

**HPS&ST Newsletter**  
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**# Introduction**

The HPS&ST Newsletter is sent monthly to about 11,000 emails of individuals who directly or indirectly have an interest in the contribution of history and philosophy of science to theoretical, curricular and pedagogical issues in science teaching, and/or interests in the promotion of innovative, engaging and effective teaching of the history and philosophy of science. The newsletter is sent on to different international and national HPS lists and international and national science teaching lists. In print or electronic form, it has been published for 40+ years.

The Newsletter, along with RESOURCES, OBITUARIES, OPINION PIECES and more, are lodged at the website: [HERE](#)

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

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

**# 17th International History, Philosophy and Science Teaching Conference  
2-6 September 2024 - Buenos Aires,  
Argentina**



Conference e-mail: [ihpst2024@gmail.com](mailto:ihpst2024@gmail.com)

Conference Theme: **Trusting school science again**

Conference Chair: Agustín Adúriz-Bravo,  
Facultad de Ciencias Exactas y Naturales,  
Universidad de Buenos Aires

**Invited Speakers**

2024 Springer Lecturer: **Cyrus Mody**, Maastricht University, The Netherlands

[HERE](#)

2024 Latin-American Lecturer: **Olimpia Lombardi**, CONICET, Argentina

[HERE](#)

**Important Dates**

Submission of proposals: Until 20<sup>th</sup> May 2024

Early registration: Until 30<sup>th</sup> June 2024

Ordinary registration: From 1<sup>st</sup> July 2024 until the first day of the Conference

Registration fee:

IHPST members: early (till June 30) USD165;  
after July 1, USD200

Non-members: USD260 & USD320

Argentina participants: USD20 discount on above.

Conference details: [HERE](#)

**# 8th Panhellenic Conference on Philosophy of Science, Dec. 5-7 2024**

The Department of History and Philosophy of Science of the National and Kapodistrian University of Athens organises the 8th Panhellenic Conference on Philosophy of Science to be held in Athens on December 5-7, 2024.

The thematic sections of the conference include all areas of philosophy of science (general philosophy of science, philosophy of special sciences), as well as areas of philosophy (metaphysics, epistemology, ethics, philosophy of language, philosophy of mind, history of philosophy, political philosophy) to the extent that they are related to issues concerning science.



**Keynote Speakers:**

*Stéphanie Rupy* (Ecole normale supérieure (ENS Paris) - Université PSL)

*James Ladyman* (University of Bristol)

Abstracts for contributed papers should be between 500 and 700 words, not including references (up to 5 references can be included). The allocated time for delivering contributed papers will be 30 minutes, including discussion. Submissions of a symposium proposal must include a general description of the topic and its significance (between 500 and 700 words) and summaries (up to 250 words) for each contribution. Symposia will be allocated 2 hours, and can include 3 to 5 talks. They can have any format.

**Deadline** for submission of abstracts: 30 June 2024  
Notifications of abstract acceptance: August 2024

For submission guidelines and to submit your abstract : [HERE](#)

For questions about the conference, please contact: [phos@phs.uoa.gr](mailto:phos@phs.uoa.gr)

# **Integrated History and Philosophy of Science, 10<sup>th</sup> conference, California Institute of Technology, Pasadena, California, 27-29 March 2025**



The Committee for Integrated History and Philosophy of Science invites the submission of abstracts for individual papers and “lightning talks” for &HPS10, the 10th conference in the series *Integrated History and Philosophy of Science*. We seek contributions that genuinely integrate historical and philosophical analyses of science (i.e., the physical sciences, life sciences, cognitive sciences, and social sciences) or that discuss methodological issues surrounding the prospects and challenges of integrating history and philosophy of science.

For information about the Committee for Integrated History and Philosophy of Science and previous conferences, see <http://integratedhps.org/>.

*Keynote speakers:* Lydia Patton (Virginia Tech), Marius Stan (Boston College)

All proposals (whether for a contributed paper or lightning talk) should contain a title and an abstract of up to 700 words (including references).

Please submit your abstracts to <https://app.oxfordabstracts.com/stages/75646/submitter>

Deadline for abstract submissions: **11:59 pm Anywhere on Earth (UTC -12) 18 August.**  
Notification date: **31 October, 2024.**

Please direct any inquiries to Uljana Feest ([feest@philos.uni-hannover.de](mailto:feest@philos.uni-hannover.de)) or Dana Tulodziecki ([dtulodzi@purdue.edu](mailto:dtulodzi@purdue.edu))

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



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

**Symposium Proposals** due by 1 May 2024.  
**Standalone Papers** due by 1 December 2024.

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

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



Details [HERE](#)

### # PhilSci Archive - Top 5 Downloads

PhilSci-Archive is the official preprint repository for the PSA and the best place to host your philosophy of science preprints. It offers a free, stable, and openly accessible archive for scholarly articles and monographs. With PhilSci-Archive, researchers can search the open-access repository and get curated alerts about new work delivered to their inboxes. Many journals encourage authors to post preprints on archives like the PhilSci-Archive in order to increase readership, and historical data suggests that posting to the archive increases a published paper's citation rates (see <https://philsci-archive.pitt.edu/20778/>). Visit [philsci-archive.pitt.edu](https://philsci-archive.pitt.edu) today to create a free account and post your preprints.

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

[Cobb, David \(2022\) Empiricism in the Philosophy of Science](#)

[Wiggleton-Little, Jada and Callender, Craig \(2022\) Screening Out Neurodiversity](#)

[Chen, Eddy Keming \(2023\) Laws of Physics](#)

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

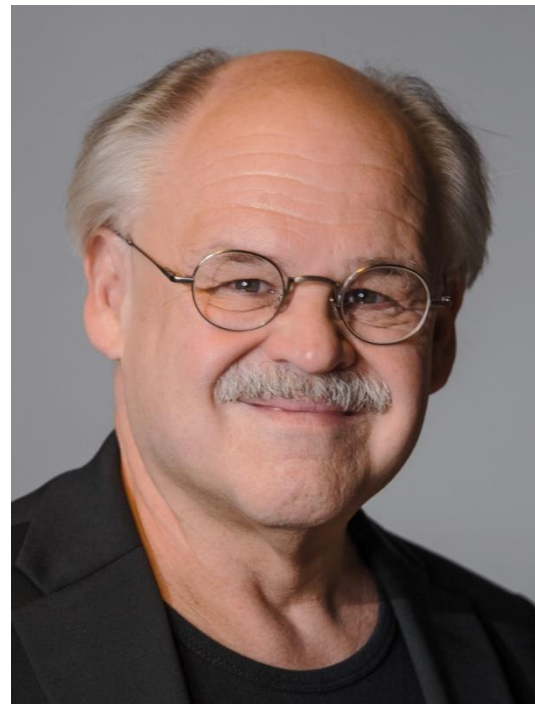
[Stern, Julio Michael and Pereira, Carlos Alberto de Braganca and Lauretto, Marcelo de Souza](#)

[and Esteves, Luis Gustavo and Izbicki, Rafael and Stern, Rafael Bassi and Diniz, Marcio Alves and Borges, Wagner de Souza \(2023\) The e-value and the Full Bayesian Significance Test: Logical Properties and Philosophical Consequences](#)

### # OPINION PAGE

## Does Agential Realism have quantum physical insights or are they just confused thinking and obscurantist writing?\*

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latter, his focus has been on role models, experiments, and scientific language in learning physics.

