987, p.1)

He echoes Emmanuel Kant and anticipates Alexandre Koyré in affirming the centrality of experiment in modern science:

> There is one great defect in Feng-shui, which our Western physicists have happily long ago discarded. This is the neglect of an experimental but at the same time critical survey of nature in all its details. (Eitel 1873/1987, p.69)

Joseph Needham (1900-1995) the greatest and most influential twentieth-century student of pre-modern Chinese science wonderfully documented the interplay of science, technology, philosophy, and metaphysics in Chinese culture (Winchester 2008), saying that:

> Superstitious practices flourished in China just as strongly as in all other ancient cultures. Divination of the future, astrology, geomancy [fortune telling], physiognomy, the choice of lucky and unlucky days, and the lore of spirits and demons, were part of the common background of all Chinese thinkers, both ancient and medieval. (Needham & Ling 1956, p.346)

And:

> The Neo Confucians [eleventh century] arrived at what was essentially an organic view of the universe. Composed of matter-energy (*Ch'i*) and ordered by the universal principle of organization (*Li*), it was a universe which, though neither created nor governed by any personal deity, was entirely real, and possessed the property of manifesting the highest human values (love, righteousness, sacrifice, etc.) when beings of an integrative level sufficiently high to allow of their appearance, had come into existence. (Needham & Ling 1956, p.412)

Needham correctly said of traditional five-element thinking that:

> The only trouble about the Chinese five-element theories was that they went on too long. What was quite advanced for the +1st century was tolerable in the +11th century, and did not become scandalous until the +18th century. The question returns once again to the fact that Europe had a Renaissance, a Reformation, and great concomitant economic changes, while China did not. (Needham & Ling 1956, p.294)

Criticism of feng shui came not only from outside the Chinese tradition; it has been persistent within. In 1915 following the collapse of the Manchu dynasty and establishment of the new Republic of China, in the bubbling economic, cultural, philosophical and warring times of the period, a hugely popular and influential periodical, *New Youth* (*La Jeunesse Nouvelle*), was launched. It was edited by Ch'en Duxiu (1879-1942), a noted champion of science, critic of traditional Confucian philosophy and culture, and a founder of the Chinese Communist Party (CCP). Its opening editorial opined:

> Our men of learning do not understand science; thus they make use of yin-yang signs and beliefs in the five elements to confuse the world and delude the people and engage in speculations on geomancy …The height of their wondrous illusions is the theory of *Ch'I* [primal force] …We will never comprehend this *Ch'I* even if we were to search everywhere in the universe. All of these fanciful notions and irrational beliefs can be corrected at their roots by science, because to explain truth by science we must prove everything with fact. Although this is slower than imagination and arbitrary judgment, every progressive step is taken on firm ground. It is different from those flights of fancy which in the end cannot advance one bit. (*New Youth*, 1915, vol.1, p.1. In Kwok 1965, p.65)

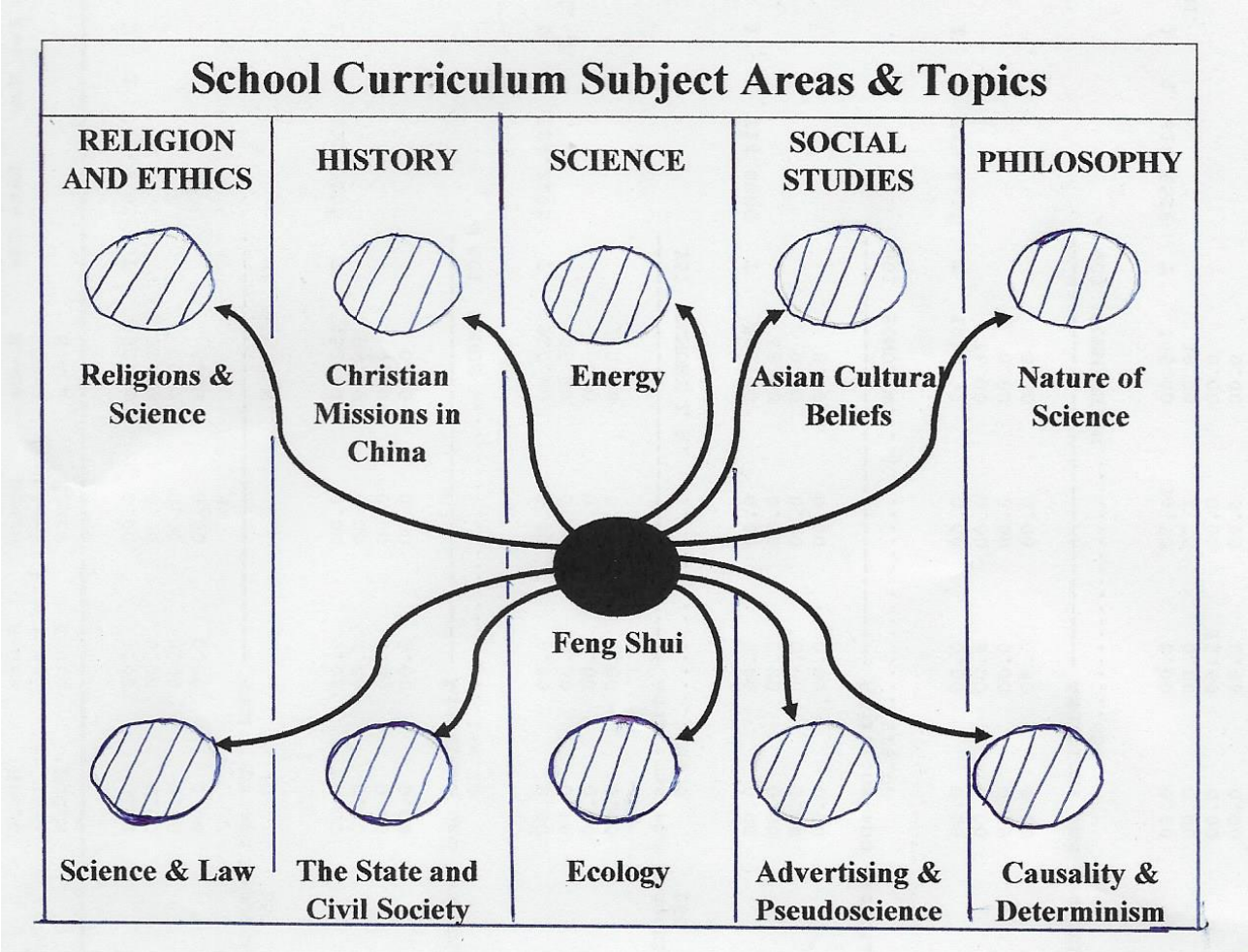
The Chinese Communist Party has had an ambivalent relation to feng shui. In 1940 Mao Tse-tung declared for science and against superstition, including feng shui, saying:

> The culture of this New Democracy is scientific. It opposes all feudal and superstitious thought; it advocates practical realism, objective truth, and the union of theory and practice. From this point of view, the scientific thought of the Chinese proletariat, along with the comparatively progressive material monists and natural scientists of the capitalist class, must unite to oppose imperialism, feudalism, and superstition; [they] must not ally themselves with any reactionary idealism. (*Selected Works*, vol.2, p.700; in Kwok 1965, p.19)

When the Chinese Communist Party came to power in 1949 feng shui was outlawed as a form of backward superstition incompatible with the materialist ontology of Marxist theory; feng shui was dismissed as one of the 'Four Olds' (Shapiro 2001). Not surprisingly senior party figures continued to employ feng shui consultants, usually under the guise of cleaners or cooks. Then from the beginnings of this century, in their bolstering of Chinese nationalism, the Party, with great intellectual contortion, formally supported feng shui. They brought TCM into university medical schools and feng shui design and theory into university architecture programmes; they hosted international congresses on 'Feng Shui Architecture'. Notoriously, one variant of feng shui, namely Falun Gong, remains illegal and can only be practiced in prison if its adherents live to do so (Lemish 2008).

Feng Shui in a Science Programme

Feng shui is not a supernatural belief. It is about the constitution and workings of the world. Its core is explicitly energy-centric; it claims to be



a scientific practice so in principle it can be discussed and examined in science classes. Further there are quite general philosophical, cultural, and educational lessons that can be learnt from its informed and critical appraisal.

Such examination offers rich opportunities for science teachers to elaborate on important features of science, or 'nature of science' (NOS) as selections of these are often labelled. Features such as: the relationship of science to metaphysics, scientific method, the connection of science to worldviews, ontological and methodological naturalism, the demarcation of science from pseudoscience, and the central scientific concept of energy. This could be an important part of the contribution of science education to cultural health.

The same education argument favours the examination in science classes, of any competing or alternative system of beliefs about the world and its mechanisms. Such examination can promote better understanding of the methods, methodology and domain of science. So, for example, when evolution is studied, then contrast Darwinism with creationist and Lamarckian science; when Mendelian genetics is studied, then contrast it with Lysenkoism; when the Copernican system is studied, then contrast it with the Ptolemaic system; when the geophysics of earthquakes or volcanoes is studied, contrast it with pre-scientific theological accounts of both phenomena. With energy being a constant and universal component of all science programmes, there is ample opportunity to study and discuss the startling chi-energy claims of feng shui.

The careful and sympathetic teaching of false theories and pseudoscientific theories not only illu-

minates the methodology of science, such teaching can prepare students for their inevitable daily encounters with bad science, bogus science and pseudoscience.

Further, feng shui can be a rich topic for co-ordinated, cross-disciplinary teaching between different school faculties: science, history, social studies, philosophy, art, economics and religion. The cross-disciplinary appraisal of feng shui is an excellent case-study for much-advocated STEM (Science-Technology-Engineering-Mathematics) education, and its Arts-augmented STEAM education.

Almost 20 years ago Mario Bunge observed:

> Given the intrinsic interest and the cultural importance of pseudoscience and anti-science, it is surprising that they should receive so little attention on the part of philosophers, particularly in our times of crisis of public confidence in science. (Bunge 2001, p.189)

Subsequently philosophers have attended to conceptual and demarcation issues occasioned by pseudoscience. But feng shui is noticeably missing from all such discussion.

Conclusion

The philosophical appraisal and educational examination of feng shui can be fitted into a larger eight-step argument concerning history, philosophy and science teaching (Matthews 2015). The argument, in brief, is:

1. Science needs to be taught in conjunction with the history and philosophy of science (HPS) as it is only in this way that proper student understanding and appreciation of science – its methodology, ontology, epistemology, ethics and interrelations with culture can be acquired.

2. Science education has to fulfil disciplinary, personal, social and cultural purposes. Each is advanced by the development of a scientific habit of mind which will bear upon student appreciation of feng shui.

3. Accepting the social and cultural purposes of science education means that teaching about feng shui is an educational obligation where the practice and beliefs are entrenched; to 'look the other way' is educationally and culturally irresponsible.

4. Such teaching about feng shui, or its local surrogates (astrology and other such belief systems), allows for clarification of many central issues in HPS, specifically concerning the nature of science (NOS), a topic that appears in nearly all national and provincial science curricula.

5. No creditable scientific or non-scientific grounds have been advanced for the existence of chi, consequently, belief in chi is fanciful. This conclusion, though clear, need not be conveyed in any closed-minded, dogmatic way; it can be done in a culturally sensitive manner that problematises issues and seriously engages student thinking about the plentiful chi claims. An at-a-distance historical approach is one such pedagogical avenue (Heering & Höttecke 2014).

6. Acknowledging whatever success astrological healing, divination, TCM, herbal infusions, acupuncture and qigong exercises have does not mean that the success is attributable to chi manipulation. Sound scientific explanations, including that of placebo effects, can be found; indeed they should be found. This is the long history of identification of the efficacious

chemicals in effective herbal treatments and then their commercial production – the story of aspro and quinine. Recourse to chi is just a distraction; it muddies the research waters. The inference to chi from effective treatment is another example of the common fallacy of affirming the consequent. The argument:

$$C \rightarrow T$$

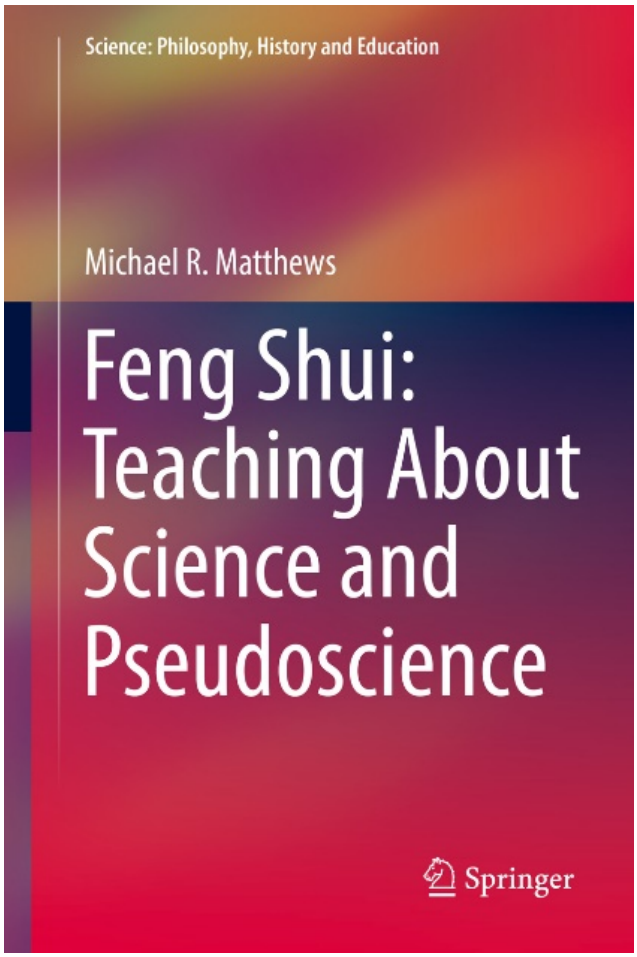
$$T$$

$$\therefore C$$

is invalid. Many other factors can equally imply T.

7. Nor can a non-realist, instrumentalist interpretation of chi be advanced as an answer to the 'failure to find' problem. That is, it cannot be said that the failure to find chi is because there is no existent there to find but nevertheless the chi concept is useful as it does instrumental duty. Much like, for instance, 'intelligence' which on an instrumentalist interpretation is not there to find, rather it marshals together various empirical accomplishments and test performances. On this account, to look for intelligence is a category mistake; it is to confuse an intervening variable with a hypothetical construct (MacCorquodale & Meehl 1948). But the chi concept is so nebulous, ill-defined and confused, that it cannot function as an intervening variable, it cannot act as a theoretical place-holder for empirical data. Thinking chi is of instrumental use is a step towards mysticism about nature. Like special creation theory, chi is always a *post factum* inference. This is another indication that the chi edifice is a pseudoscience.

8. Contrary to popular philosophical belief (Laudan 1983/1996), the distinction between science and pseudoscience can be consistently and intelligently maintained and feng shui can be shown to be a pseudoscience.



This brief Opinion Piece is more programmatic than programme; there are more signposts than road. But a 340-page elaboration of the argument, along with 840 references, can be read in: Michael R. Matthews (2019) *Feng Shui: Teaching About Science and Pseudoscience*, Springer, Dordrecht.

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To contribute to a possible anthology in which research on philosophical, historical, cultural, sociological and educational issues occasioned by feng shui will be published, contact the author.

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Wheeler, L. B., Mulvey, B. K., Maeng, J. L., Librea-Carden, M .L., & Bell, R.L. (2019) Teaching the teacher: exploring STEM graduate students' nature of science conceptions in a teaching methods course, *International Journal of Science Education*, doi:10.1080/09500693.2019.1647473 online first

Zhang, L. & Li, Z. (2019), 'How Does Inquiry-Based Scientific Investigation Relate to the Development of Students' Science Knowledge, Knowing, Applying, and Reasoning? An Examination of TIMSS Data', *Canadian Journal of Science, Mathematics and Technology Education*, 19, 334-345.