## Introduction

In science education research, we have seen increased attention in recent years on the role of material practices and materiality as a perspective on science education and science education research.<sup>i</sup> The basic tenets regarding the roles of matter and materiality of such views are derived from the so-called new materialism, and most often from the version that emphasizes the agential role of matter as well as performative agency, thus termed performative new materialism to highlight the agential or active role of matter.<sup>ii</sup>

Some science education researchers have recently claimed that the active or agential role of matter, materiality, and material practices have too long been ignored in science education and thus turned to performative new materialism as a remedy for the recognized shortcomings.<sup>iii</sup> In these views, “materiality” is used to refer to anything that materially exists in a school laboratory or in the context of learning science topics, including not only man-made objects but all material objects and all kinds of material existence that are relevant to the context of learning.<sup>iv</sup>

Many scholars who favor such a broad view of “materiality” appear to share common philosophical underpinnings in performative new materialism, in particular in the form of Barad’s agential realism (Barad 2007).

The focus of my commentary is on those recent studies in science education research that have adopted Barad’s agential realism to support new materialism at a sufficiently advanced level of science education, in which scientific-like laboratory work with its materials and material practices are central. These framings leave a relatively narrow focus and exclude many other ways in which new materialism is used in science education. Consequently, only a few studies are relevant here.<sup>v</sup>

Focusing on Barad’s conception entanglement and how it becomes visible in the studies mentioned

above, I attempt to pin down the reasons for adopting the quantum physical insights of agential realism in new materialism-inspired approaches to science education. I attempt to clarify whether or not such underpinnings, obviously important to Barad’s thinking, are equally important in the context of science education. As possible answers to this basic question, I have in mind three options.

The first option is that agential realism provides genuinely new phenomenon-based conceptualizations with new concepts, thus allowing the researcher to design empirical research settings. It would also allow ways to analyze the results that show how something materially new comes into existence through entanglement in phenomena related to science education. Such materially real emergence is important for Barad’s agential realism, as will be discussed in detail below. When agential realism is applied in learning situations, a legitimate question is how far such views can be pushed, and what it may mean to claim that one can see entanglements or materially new realities coming into existence. Is it indeed possible that the notion of entanglement retains similar meanings as in phenomena in quantum physics? If the answer were positive, that would open a completely new viewpoint to learning phenomena. If the answer is negative, one must ask why the quantum background and thinking is needed at all.

The second option for endorsing agential realism in science education research is that it provides a kind of motivational metaphysics. By motivational metaphysics I mean a similar stance as motivational realism, a term used by some philosophers of science (Darling, 2003; Fine, 1996) about positions where metaphysics provides motivation and guidance but has relatively few practical consequences, if any. Pragmatic considerations – whether the outcomes of empirical research provide useful results or lead to useful, reliable practices – determine whether the adopted views are viable, adequate, and acceptable. In the context of application to science education research, it is worth asking whether the situation is more like this second option than the first.

The third option is that quantum physics-inspired concepts of agential realism provide a kind of

metaphorical talk and a figurative way of speaking about familiar events but does not lead to changes or inventions in empirical practices that produce genuinely new phenomena and designs to create them (e.g. as in quantum physics). This is obviously the least controversial way to use agential realism but it seems to water down the ambitious ontological goals of Barad's agential realism. Nevertheless, this third option must be kept as a possibility in works where agential realism is applied by other authors.

Each of these three options has its own advantages and benefits. The first option is possible, credible, and empirically accessible in the case of quantum phenomena. However, in the context of classroom phenomena that are relevant to education, I see it as a quite implausible possibility. At present, no empirical evidence supports that possibility, and it is beyond empirical study in any ordinary sense of empirical research. The last option may be useful as a source of inspiration and may give satisfaction in the form of the experience of gaining insights, but then, not through evidence-based and rationally explicated argument.

The middle option is interesting, because then agential realism may be of value in guiding attention, inspiring research questions and empirical studies without the need to take the motivational metaphysics and quantum physics background too seriously. In this case, the value of agential realism derives from its power to guide useful action in practical situations e.g. in addressing practical questions of how to design and evaluate teaching situations.

I begin my commentary with a short critical summary of Barad's agential realism. Next, the role of agential realism as a basis for theorizing in humanistic, social, and behavioral sciences is briefly outlined, before focusing on its uses in science education. On the basis of these two sections, I discuss what reasons, as well as what problems, can be recognized behind the adoption of agential realism, with its quantum-inspired background thinking and quantum physics-related terms, in new materialist approaches in scholarly studies in science education.

### **Background: New materialism and agential realism**

Advocates of new materialism in science education claim that current trends in science education do not adequately address the material aspects of learning, at least not in the sense of how that materiality is understood in new materialism. The supporters of new materialism criticize three aspects as the main shortcomings of current trends in science education. First, what they see as the "active agency" of matter and materiality is not taken into account in ways they find appropriate.<sup>vi</sup> Second, they claim that constructivism-dominated views in science education are too strongly affected by separation between knower and known, between subject and object, which they refer to as "Cartesian dualism". Third, these researchers believe that science education pays too much attention to language and the linguistic aspects of learning, and consequently undervalues the material aspects of learning science. The new materialism movement therefore seeks to overcome these shortcomings by better acknowledging what they call the "active role of matter".<sup>vii</sup>

Here, I focus on the narrow set of studies in science education described above, because they discuss the topic of interest at a sufficiently advanced level, where experimentation and experiments utilizing laboratory instruments and devices are important. In these studies, the researchers aspire to stick closely to Barad's key concepts, in particular entanglement, intra-actions, and agential-cuts. This warrants asking how the researchers have managed to take into account the centrality of quantum-inspired thinking and the quantum physics origins of Barad's agential realism.

### **Agential realism and active agency of matter**

When specifying what the active role of matter might mean, the advocates of new materialism in science education have turned to so-called agential realism, introduced by the feminist theorist and philosopher Karen Barad (2007). One obvious reason to endorse Barad's agential realism as an underpinning for new materialism movement is its agential and performative nature. It motivates the active role and agency of matter in events and processes that are relevant in science education in laboratory settings.<sup>viii</sup> Barad's agential realism is well suited to that purpose because it pays close attention to "*relationalities of becoming, of which*

*we are a part*” (Barad, 2007, p.393), and how *“matter does not refer to a fixed substance; rather, matter is substance in its intra-active becoming – not a thing, but a doing, a congealing of agency”* (Barad, 2007, p.822).

For example, Julskjær et al. have summarized such aspects of the agential realist position as follows:

[A]gential realism undoes the division between being and knowing – ontology and epistemology. This undoing is marked by the concept of onto-epistemology: knowledge practice is a practice of worlding; the world, and “us” with it, are continuously performed; that is, continuously coming into being. Research is of the world, is part of the world’s ongoing reconfiguration. (Juelskjær et al. 2020, p. 13-14)

Accordingly, agential realism is clearly meant to be an ontological position, “onto-epistemology”, not only about epistemology but an overarching view on how world is: a view of “coming into being”.

For Barad, the quantum physics connection is an important part of agential realism, not a metaphorical or analogous way of speaking, but an empirically testable theory of being or coming into being. Commenting on the agential realist position, Barad has noted that:

[A]gential realist interpretation is vulnerable to empirical results, as it should be. It has to cohere with what we know. And likewise, yes, scandalous as it may be to some, agential realism could ultimately prove to be wrong, or at least not sufficiently responsive to various ‘human’ and ‘nonhuman’ intra-active engagements that matter. That vulnerability, to my mind, is a real strength of any theory (‘scientific’ or otherwise), not a failing. (Barad 2011, 446-447)

For Barad, this stance is not restricted to agential realism as applied to physics only, but goes through all of their thinking. If agential realism is

a position of such weight and strength as Barad and Barad’s supporters claim, and if we believe that agential realism provides more than metaphorical talk, similar criteria to those in the quotation above should also be valid when agential realism is applied within science education research. It is also interesting to ask what empirical evidence (in the same sense as in the quantum experiments Barad uses as inspiration) becomes available for classroom entanglements, or what actually is materially coming into being (as in quantum experiments).

### **Agential realism’s terms as Baradian quantum lingo**

Given that Barad’s agential realism is meant to be an onto-epistemological interpretation of reality and its constitution, based on quantum physics, it is astonishing to find it borrowed and gaining favor when theorizing in social sciences, certain areas of the humanities, and behavioral sciences. Recent critical analyses have pointed out deficiencies and fault-lines in adopting such stances.<sup>ix</sup> One possible reason behind such uncritical adoption of the quantum physics underpinnings of agential realism is related to difficulties in translating ideas between different fields of inquiry (Jaksland, 2021).

Barad’s expertise lies mainly in feminist and posthumanistic studies but, in addition, Barad has received PhD in theoretical physics and contributed to a few physics research papers, and thus also has the necessary expertise in physics to act as a competent translator.<sup>x</sup>

However, when scholars in fields of humanities, social, and behavioral sciences borrow ideas, views, and terminology from a field they have little if any familiarity with (here quantum physics) through a translator (here Barad), they lack the ability to critically examine the validity and credibility of the ideas that they adopt as underpinnings of their own studies (Jaksland 2021).

One reason behind the growing popularity of agential realism in humanities, social, and behavioral sciences might be the very special and imaginative vocabulary Barad has used to express their views and which is part of vocabulary of agential realism. In what follows, I will use term

“Baradian lingo” to refer to Barad’s use of terms and expressions that are borrowed from quantum physics but stripped of their definite and mathematical content to emancipate them from the constraints of normativity and make them more flexible.

Barad’s agential realism borrows quite a lot from the terminology of quantum physics and, for example, “entanglement”, “diffraction”, and “apparatus” are key terms of agential realism and of central importance to it. However, many of the terms contained in agential realism are specific to it, for example, “intra-activity”, “agential cut”, and “spacetime-mattering”. In the case of terms simply borrowed from physics (e.g. entanglement”), Barad and Barad’s followers use these terms in much broader and flexible ways than they are used in quantum physics. Such augmented meanings remain, however, obscure, and much is left to the reader in deciding the connotation of a term in different contexts of its use.

It is difficult to take a stance on the Barad’s use of language, because although it is associated with quantum physics, it has eventually developed into a quantum physics-inspired lingo with meanings that are difficult to decipher because Barad’s prose is so dense and convoluted.<sup>xi</sup>

It is productive to be able to discuss views inspired by quantum physics in humanistic sciences and social and behavioral sciences as well as arts and literature, to provide broader ways to understand phenomena in those areas of scholarship (compare Schaffer & Barreto Lemos, 2021). Therefore, it is important to pay explicit attention to how we use the ideas and terms borrowed from quantum physics to provide new viewpoints and ideas in other fields of scholarship. Thus, it should be clear if one is using terms like “entanglement” (a favorite of those who endorse agential realism) by keeping close to their original sense (when fidelity to quantum theory matters) or only metaphorically, as a source of inspiration and motivation (when much creative freedom is possible).

Finally, a scenario that needs to be taken into account is that the quantum-lingo of agential realism is another example of how postmodern and posthumanistic philosophizing uses obscure

and ambiguous language and terms, and extend and alter the meanings of the terms from those in their original context. Many examples of such introduction and use of terms, drawn from postmodern and posthumanistic philosophizing, are discussed in detail in several critical reviews.<sup>xii</sup> In that case, complicated terminology is not necessarily a hallmark of profundity, but rather, “*verbal smoke and mirrors to suggest depth and insight where none exists*” (Buekens & Boudry, 2015, p 126).

In my reading, Barad’s agential realism, utilized as a research methodology (see e.g. Juelskjær et al. 2020) or as a viewpoint in science education (see e.g. Milne & Scantlebury, 2019) appears to come close to such verbal “smoke and mirrors”. Perhaps, however, the apparent obscurantism is just a consequence of a certain style of writing typical of the social sciences, where expression contains many new neologism-like and term-like substantives, attributes, and adjectives instead of plain language. Such a writing style has been claimed to be abundant in social sciences, as discussed in detail with examples by Billig in his book *Learn to Write Badly: How to Succeed in the Social Sciences* (Billig, 2013).

After this background discussion, I next turn to the main issue of my commentary, to scrutinize how agential realism’s quantum physics background and its related terminology, in particular the concept of entanglement, are seen and used by researchers who utilize agential realism.

### **Agential realism as a basis of theorizing**

Agential realism is gaining popularity as a research approach in the new materialism movement and in the more focused field of new materialism-inspired science education. A representative example of the hopes and enthusiasm attached to agential realism is provided by Juelskjær et al. (2020) in their recent book *Dialogues on Agential Realism*, and, in the context of science education, in an edited volume *Material Practice and Materiality: Too Long Ignored in Science Education*, by Milne and Scantlebury (2019). Also in some recent articles focusing on science education and science teacher education.<sup>xiii</sup>



I begin here with agential realism as discussed in the broader context of theorizing related to new materialism, as exemplified by Juelskjær et al. (2020), and then narrow down to the discussion as found in new materialism within science education research. In what follows, the Baradian conception of “entanglement” is the focus, because much of the assumed power of agential realism seems to revolve around that conception.

Agential realism provides lenses to see research topics differently, and, in addition to lenses, it provides Baradian quantum lingo to frame and conduct discourse about research topics. It is instructional to ask how those who have found agential realism useful express their ideas, views, and motivations to use it, and how they make use of the Baradian lingo.