Recent HPS&ST Related Books

Alger, Bradley (2019) *Defense of the Scientific Hypothesis: From Reproducibility Crisis to Big Data*. New York, NY: Oxford University Press.
ISBN: 9780190881481

"In an age where scientific thinking is under attack, where big data analytics is marketed as the end of theory, and where social media spread fake news faster than facts, Alger's impressive book reminds us what a gift the scientific method is for each and every one of us. Its systematic steps can overcome mere opinion and targeted misinformation. But Alger also highlights that scientific training needs to be improved. For instance, although 70% of biological researchers report having received little or no training in scientific thinking, 90% nevertheless (or consequently) felt confident about their skills. Alger's writing is clear and engaging, and I truly enjoyed reading this insightful book." – Gerd Gigerenzer, Director, Harding Center for Risk Literacy, Max Planck Institute for Human Development

"I read with great interest and enthusiasm *Defense of the Scientific Hypothesis*. It was music to my ears. During my training with Sir John Eccles, I was immersed in Popper's philosophy of falsification and it has guided my thought and experimental design ever since. Alger gives a comprehensive overview of the central role that the hypothesis plays in driving science forward. His book should be recommended reading for any student of science and its accessible style and simple analogies will also appeal to non-scientists." – Roger Nicoll, National Academy of Sciences, University of California, San Francisco

"The scientific hypothesis is a unique tool for problem-solving that can be deployed to great advantage in nearly any setting. Brad Alger ranges across many disciplines to explore how the hypothesis helps to frame questions for scientists and non-scientists. He discusses the hidden dangers of the view that science involves gathering data to support preconceived notions rather than critically testing ideas, and how this attitude leads to poor decisions on societal issues such as climate change and science education. *Defense of the Scientific Hypothesis* is thoroughly rich and enlightening." – Ray Dingledine, Member, National Academy of Medicine, Emory University School of Medicine

More information available here.

Appel, Toby A. (2019) *Shaping Biology: The National Science Foundation and American Biological Research, 1945-1975*. Baltimore, MD: John Hopkins University Press. ISBN: 9780801873478

"Historians of the postwar transformation of science have focused largely on the physical sciences, especially the relation of science to the military funding agencies. In *Shaping Biology*, Toby A. Appel brings attention to the National Science Foundation and federal patronage of the biological sciences. Scientists by training, NSF biologists hoped in the 1950s that the new agency would become

the federal government's chief patron for basic research in biology, the only agency to fund the entire range of biology–from molecules to natural history museums–for its own sake. Appel traces how this vision emerged and developed over the next two and a half decades, from the activities of NSF's Division of Biological and Medical Sciences, founded in 1952, through the cold war expansion of the 1950s and 1960s and the constraints of the Vietnam War era, to its reorganization out of existence in 1975. This history of NSF highlights fundamental tensions in science policy that remain relevant today: the pull between basic and applied science; funding individuals versus funding departments or institutions; elitism versus distributive policies of funding; issues of red tape and accountability.

"In this NSF-funded study, Appel explores how the agency developed, how it worked, and what difference it made in shaping modern biology in the United States. Based on formerly untapped archival sources as well as on interviews of participants, and building upon prior historical literature, *Shaping Biology* covers new ground and raises significant issues for further research on postwar biology and on federal funding of science in general." (From the Publisher)

More information available here.

Barnett, Lydia (2019) *After the Flood: Imagining the Global Environment in Early Modern Europe*. Baltimore, MD: John Hopkins University Press. ISBN: 9781421429519

"An incisive and thorough examination of how complex, natural philosophical discourse developed around Noah's Flood in the early modern period. This is cultural and intellectual history at its best, and it should attract a wide readership." – Dániel Margócsy, University of Cambridge, author of *Commercial Visions: Science, Trade, and Visual Culture in the Dutch Golden Age*

"Nuanced and beautifully crafted. After the Flood reveals the surprisingly long history of the idea that humanity is capable of transforming nature on a global scale–an idea commonly assumed to be a twenty-first-century insight. Making use of an impressive range of archival sources, Barnett's scholarship is original, wide-ranging, and erudite." – Deborah R. Coen, Yale University, author of *Climate in Motion: Science, Empire, and the Problem of Scale*

"In this dazzlingly original and deeply researched book, Lydia Barnett demonstrates how debates in early modern Europe about the causes of the Deluge stimulated arguments about anthropogenic climate change. This is a major contribution to the growing literature on the historical roots of the Anthropocene. It is also an important reminder that the religious imagination grappled with planetary scale long before the advent of earth system science." – Fredrik Albritton Jonsson, The University of Chicago, coauthor of *Green Victorians: The Simple Life in John Ruskin's Lake District*

"After the Flood offers a provocative, erudite history of environmental thinking, global imagining, and Christian universalism between the Renaissance and the Enlightenment. Barnett's wide-ranging research on how Catholics and Protestants debated a biblical understanding of human sin and natural catastrophe between Europe and the Americas reminds us that climate change was a subject forged on the fault lines between knowledge and faith in the early modern world. An excellent contribution to global intellectual history." – Paula Findlen, Stanford University, editor of *Empires of Knowledge: Scientific Networks in the Early Modern World*

"Laying waste to received environmental ideas, After the Flood delivers a strikingly original account of a seemingly recent notion: that humans are responsible for the earth's destruction. This extraordinary book weaves together imperial expeditions, theological wars, and early scientific networks to rediscover the natural and human history of a vulnerable planet." – John Tresch, The Warburg

Institute, University of London, author of *The Romantic Machine: Utopian Science and Technology After Napoleon*

More information available here.

Büttner, Jochen (2019) *Swinging and Rolling: Unveiling Galileo's unorthodox path from a challenging problem to a new science* (BSPS, volume 335). Dordrecht: Springer. ISBN: 978-94-024-1592-6

"This volume explores the reorganisation of knowledge taking place in the course of Galileo's research process extending over a period of more than thirty years, pursued within a network of exchanges with his contemporaries, and documented by a vast collection of research notes. It has revealed the challenging objects that motivated and shaped Galileo's thinking and closely followed the knowledge reorganization engendered by theses challenges. It has thus turned out, for example, that the problem of reducing the properties of pendulum motion to the laws governing naturally accelerated motion on inclined planes was the mainspring for the formation of Galileo's comprehensive theory of naturally accelerated motion." (From the Publisher)

More information available here.