The Baradian understanding of world, existence, and knowing is a central theme in new materialism, which, according to Juelskjær et al. (2020), attempts to dissolve the boundary between subject and object; becoming and being are seen as a continuous process, reality emerging in a continuous creation of existence in joint performative acts of humans and non-humans. In this process, “entanglement” plays a key role:

[A]gential realism starts out in a fundamental connectivity or entanglement. A quantum entanglement. The thinking/theory as such, and all agential realist concepts, are designed and defined through this premise of entanglement and more-than, less-than or other-than human performativity. (Juelskjær et al. 2020, p. 14)

Here, the importance of “entanglement” becomes evident, as many key ideas of agential realism are related to entanglement. Crucially, it is emphasized that the entanglement in question is “quantum entanglement”. Taken at face value, speaking about quantum entanglement entails being able to define the (quantum) states that are entangled. Otherwise, we must take “quantum entanglement” only metaphorically. Attempts to clarify “entanglement” by equating it with “fundamental connectivity” and using the attributes “more-than, less-than or other-than” to connect it with “human performativity” do not help us understand the meaning of the sentence any better.

Soon after, the authors elaborate the meaning of “entanglement” by noting that:

Through quantum entanglement, we note that the constitution of space, time and matter in its specificity is part of the nature and workings of the entanglements and the phenomena they enable and are enabled by. (Juelskjær et al. 2020, p. 14)

In this passage, new claims are made about “quantum entanglement”. We can think (but it is not necessary) that “the constitution of space, time, and matter” is indeed “part of the nature and workings of the entanglement” but it does not help us to understand any better the notion of the entanglement, and furthermore, it is even more difficult to understand what the rest of the sentence means. It sounds profound but probably has no unambiguous meaning and it is left to a reader to construct a meaning. Therefore, the entanglement as outlined in these passages is somewhat distant from quantum entanglement. This way of characterizing quantum entanglement is itself so entangled that all sound basis or practical utility of speaking of quantum entanglement is lost; only metaphorical talk is left.

In addition to entanglement, agential realism uses other quantum physics-related terms that also receive significant extensions and redefinitions, for example the terms “diffraction” and “apparatus”. It is not necessary here to provide any detailed scrutiny of the use of these terms. It is enough to note that with regard to applications in educational (as well as in sociological) contexts they are also used in such a vague and metaphorical way that it makes it difficult to take seriously the onto-epistemology that Barad’s agential realism attempts to ground on inspirations drawn from quantum physics. Consequently, the quantum physics groundings that are important to Barad, in the context of their applications, can no longer serve the purpose of finding an ontology based on the primacy of phenomena, where material becoming and being takes place; only metaphors remain.

Interestingly, in adopting agential realism and Baradian quantum lingo, Juelskjær et al. are quite aware that Barad’s reading of quantum physics and Bohr’s views is intentionally “queer”. They explain that:

In agential realism, quantum physical experiments and physics philosophy discussions are read differently; that is, Barad underlines how this reading of quantum physics is not “straight” ... Rather it is queered, employing agential realism to contribute with new physics interpretations vis-à-vis the sensitivity to difference, power dynamics, subjectivity and situatedness embedded in feminist theory, postcolonial thinking, queer studies and other critical social theories. (Juelskjær et al. 2020, p. 14).

Such a reading of quantum theory and Bohr’s views (or views in any other interpretation of quantum theory) is quite acceptable as a basis to form a motivational metaphysical stance (i.e. a set of beliefs to provide meaning and purpose to believe in a preferred kind of ontology and constitution of world) or as the basis of a metaphorical way of speaking. Similar reasons to adopt quantum physical views as a basis for theorizing outside physics are discussed by e.g. Shaffer & Barreto Lemos, 2021.

Such an attitude would also save positions based on agential realism from criticism of false pretensions to be an ontologically credible view that somehow finds support from quantum physics. However, they can be fruitful and useful in other ways for purposes of scrutinizing, e.g.. “power dynamics”, “feminist theory”, “postcolonial thinking”, or “queer studies”, although then agential realism loses its power to provide ontological support or authority borrowed from natural sciences.

The advocates of agential realism, however, appear not to be satisfied with giving up the strong ontic stance contained in Barad’s agential realism, which is an essential part of it. In addition, they seem to believe that quantum theory and Barad’s interpretation of Bohr’s views lend credibility to agential realism. This is evident from many passages in interviews contained in *Dialogues on Agential Realism* (Juelskjær et al., 2020). For example, one of the interviewees mentions:

Barad shows that quantum ontology entails an entirely new conceptual mixture. Agential realism tracks this mixture in the actual quantum experiments performed by Bohr and

others, carefully examining the experimental event for how particular quantum concepts thrive and mutate. In other words, Barad looks to experimental practice to show how scientific research entails a particular metaphysics. (Juelskjær et al., 2020, p 78)

The tone is strongly convincing, with assuring expressions “showing” how “actual experiments” are “carefully examined” in the context of “experimental practices” to demonstrate how such scrutiny “entails a particular metaphysics”. Such prose greatly exaggerates how Barad’s views have received support from experiments or experimental practices, or their interpretations.<sup>xiv</sup> In many instances, in the interviews of supporters of agential realism (see Juelskjær et al., 2020), we can find similar assurances and attempts to draw credibility from quantum physics and its authorities (mostly Bohr) in quantum physics. A crucial question is: why are such assurances needed?

Taken as a kind of speculative theorizing for a metaphorical way of speaking, the adoption of agential realism would not need any support from the authority of quantum physics (or natural sciences in general). The credibility of agential realism could also come from its utility and practical success in fields where it is applied (e.g. in social and behavioral sciences, political sciences, or feminist and queer studies) without help from quantum theory.

However, gaining credibility through practical utility requires that agential realism be helpful in finding new successful and beneficial practices or useful changes in practices and actions. At least, it should help us to find out what actions are needed to change to better practices and outcomes.

Next, to better understand the possible uses of agential realism, ways to apply it, and the possible utility (or futility) of its quantum lingo, I turn to applications of agential realism in attempts to understand phenomena of interest in science education.

### **Agential realism and science education research**

In science education research, the so-called material-dialogical approach has adopted agential

realism as its theoretical underpinning in addition to Bakhtian material-discourse.<sup>xv</sup> Paralleling the new materialism movement (Scantlebury et al., 2019; Scantlebury & Milne, 2019) in science education, Hetherington et al. (2018) note that “*engaging with the materiality of that world is integral to both empirical experimentation and theorizing within science*” (Hetherington et al. 2018, p. 141).

There is nothing to object to in this statement (nor is there anything very informative either) but the authors are clearly seeking something more when they claim that “*the role of the material remains undertheorised, not only within practical science inquiry, but also in relation to the broader materiality of classrooms*” (Hetherington et al. 2018, p 141). To address the “broader materiality”, they evoke the Baradian conception of entanglement.

Hetherington et al. condense the idea of entanglement (Hetherington et al. 2018, p. 162) by quoting Barad: “*To be entangled is not simply to be intertwined with another, as in the joining of separate entities, but to lack an independent, self-contained existence*” (Barad, 2007, loc. 19). Here, as in Juelskjær et al. (2020), entanglement has a strong ontic meaning. The idea of entanglement is next clarified through notions of “intra-action”, which highlights (supposedly refers to) an “*entangled, co-emergent, co-productive relational stance*”. Such “intra-action” is closely related to phenomena in the sense that “*phenomena are continuously performed through intra-action*”, as is outlined in a passage:

Barad uses the neologism intra-action rather than interaction, to highlight this entangled, co-emergent, co-productive relational stance. Similarly, instead of referring to ‘objects’ in the world, with determinate boundaries and properties, Barad’s basic unit of reality is not the object but the phenomena, which are temporarily bounded and continuously performed through intra-action. (Hetherington et al. 2018, p 162).

Here, the authors motivate the ontological primacy of phenomena, out of which objects in the world emerge. This appears to be consistent with Barad’s views, and in a broad sense compatible with strong ontic interpretations of

quantum theory (with the epistemic interpretations being the exception) as it concerns quantum entities (see e.g. Boge 2018).

The advocates of the material-dialogic approach, paralleling Juelskjær et al., (2020), make sporadic rhetorical references to the authority of quantum physics and draw rhetorical advances from the authority of Bohr in stating:

Inspired by quantum physics (the discipline in which she holds a doctorate), in particular Niels Bohr’s ‘philosophy-physics’ ... Barad deploys a number of entwined ideas to develop a distinctive way of thinking about the ‘natural-cultural’ world. (Hetherington et al. 2018, p 162).

[Barad] uses key concepts from quantum physics (in particular Bohr’s ‘philosophy-physics’ drawing out the ontological and epistemological stances that emerge from quantum theory’s insights. (Hetherington & Wegerif 2018, p 29).

“Barad builds on the insight from research into quantum level reality by showing that the way in which experiments ... brings apparent reality into being. (Hetherington & Wegerif, 2018, p 30).

Here, we again find insinuations to accept agential realism by noting Barad’s expertise in physics and on the basis of authorities in quantum physics. Let us imagine that the authority of quantum theory and physics is not available to support how agential realism is applied here.

For the sake of argument, assume that Barad’s views cannot be licensed by quantum theory and no support is coming from interpretations of quantum theory, nor from Bohr’s thinking. In that case, expressions different from Barad’s quantum lingo should do equally well: for example, instead of “entanglement”, the word “enmeshment” might serve just as well. Is the position of agential realism then still compelling? This should be the case if one is dealing with a robust philosophical or theoretical underpinning for educational research, in no need of support from quantum theory.

When agential realism is applied in learning and school contexts, advocates of the material-dialogic approach speak of the emergence of phenomena – phenomena coming into being or existence – but not about “worlds” coming into existence, as for example in Julskjær (2020). Consequently, as applied to science education, the strong ontic position of “worlds” coming into existence or ontologically real material reality coming into being through agency is now elided.

This is a good move in emphasis, but if only phenomena are coming into existence, but the students, teacher, blackboards, calculators, and all the furniture of the school class remain as they are, how is that then different from our ordinary understanding of phenomena? The ontic power of agential realism seems to be greatly diminished in such a watered-down application.

Not much has been reported regarding the use of agential realism as a research approach and how it might make better sense of the roles played by, for example, devices, study materials, and other material aspects in science education. However, some reports are already available. Hetherington and Wegerif (2018) focus on the role of the materials and materiality in dialogic pedagogy and discuss teachers’ perspectives on their practices. Data based on interviews was interpreted using a material-dialogic viewpoint, thus including the perspective of agential realism. Researchers noted that the teachers involved in the study thought of the materiality of practical work with objects and tools from the vantage point of how they are used to illustrate concepts. On the other hand, the materiality of whiteboards and other technologies of communication was thought of in terms of opening and supporting dialogue, but there was “*little evidence of clear pedagogical thinking about the role of these materials in the dialogue*” (Hetherington & Wegerif, 2018, p 34-35).

In discussing the results, the researchers note that the teachers’ views do not correspond to the desired picture of the basis of the material-dialogic approach, nor do they show the attitudes one could wish from the perspective of agential realism. This they clearly see as a deficiency, in need of remedy.

As a remedy to the shortcomings of teachers in paying attention to the role of materiality and

materials in the proper way required by new materialism and agential realism, the researchers suggest that:

Looking at the data using this [material-dialogic] lens, we can see that teachers, students and materials enact agential cuts through their intra-actions that enable particular learning phenomena to emerge ... In the classroom we see how discourse and matter conspire to produce key decisions that shape learning. (Hetherington & Wegerif, 2018, p39).

In such passages, the researchers have chosen to say that they have “seen” agential cuts enacted, through intra-actions, as well as “how discourse and matter conspire”. This is very metaphorical and figurative speech, and instead of seeing or observing such things, researchers have used Baradian quantum lingo to interpret or dub what they have seen or observed. Such dubbing is of course possible, but we must ask: what useful views are the outcomes of that dubbing? The researchers go on to endorse and recommend:

[P]edagogy in which science teachers are explicitly aware that their intra-action with both the students and the material generates distinct phenomena that matter in the world; that the becomings of material-student-teacher (i.e. learning) are enabled and constrained by the choices that are made through those ongoing intra-actions. (Hetherington & Wegerif, 2018, p 39).

Such a description implies that more profound things than ordinary learning are at stake, where what is important is an awareness of how intra-actions generate phenomena and how learning is the becomings of material-student-teacher, produced through intra-actions.

A final example comes from a study of learning chromatography in a classroom (Hardman et al., 2022). In this case, the learning situation is rather conventional, but the researchers analyze it through the lenses of the material-dialogic approach and new materialism. In this case, the researchers provide a description of a classroom situation, dubbed in Baradian quantum lingo. Having provided a description of how students use interactive whiteboards – in writing and in drawing – and exercise books, and in one case,

bend a mini whiteboard to pass a “covert message”, researchers decide that the example allows them to “*see that the materials of the classroom are intra-acting with the understandings of the teacher and the pupils.*” (Hardman et al., 2022, p 165).

Researchers also note that, in making an observation, some pupils misunderstand and misinterpret it, which “*emerges within the dialogic space as pupils intra-act with the experimental findings (the ink and the paper)*” (Hardman et al., 2022, p 165). Shortly, afterwards, when the authors discuss how students’ misconceptions might arise, they note that:

It is through material-dialogue between the teacher, pupils and materials that a misconception emerges. Our data therefore suggest that considering transformations involves recognizing the agency of material aspects of the classroom. Pupil prior knowledge (here about pigments) intra-acts with the class experimental results during dialogue. (Hardman et al., 2022 p 167).

A little later, in concluding, the authors note that:

We believe that a material-dialogic perspective ... allows us to consider how pupils learn through being entangled within phenomena, which emerge from teacher intentions, understandings, pedagogical strategies and the materials within specific classrooms.” (Hardman et al. 2022, pp 171-172).

In all these cases (and in many more to be found in the study) the descriptions of learning situations are based on Baradian quantum lingo. It is difficult to see the advantages of such dubbing of commonplace observations and findings, and what is gained by using the terms “intra-acting” and “being entangled” instead of more commonplace term “interacting” and “being involved”. In addition, the “agency of material” is claimed but no evidence is provided as to how this agency manifests itself.