Corry, Richard (2019) *Power and Influence: The Metaphysics of Reductive Explanation*. New York, NY: Oxford University Press.
ISBN: 9780198840718

"The world is a complex place, and this complexity is an obstacle to our attempts to explain, predict, and control it. In *Power and Influence*, Richard Corry investigates the assumptions that are built into the reductive method of explanation–the method whereby we study the components of a complex system in relative isolation and use the information so gained to explain or predict the behaviour of the complex whole. He investigates the metaphysical presuppositions built into the reductive method, seeking to ascertain what the world must be like in order that the method could work. Corry argues that the method assumes the existence of causal powers that manifest causal influence– a relatively unrecognised ontological category, of which forces are a paradigm example. The success of the reductive method, therefore, is an argument for the existence of such causal influences. The book goes on to show that adding causal influence to our ontology gives us the resources to solve some traditional problems in the metaphysics of causal powers, laws of nature, causation, emergence, and possibly even normative ethics. What results, then, is not just an understanding of the reductive method, but an integrated metaphysical worldview that is grounded in an ontology of power and influence." (From the Publisher)

More information available here.

Currie, Adrian (2019) *Scientific Knowledge and the Deep Past: History Matters*. Cambridge, UK: Cambridge University Press.
ISBN: 9781108730556

"Historical sciences like paleontology and archaeology have uncovered unimagined, remarkable and mysterious worlds in the deep past. How should we understand the success of these sciences? What is the relationship between knowledge and history? In *Scientific Knowledge and the Deep Past: History Matters*, Adrian Currie examines recent paleontological work on the great changes that occurred during the Cretaceous period – the emergence of flowering plants, the splitting of the mega-continent Gondwana, and the eventual fall of the dinosaurs – to analyse the knowledge of historical scientists, and to reflect upon the nature of history. He argues

that distinctively historical processes are 'peculiar': they have the capacity to generate their own highly specific dynamics and rules. This peculiarity, Currie argues, also explains the historian's interest in narratives and stories: the contingency, complexity and peculiarity of the past demands a narrative treatment. Overall, Currie argues that history matters for knowledge."

More information available here.

Dry, Sarah (2019) *Waters of the World: The Story of the Scientists who Unraveled the Mysteries of our Oceans, Atmosphere, and Ice Sheets and Made the Planet Whole*. Chicago, IL: Chicago University Press. ISBN: 9780226670041

"From the glaciers of the Alps to the towering cumulonimbus clouds of the Caribbean and the unexpectedly chaotic flows of the North Atlantic, *Waters of the World* is a tour through 150 years of the history of a significant but underappreciated idea: that the Earth has a global climate system made up of interconnected parts, constantly changing on all scales of both time and space. A prerequisite for the discovery of global warming and climate change, this idea was forged by scientists studying water in its myriad forms. This is their story.

"Linking the history of the planet with the lives of those who studied it, Sarah Dry follows the remarkable scientists who summited volcanic peaks to peer through an atmosphere's worth of water vapor, cored mile-thick ice sheets to uncover the Earth's ancient climate history, and flew inside storm clouds to understand how small changes in energy can produce both massive storms and the general circulation of the Earth's atmosphere. Each toiled on his or her own corner of the planetary puzzle. Gradually, their cumulative discoveries coalesced into a unified working theory of our planet's climate.

"We now call this field climate science, and in recent years it has provoked great passions, anxieties, and warnings. But no less than the object of its study, the science of water and climate is–and always has been–evolving. By revealing the complexity of this history, Waters of the World delivers a better understanding of our planet's climate at a time when we need it the most." (From the Publisher)

More information available here.

Brief interview with Sara Dry on the book here.

More work from Author's web page (mostly on Newton) here.

Drouin, Jean-Marc (2019) *A Philosophy of the Insect*. (Anne Trager, Trans.). New York, NY: Columbia University Press. ISBN: 9780231175791

"The world of insects is at once beneath our feet and unfathomably alien. Small and innumerable, insects surround and disrupt us even as we scarcely pay them any mind. Insects confront us with the limits of what is imaginable, while at the same time being essential to the everyday functioning of all terrestrial ecosystems.

"In this book, the philosopher and historian of science Jean-Marc Drouin contends that insects pose a fundamental challenge to philosophy. Exploring the questions of what insects are and what scientific, aesthetic, ethical, and historical relationships they have with humanity, he argues that they force us to reconsider our ideas of the animal and the social. He traces the role that insects have played in language, mythology, literature, entomology, sociobiology, and taxonomy over the centuries. Drouin emphasizes the links between humanistic and scientific approaches–how we have projected human roles onto insects and seen ourselves in insect form. Caught between the animal and plant kingdoms, insects force us to confront and reevaluate our no-

tions of gender, family, society, struggle, the division of labor, social organization, and individual and collective intelligence. A remarkably original and thought-provoking work, A Philosophy of the Insect is an important book for animal studies, environmental ethics, and the history and philosophy of science." (From the Publishers)

More information available here.