At best, the study by Hardman et al. (2022) manages to show that Baradian dubbing is possible. From the study, however, it is difficult to pin down what it claims to achieve apart from succeeding in translating rather commonplace

activities into curious-sounding Baradian quantum lingo although clearly quite ordinary and everyday actions are taking place that could be described as such. Admittedly, in a metaphorical sense, the Baradian quantum lingo appears to be flexible enough to allow its use in dubbing such commonplace learning situations, but the outcome appears to fall short in providing insights or helping us see what benefits such dubbing provides.

### **Discussion and conclusions: metaphysics or metaphors?**

The examples of the uses of agential realism in science education begs the question of the necessity of the quantum physics insights of agential realism as it is used as an underpinning in science education. Should we take it seriously, as an “onto-epistemological” position with real power to guide research and help us understand how to improve science education, goals that all science educators can share and that are recognizable as teaching of science? Alternatively, is it merely a motivational metaphysics, providing profound-sounding metaphorical talk, or in the worst case, mere fashionable nonsense?

The utility of agential realism as a metaphysical underpinning for research approaches in empirical research and in generating plausible empirical hypotheses to be tested appears to be low. Such possibilities are barred because the basic conceptualization as agential realism presents them – most evidently, entanglement, apparatus, intra-actions, and agential cuts – are so vaguely defined that it seems impossible to derive any empirically testable claims by using them.

Moreover, the possibility that phenomena relevant to quantum physical entities and phenomena are also relevant at the macro level and, in particular, applicable to classroom phenomena is bold and finds little if any support from reported research still.

Of course, this is not a refutation of the possibility that mathematical modelling of phenomena with models similar to those employed in quantum theory might turn out to be feasible and useful (see e.g. Cantley, 2015, 2017). However, the transferability of mathematical models from one area to another does not indicate that the

phenomena are the same (see also Schaffer & Barreto Lemos, 2021).

In any case, agential realism is not about the transferability of models, nor does it provide any usable models of its own. Consequently, whether as a viable realistic ontology or as a fruitful source of analogies for modelling, we have every reason to reject the viability of agential realism as an underpinning of educational applications.

We still have the idea that the basic terms and notions of agential realism provide motivational metaphysics. Even if one cannot derive hypotheses to be tested, nor use the theory as a basis to design empirical settings, we can use it as a source of inspiration as well as lending personal meaning and significance to results. Then the theoretical underpinning is capable of providing a motivational metaphysics, a psychologically satisfying belief system akin to an ideology, which provides a coherent framework of thought and actions, but either remains beyond empirical testing or does not make empirically testable predictions. In a sense, this is analogous to the role of various popularizations based on quantum physics interpretations (see e.g. Schaffer & Barreto Lemos, 2021).

Motivational metaphysics generates neither new scientific knowledge nor empirical claims, but it may generate ideas and inspiration to try out new experiments and provide satisfying metaphysical interpretations of the results so obtained. This, of course, is useful (although perhaps not exactly what agential realism desires to achieve). The usefulness of motivational metaphysics in this sense comes from its ability to provide a belief system that has practical benefits as a motivation for actions that may indirectly help to produce robust and reliable science. If such benefits exist, they are enough to make the belief system useful, but no more than as a motivational metaphysics (because the empirical success is not derived from the belief system, although motivation is).

Here, one approaches what is usually called ideology: an overarching belief system that provides a way to see and interpret everything (like in new materialism), but which evades discussion under ordinary scientific criteria of rationality and logic, as well as empirical

conscientiousness if it pretends to make empirical claims.

If it turns out that agential realism also falls short as a motivational metaphysics (which seems quite likely in the light of the published results), we are left with its possible role as a source of metaphors, a generator of metaphorical and figurative speech. A greatly extended (and exaggerated) use of scientific vocabulary of quantum theory may provide grand interpretations of world, humanity, sociology, organizations, etc., and we get, for example, ideas about the possibility of quantum brains (see e.g. Wendt, 2015) leading to the theorizing of humans as walking wave functions (Wendt 2015). Quantum-inspired ideas as well as Barad's views have also fundamentally affected socio-cultural theorizing (Kirby, 2011).

These broader issues, going beyond Barad's work, have recently been discussed in detail in several critical commentaries.<sup>xvi</sup> Such metaphorical use of agential realism is of course acceptable and provides momentum for new ideas, and may eventually even be useful to the progress of understanding. There is no reason to object to or diminish the value of metaphorical and figurative talk, but also every reason to understand that it is not yet science in the sense that one could evaluate and scrutinize the arguments based on such figurative talk.

Finally, the bleakest (and unfortunately the most likely) reason for the current popularity of agential realism as part of the new materialism movement in science education might be due to Baradian quantum lingo. The curious terms and expressions of Baradian quantum lingo and its convoluted sentences with ambiguous meanings readily provide an appearance of profundity where we actually have commonplace notions and trivialities in the guise of deep truths.

This is a well-known and widely discussed case of the obscurantism and nonsense of pseudophilosophies.<sup>xvii</sup> Moreover, agential realism as its supporters use it shows signs of what has been called a fashionable nonsense (Sokal & Bricmont, 1998), in which new ideas and views circulate and are repeated uncritically, and the bases of claims are accepted as such and not scrutinized conscientiously.

Despite these critical remarks, agential realism may, after all, have its advantages in directing attention to the importance of devices, apparatuses, and material aspects in interacting with world and in gaining knowledge through those interactions. In addition, it directs attention to the role of conceptualization and language as part of that process, not separate from it but essentially connected and intertwined with it. However, it should be remembered that agential realism aspires to more than that. According to agential realism, quantum mechanics provides a sound ontological stance to assume that the entanglement process is crucial in producing something materially real and new, and where constituents of reality do not have independent separable existence.

Such a picture indeed follows if entanglement as an ontic possibility is taken as granted and when an entire worldview is derived from it. However, at present, we have no pressing reasons to assume that quantum physics forces such a strong ontic position on us. Even more pressingly, we have neither rational reasons nor empirical evidence to assume that we need agential realism to understand the real macrolevel world better – in particular as applied to humans, human behavior and interaction, and learning situations in the context of science education. Such a basis is perhaps possible, but it appears to be so implausible that mere possibility is not enough for its acceptance; inability to refute is not an obligation to accept.

### Endnotes

<sup>1</sup> Hardman, Riordan & Hetherington, 2022; Hetherington, Hardman, Noakes & Wegerif, 2018; Hetherington & Wegerif, 2018; Milne & Scantlebury, 2019.

<sup>2</sup> See e.g. Gamble, Hanan & Nail, 2019.

<sup>3</sup> See e.g. Scantlebury, Danielsson, Hussénus, Gullberg & Andersson, 2019; Scantlebury & Milne, 2019.

<sup>4</sup> Hetherington et al. 2018, 4 Hetherington & Wegerif, 2018, Scantlebury et al. 2019; Scantlebury & Milne, 2019.