Erduran, Sibel, & Kaya, Ebru (2019) *Transforming Teacher Education Through the Epistemic Core of Chemistry: Empirical Evidence and Practical Strategies*. Dordrecht: Springer.
ISBN: 978-3-030-15326-7

"This book synthesizes theoretical perspectives, empirical evidence and practical strategies for improving teacher education in chemistry. Many chemistry lessons involve mindless "cookbook" activities where students and teachers follow recipes, memorise formulae and recall facts without understanding how and why knowledge in chemistry works. Capitalising on traditionally disparate areas of research, the book investigates how to make chemistry education more meaningful for both students and teachers. It provides an example of how theory and practice in chemistry education can be bridged. It reflects on the nature of knowledge in chemistry by referring to theoretical perspectives from philosophy of chemistry. It draws on empirical evidence from research on teacher education, and illustrates concrete strategies and resources that can be used by teacher educators. The book describes the design and implementation of an innovative teacher education project to show the impact of an intervention on pre-service teachers. The book shows how, by making use of visual representations and analogies, the project makes some fairly abstract and complex ideas accessible to pre-service teachers." (From the Publisher)

More information available here.

Frith, Jordan (2019) *A Billion Little Pieces: RFID and Infrastructures of Identification*. Cambridge, MA: The MIT Press. ISBN: 9780262039758

"RFID (Radio Frequency Identification) is ubiquitous but often invisible, a mobile technology used by more people more often than any flashy smartphone app. RFID systems use radio waves to communicate identifying information, transmitting data from a tag that carries data to a reader that accesses the data. RFID tags can be found in credit cards, passports, key fobs, car windshields, subway passes, consumer electronics, tunnel walls, and even human and animal bodies–identifying tens of billions of objects as they move through the world. In this book, Jordan Frith looks at RFID technology and its social impact, bringing into focus a technology that was designed not to be noticed.

"RFID, with its ability to collect unique information about almost any material object, has been hyped as the most important identification technology since the bar code, the linchpin of the Internet of Things–and also seen (by some evangelical Christians) as a harbinger of the end times. Frith views RFID as an infrastructure of identification that simultaneously functions as an infrastructure of communication. He uses RFID to examine such larger issues as big data, privacy, and surveillance, giving specificity to debates about societal trends.

"Frith describes how RFID can monitor hand washing in hospitals, change supply chain logistics, communicate wine vintages, and identify rescued pets. He offers an accessible explanation of the technology, looks at privacy concerns, and pushes back against alarmist accounts that exaggerate RFID's capabilities. The increasingly granular practices of identification enabled by RFID and other identification technologies, Frith argues, have become essential to the working of contemporary networks, reshaping the ways we use information." (From the

Publishers)

More information available here.

Gbur, Gregory J. (2019) *Falling Felines and Fundamental Physics*. New Haven, CT: Yale University Press. ISBN: 9780300231298

"The question of how falling cats land on their feet has long intrigued humans. In this playful and eye-opening history, physicist and cat parent Gregory Gbur explores how attempts to understand the cat-righting reflex have provided crucial insights into puzzles in mathematics, geophysics, neuroscience, and human space exploration.

"The result is an engaging tumble through physics, physiology, photography, and robotics to uncover, through scientific debate, the secret of the acrobatic performance known as cat-turning, the cat flip, and the cat twist. Readers learn the solution but also discover that the finer details still inspire heated arguments. As with other cat behavior, the more we investigate, the more surprises we discover." (From the Publishers)

More information available here.

Halvorson, Hans (2019) *The Logic in Philosophy of Science*. Cambridge, UK: Cambridge University Press. ISBN: 9781107527744

"Major figures of twentieth-century philosophy were enthralled by the revolution in formal logic, and many of their arguments are based on novel mathematical discoveries. Hilary Putnam claimed that the Löwenheim-Skølem theorem refutes the existence of an objective, observer-independent world; Bas van Fraassen claimed that arguments against empiricism in philosophy of science are ineffective against a semantic approach to scientific theories; W.V.O. Quine claimed that the distinction between analytic and synthetic truths is trivialized by the fact that any theory can be reduced to one in which all truths are analytic. This book dissects these and other arguments through in-depth investigation of the mathematical facts undergirding them. It presents a systematic, mathematically rigorous account of the key notions arising from such debates, including theory, equivalence, translation, reduction, and model. The result is a far-reaching reconceptualization of the role of formal methods in answering philosophical questions." (From the Publishers)

More information available here.

Hoefer, Carl (2019) *Chance in the World: A Humean Guide to Objective Chance*. New York, NY: Oxford University Press.
ISBN: 9780190907419

"Probability has fascinated philosophers, scientists, and mathematicians for hundreds of years. Although the mathematics of probability is, for most applications, clear and uncontroversial, the interpretation of probability statements continues to be fraught with controversy and confusion. What does it mean to say that the probability of some event X occurring is 31%?

"In the 20th century a consensus emerged that there are at least two legitimate kinds of probability, and correspondingly at least two kinds of possible answers to this question of meaning. Subjective probability, also called 'credence' or 'degree of belief' is a numerical measure of the confidence of some person or some ideal rational agent. Objective probability, or chance, is a fact about how things are in the world.

"It is this second type of probability with which Carl Hoefer is concerned in this volume, specifically how we can understand the meaning of statements about

objective probability. He aims to settle the question of what objective chances are, once and for all, with an account that can meet the demands of philosophers and scientists alike. For Hoefer, chances are constituted by patterns that can be discerned in the events that happen in our world. These patterns are ideally appropriate guides to what credences limited rational agents, such as ourselves, should have in situations of imperfect knowledge. By showing this, Hoefer bridges the gap between subjective probability and chance. In a field where few scholars have given adequate treatment to interpreting statements of chance, Hoefer develops a philosophically rich theory which draws on the disciplines of metaphysics, ontology, and philosophy of science."

More information available here.

Kampourakis, Kostas & McCain, Kevin (2019) *Uncertainty: How It Makes Science Advance*. New York, NY: Oxford University Press.
ISBN: 9780190871666

"Through case studies that include climate science, vaccination, and human evolution, Kampourakis and McCain emphasize not only why uncertainty is inherent to the continual advancement of science, but also how a misunderstanding of this fact is repeatedly used by special interests to mislead the public. With quotations from an impressively wide range of sources - from philosophers to outstanding scientists - this short book will motivate its readers to think deeply about what is meant by 'scientific understanding', as well as to explore the valuable references that are cited, many of which they would otherwise miss." – Bruce Alberts, Chancellor's Leadership Chair in Biochemistry and Biophysics for Science and Education, University of California, San Francisco, Former Editor-in-Chief, *Science* magazine (2008-2013), President Emeritus, US National Academy of Sciences (1993-2005)

"Kampourakis and McCain have produced a provocative book of enumerable insights. They have navigated skillfully through a bramble bush of prickly problems and come out of it with a coherent analysis of science that elevates the concept of "uncertainty" without diminishing the standing of science. As one trained in and familiar with the scholarship of philosophy of science, I appreciated every line of inquiry and every argument in the book. To me it brings together philosophy of science, social psychology and the social studies of science in a way that explains human behavior and irrational skepticism towards strongly supported scientific claims." – Sheldon Krimsky, Lenore Stern Professor of Humanities & Social Sciences, Tufts University

"This is a wonderfully clear and engaging book on a very important and topical issue: How can science contribute to solving the problems society faces today? The cases are well chosen and the philosophical chapters do a great job in synthesizing many insights from recent philosophy of science into a coherent whole. The book succeeds admirably in showing the societal relevance of philosophical reflection on science." – Henk de Regt, Professor of Philosophy of Science, Vrije Universiteit Amsterdam

More information available here.

Kuznick, Peter J. (2019) *Beyond the Laboratory: Scientists as Political Activists in 1930s America*. Chicago, IL: The University of Chicago Press.
ISBN: 9780226676203

"The debate over scientists' social responsibility is a topic of great controversy today. Peter J. Kuznick here traces the origin of that debate to the 1930s and places it in a context that forces a reevaluation of the relationship between science and politics in twentieth-century America. Kuznick reveals how an influential segment of the American scientific

community during the Depression era underwent a profound transformation in its social values and political beliefs, replacing a once-pervasive conservatism and antipathy to political involvement with a new ethic of social reform." (From the Publishers)

More information available here.

Maxwell, Nicholas (2019) The Urgent Need for Social Wisdom. In R. Sternberg & J. Glück (Eds.), *The Cambridge Handbook of Wisdom* (754-780). Cambridge, UK: Cambridge University Press. ISBN: 9781108568272

"This is a comprehensive review of the psychological literature on wisdom by leading experts in the field. It covers the philosophical and sociocultural foundations of wisdom, and showcases the measurement and teaching of wisdom. The connection of wisdom to intelligence and personality is explained alongside its relationship with morality and ethics. It also explores the neurobiology of wisdom, its significance in medical decision-making, and wise leadership. How to develop wisdom is discussed and practical information is given about how to instil it in others. The book is accessible to a wide readership and includes virtually all of the major theories of wisdom, as well as the full range of research on wisdom as it is understood today. It takes both a basic-science and applied focus, making it useful to those seeking to understand wisdom scientifically, and to those who wish to apply their understanding of wisdom to their own work." [Description of the Handbook] (From the Publisher)

More information available here.

Maxwell, Nicholas (2019) How Wisdom Can Help Solve Global Problems. In R. Sternberg, H. Nusbaum & J. Glück (Eds.) *Applying Wisdom to Contemporary World Problems* (337-380) London: Palgrave Macmillan

"This book presents perspectives from world experts in the field of wisdom studies to propose how wisdom can provide the foundation upon which solutions to social and global problems can be grounded. The authors argue that where society has come to rely on leaders with skills relating to knowledge and intelligence; instead we should focus on wisdom-based acumen for our leaders in government, business, and the military.

"In this book the authors offer evidence-based definitions of wisdom and apply these to world problems they believe could potentially be solved using wise solutions. Among the case studies confronted are terrorism and war, poverty and economic disparity, climate change, increasing antibiotic resistance and political corruption.

"Focusing on the cognitive, social and emotional processes involved in everyday decision-making, this book presents a compelling argument for the application of wise problem-solving to complex world issues that will appeal in particular to those in leadership, teaching and policy roles, and open new pathways in the fields of wisdom-studies, psychology, sociology and political theory." [Description of the edited book] (From the Publishers)

More information available here.

Mertens, Rebecca (2019) *The Construction of Analogy-Based Research Programs: The Lock-and-Key Analogy in 20th Century Biochemistry*. Bielefeld: transcript-verlag. ISBN: 978-3-8376-4442-5

"When the German chemist Emil Fischer presented his lock-and-key hypothesis in 1899, his analogy to describe the molecular relationship between enzymes and substrates quickly gained vast influence and provided future generations of scientists with

a tool to investigate the relation between chemical structure and biological specificity.

"Rebecca Mertens explains the appeal of the lock-and-key analogy by its role in model building and in the construction of long-term, cross-generational research programs. She argues that a crucial feature of these research programs, namely ascertaining the continuity of core ideas and concepts, is provided by a certain way of analogy-based modelling." (From the Publisher)

More information available here.

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)

Information available here.