<sup>5</sup> Hardman et al. (2022), Hetherington et al. (2018), Hetherington and Wegerif (2018), Milne (2019), and Scantlebury et al. (2019)

<sup>6</sup> Hardman et al., 2022, Hetherington et al., 2018; Hetherington & Wegerif, 2018, Milne, 2019; Scantlebury et al. 2019; Scantlebury & Milne, 2019)

<sup>7</sup> Scantlebury et al., 2019; Scantlebury & Milne, 2019; Hardman et al., 2022; Hetherington et al. 2018; Hetherington & Wegerif, 2018)

<sup>8</sup> Hardman et al., 2022; Hetherington et al., 2018; Hetherington & Wegerif, 2018; Scantlebury et al., 2019; Scantlebury & Milne, 2019)

<sup>9</sup> See e.g. Faye & Jaksland, 2021; Hollin, Forsyth, Giraud & Potts, 2017; Jaksland, 2021.

<sup>10</sup> See Jaksland 2021, and Faye & Jaksland, 2021 for a detailed analysis.

<sup>11</sup> For similar difficulties, see review by Pinch, 2011.

<sup>12</sup> Buekens & Boudry, 2015, Elster, 2012, Moberger, 2020, Sokal & Bricmont, 1998, Matthews 2015, pp.415-419.

<sup>13</sup> Hardman et al. 2022; Hetherington et al. 2018; Hetherington & Wegerif, 2018.

<sup>14</sup> See e.g. Faye & Jaksland, 2021; Jaksland, 2021.

<sup>15</sup> Hardman et al. 2022; Hetherington et al. 2018; Hetherington & Wegerif, 2018.

<sup>16</sup> See e.g. Hollin et al. 2017; Jaksland, 2021; Schaffer & Barreto Lemos, 2021; Waldner 2017.

<sup>17</sup> Buekens & Boudry, 2015; Elster, 2012; Moberger, 2020; Sokal & Bricmont, 1998.

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### Invitation to Submit Opinion Piece

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

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

They will be archived, and downloadable, in the OPINION folder at the HPS&ST web site [HERE](#).

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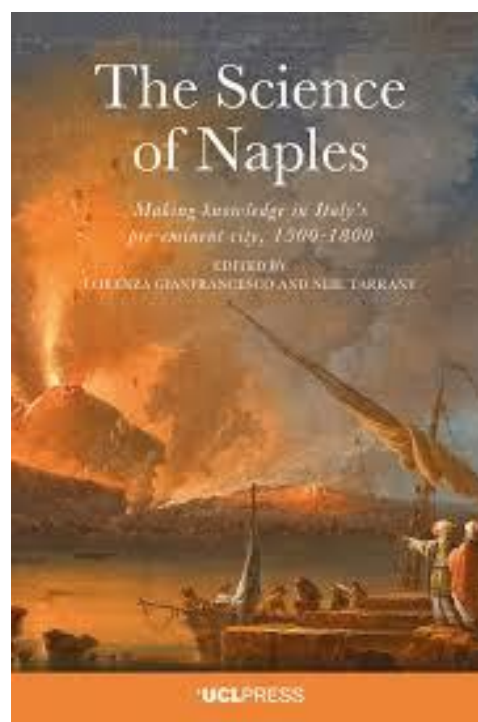
- Vale Ron Numbers (1942-2023), by Mike Osborne, [HERE](#)
- Society for Philosophy of Science in Practice, June Newsletter [HERE](#)
- Subrena E. Smith, *Why philosophy is so important in science education* [HERE](#)
- Schickore, J. & Newman, W. R. (Eds.) (2024). *Elusive Phenomena, Unwieldy Things: Historical Perspectives on Experimental Control*. Dordrecht: Springer. [\[Open Access\]](#)
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### # Featured Book

*The Science of Naples: Making knowledge in Italy's pre-eminent city, 1500-1800*

Lorenza Gianfrancesco and Neil Tarrant (eds.)

University College London Press, 2024



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Long neglected in the history of Renaissance and early modern Europe, in recent years scholars have revised received understanding of the political and economic significance of the city of Naples and its rich artistic, musical and political culture. Its importance in the history of science, however, has remained relatively unknown.

*The Science of Naples* provides the first dedicated study of Neapolitan scientific culture in the English language. Drawing on contributions from leading experts in the field, this volume presents a series of studies that demonstrate Neapolitans' manifold contributions to European scientific culture in the early modern period and considers the importance of the city, its institutions and surrounding territories for the production of new knowledge.

Individual chapters demonstrate the extent to which Neapolitan scholars and academies contributed to debates within the Republic of Letters that continued until deep into the nineteenth century. They also show how studies of Neapolitan natural disasters yielded unique insights that contributed to the development of fields such as medicine and earth sciences. Taken together, these studies resituate the city of Naples as an integral part of an increasingly globalised scientific culture, and present a rich and engaging portrait of the individuals who lived, worked and made scientific knowledge there.

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

### **# Intercultural Education as Dialogue Between Knowledge Systems**

The paper "Intercultural Education as Dialogue Between Knowledge Systems: Elements of a Theoretical Framework" has been published online in *Science & Education*.

The following link is to a "view-only" version. <https://rdcu.be/dIXau>

Those with an interest in accessing the downloadable file of the paper, please contact co-author:

Charbel El-Hani [charbel.elhani@gmail.com](mailto:charbel.elhani@gmail.com)

“This is an important article in the research trajectory of our lab, as it consolidates a theoretical work that has been developing since my stay at the Center of Social Studies in the University of Coimbra, under the supervision of Prof. Boaventura de Sousa Santos, and along with other theoretical backgrounds, has been guiding our work in schools situated in fishing and Indigenous communities.” [author]

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

Much education research is timely. This is useful, but an unfortunate consequence can be that what can relevant today might be irrelevant tomorrow; the research might leave no trace. Conversely, some research can leave a big trace but be philosophically flawed and so do educational and cultural damage. In comparison, good HPS&ST research is clearly written, well-argued, and has an enduring value and a long shelf-life. Clarity encourages critique and evaluation, where flaws can be identified and corrected, a condition for the advance of knowledge.

In defence of this claim, the HPS&ST Newsletter will identify a 30+ years-old article that had, and still has, philosophical, historical and educational value: A Golden Oldie.

Cordero, A.: 1992, 'Science, Objectivity and Moral Values', *Science & Education* 1(1), 49-70.

ABSTRACT: Scientific facts are loaded with values, but, it is argued, this does not viciously compromise the objectivity of scientific claims, because the values that permeate scientific discourse (a) are loaded in turn with facts, (b) are not immune from critical revision, and (c) have changed in the past and continue to be subjected to revision. In science, unlike such enterprises as Scientific Creationism, values are discovered, introduced, tested and challenged in the same way that other aspects of scientific discourse are. All of this makes scientific discourse relevant to the contemporary exploration and critique of human

values in general, particularly as more aspects of life become illuminated by science.