Schechner, Sara J., & Wheatland, David P. (2019) *Time of Our Lives: Sundials of the Adler Planetarium*. Chicago, IL: Adler Planetarium.
ISBN: 9780578497105

"The Adler Planetarium of Chicago has the best and most comprehensive collection of sundials and time-finding instruments in North America. Now many of these objects can be yours to explore. This volume encompasses a dazzling array of sundials, 268 in all, that date from the 15th to 20th centuries.

"What makes this catalogue special is that it is written to engage non-specialists approaching sundials for the first time. Although the organizational logic is astronomical and mathematical, the primary Interpretive essays set the sundials into cultural and social context.

"The catalogue divides sundials into classes according to the element of the Sun's apparent motion that they track (e.g. hour-angle, altitude, azimuth, or a combination) and the orientation of the surfaces on which the hour lines are mathematically drawn. Within each chapter, the instruments are organized chronologically and by workshop, thereby giving readers insight into that type's development over time and differences among makers. Technical ob-

ject descriptions are supplemented by tables of divisions, gazetteers, saints' days, weather forecasts, and in the case of polyhedral dials, the dial types, orientations, and hour systems drawn on every face. The tables offer a snapshot of the precision to which the maker aimed and the sundial's complexity. Color photographs of each sundial show its overall appearance and details.

"Chapter introductions go beyond mathematical descriptions of how each type works. "Drawing upon research findings presented here for the first time, the essays offer insights into early production techniques, fads and fashions, social hierarchy among users, the impact of church and civil authorities, and the history of the sundial classes. "Throughout the ages, people's sense of time has been influenced by their culture, politics, religion, labor, society, and geography. This catalogue offers concrete evidence, for every sundial in it embodies the time-related needs and values of its maker and users.

"The catalogue includes a taxonomy of compass needles, glossary, bibliography, and index."

More information available here.

Sinclair, Mark (2019) *Bergson*. Abingdon, UK: Taylor and Francis Group. ISBN: 9781315414935

"Henri Bergson (1859-1941) was one of the most celebrated and influential philosophers of the twentieth century. He was awarded in 1928 the Nobel prize for literature for his philosophical work, and his controversial ideas about time, memory and life shaped generations of thinkers, writers and artists. "In this clear and engaging introduction, Mark Sinclair examines the full range of Bergson's work. The book sheds new light on familiar aspects of Bergson's thought, but also examines often ignored aspects of his work, such as his philosophy of art, his philosophy of technology and the relation of his philosophical doctrines to his political commitments. (…)

"With a final chapter on his legacy, Bergson is an outstanding guide to one of the great philosophers. Including chapter summaries, annotated further reading and a glossary, it is essential reading for those interested in metaphysics, time, free will, aesthetics, the philosophy of biology, continental philosophy and the role of European intellectuals in World War I." (From the Publisher)

More information available here.

Sprenger, Jan & Hartmann, Stephan (2019) *Bayesian Philosophy of Science*. New York, NY: Oxford University Press. ISBN: 9780199672110

"How should we reason in science? Jan Sprenger and Stephan Hartmann offer a refreshing take on classical topics in philosophy of science, using a single key concept to explain and to elucidate manifold aspects of scientific reasoning. They present good arguments and good inferences as being characterized by their effect on our rational degrees of belief. Refuting the view that there is no place for subjective attitudes in 'objective science', Sprenger and Hartmann explain the value of convincing evidence in terms of a cycle of variations on the theme of representing rational degrees of belief by means of subjective probabilities (and changing them by Bayesian conditionalization). In doing so, they integrate Bayesian inference–the leading theory of rationality in social science–with the practice of 21st century science. Bayesian Philosophy of Science thereby shows how modeling such attitudes improves our understanding of causes, explanations, confirming evidence, and scientific models in general. It combines a scientifically minded and mathematically sophisticated approach with conceptual analysis and attention to methodological problems of modern science, especially in statistical inference, and is therefore a valuable resource for

philosophers and scientific practitioners." (From the Publisher)

More information available here.

Authors of HPS&ST-related papers and books are invited to bring them to attention of Paulo Maurício or Nathan Oseroff-Spicer for inclusion in these sections.

Coming HPS&ST Related Conferences

September 9-12, 2019, XXXIX National Congress of the Italian Society for the History of Physics and Astronomy (SISFA), Pisa
Details available here.

September 10-14, 2019, European Philosophy of Science Association biennial conference, University of Geneva
Details available here.

September 19-21, 2019, Experimental Philosophy Conference, University of Bern, Switzerland.
More information available here.

October 29-30, 2019, 'Scientific Literacy for All' Conference, Beijing Normal University, China.
More information available here.
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 available here.

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 available here.

January 8-9, 2020, 'Universals Locales', British Academy Sponsored, University of Edinburgh.
Details: http://mathglobal.org/locales.html

January 8-9, From Scientific Pluralism to Pluralism in HPS, University of Exeter, UK
Details: Alex Aylward (a.m.aylward@leeds.ac.uk) and Adrian Currie (a.currie@exeter.ac.uk)

March 15-18, 2020, NARST Annual Conference, Portland OR, USA
More information available here.

July 15-17, 2020, 8th Integrated History and Philosophy of Science Conference (&HPS8). Virginia Tech, Blacksburg VA
Information: Lydia Patton (critique@vt.edu) or Jutta Schickore (jschicko@indiana.edu)

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

July 25-31, 2021, 26th International Congress of History of Science and Technology (DHST), Prague
Information: https://www.ichst2021.org/

July 24-29, 2023, 17th DLMPST Congress, Univer-

sity of Buenos Aires Information: Pablo Lorenzano, pablo@unq.edu.ar.

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

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

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

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.

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The font used is Minion Pro.
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