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## # Recent HPS&ST Research Articles

*Osiris* (Volume 39, 2024))

Theme: Disability and the History of Science

Editors: Jaipreet Viridi, Mara Mills, and Sarah F. Rose

*Perspectives on Science* (Volume 32, Issue 3, 2024)

Editors : Robert Harlander, Jean-Philippe Martinez, Friedrich Steinle, and Adrian Wüthrich

Special Issue : Virtual Entities in Science

Becker, M.H.T., Heidemann, L.A. & Lima, N.W. (2024). History of Science in Physics Education in the Last (2024). Decade: Which Direction We Are Heading?. *Sci & Educ*, 1-38. <https://doi.org/10.1007/s11191-024-00537-9>

de Melo-Martín, I. (2024). Concerns about Contextual Values in Science and the Legitimate/Illegitimate Distinction. *Philosophy of Science*, 1–29. doi:10.1017/psa.2024.2

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Jones, E. (2024). Exploring the socio-ecology of science: the case of coral reefs. *Euro Jnl Phil Sci*, 1-32. <https://doi.org/10.1007/s13194-024-00589-2>

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*Research in Science Teaching*, 1–29. <https://doi.org/10.1002/tea.21967>

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Martín, E., Ariza, Y. (2024). A Didactic and Metatheoretical Characterization of Computational Simulations in Science Education. *Sci & Educ*, 1-21. <https://doi.org/10.1007/s11191-024-00539-7>

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Turnbull, T. M. (2024). Redefining Efficiency: US Physicists and the 1970s Energy Crisis. *Historical Studies in the Natural Sciences*, 54 (3), 365–406. <https://doi.org/10.1525/hsns.2024.54.3.365>

Walker, M. (2024). The Historiography of “Hitler’s Atomic Bomb”. *Phys. Perspect.* 26, 18–4. <https://doi.org/10.1007/s00016-024-00309-6>

## # Recent HPS&ST Related Books

Fopp, D., Axelsson, I., & Tille, L. (2024). *The Youth Climate Uprising: From the School Strike Movement to an Ecophilosophy of Democracy*. Columbia, NY: Columbia University Press. ISBN: 9783837670318

“Species are going extinct, forests are burning, and children are worried about the future and their peers worldwide. But that is not the whole story: One Friday in 2018, a few young people joined Greta Thunberg to protest, and the global climate strike movement was born. Scientist David Fopp spent 250 Fridays with the newly formed grassroots movements. Together with activists Isabelle Axelsson and Loukina Tille, he offers an insider perspective on how scientists and activists can fight for a just and sustainable global society.

“The volume also offers both an introduction to ecophilosophy and a unified science of democracy in times of interdependent crises. How can research in all disciplines - from (drama) education and economics to psychology - help with this struggle? And how can we all fight the climate crisis by transforming and deepening democracy?”  
(From the Publishers)

More information [HERE](#)

Jamieson, D. (2024). *Ethics and the Environment: An Introduction* (2nd ed.). Cambridge: Cambridge University Press. ISBN: 9781108992053

“This new edition of a widely used and cited introduction to ethics and the environment offers a broad and lively discussion of nature's future, focusing on climate change, conservation, and justice for both our contemporaries and future generations. It discusses the nature of environmental problems and their relationship to economics, religion, technology, and aesthetics. It includes incisive discussions of our moral relations with other animals, and of how animals are used in our food systems.

“It also provides a deep discussion of the value of nature, which takes up ecofeminist and deep ecology views as well as sentientism and biocentrism. It discusses the plurality of values, and applies this analysis to some conflicts from the author's home state of California. The volume is comprehensively revised and updated, with several new chapters, and concludes with a compelling discussion of the question “How should I live?” in this new

epoch of the Anthropocene.” (From the Publishers)

More information [HERE](#)

Keller, V. (2024). *Curating the Enlightenment: Johann Daniel Major and the Experimental Century*. Cambridge: Cambridge University Press. ISBN: 9781009506854

“How did the research universities of the Enlightenment come into being? And what debt do they owe to scholars of the previous era? Focusing on the career of German polymath Johann Daniel Major (1634–93), *Curating the Enlightenment* uncovers how late seventeenth-century scholars crafted the research university as a haven for critical inquiry in defiance of political and economic pressures. Abandoning the surety of established intellectual practice, this 'experimental century' saw Major and his peers reshaping fragments of knowledge into new perspectives. Across new disciplines, from experimental philosophy to archaeology and museology, they reexamined what knowledge was, who it was for, and how it was to be stored, managed, accessed, judged, and transformed.

“Although later typecast as Baroque obstacles to be overcome by the Enlightenment, these academics arranged knowledge in dynamic infrastructures that encouraged its further advancement in later generations, including our own. This study examines these seventeenth-century practices as part of a continuous intellectual tradition and reconceptualizes our understanding of the Enlightenment.” (From the Publishers)

More information [HERE](#)

Klein, A. M. (Ed.) (2024) *The Oxford Handbook of William James*. Oxford, UK. Oxford University Press. ISBN: 9780199395699

“William James was a giant of turn-of-the-century intellectual life. He helped found the young science of physiological psychology, produced a series of widely debated texts on religious experience and on the ethics of faith, co-founded the pragmatist movement in philosophy, and at the end of his life,

developed a distinctive metaphysics concerning the relationship between mind and matter that is still influential today.

“In philosophy, James is remembered for his pragmatism, an outlook that ties truth and meaning to practical results, and for his will to believe doctrine, which defends a right to believe even without evidence, in some cases. His landmark contributions to psychology include his theory that emotions are feelings of bodily changes following excitement—that “*we feel sorry because we cry, are angry because we strike*” and not vice versa. His *Varieties of Religious Experience* offered an intimate look at intense, personal, and often heterodox religious experiences.

“Featuring twenty-nine new essays by leading scholars like Gary Hatfield, Philip Kitcher, Cheryl Misak, and Jesse Prinz, this Oxford Handbook provides an organized, chapter-by-chapter presentation of key themes in James's thought. These themes include attention, emotion, consciousness, evolution, intentionality, truth, religion, ethics, pragmatism, mathematics, and radical empiricism. James was an extraordinarily dialectical thinker, and his engagement with figures from Hume and Hegel to Peirce and Dewey are covered along with his influence on later phenomenology and analytic philosophy. Each chapter provides those new to James with an accessible route into a topic of interest, while also providing seasoned readers sophisticated interpretations by the best living scholars working on James today.” (From the Publishers)

More information [HERE](#)

Kragh, H. (2024). *The Names of Science: Terminology and Language in the History of the Natural Sciences*. Oxford, UK: Oxford University Press. ISBN: 9780198917441

“The history of science is echoed in the development of its language and the names chosen for its technical terms. *The Names of Science* examines in detail how, over time, new words have entered the scientific lexicon and how some of them, but far from all, have survived to the present. Why is a transistor

called a transistor and not something else? Why was the term 'scientist' only coined in 1834, and why was the name regarded as controversial for a long time afterwards?

“There is a story behind every scientific word we use today. In this work, Helge Kragh tells many of these stories, taking a broad historical perspective from the Renaissance to the present. By combining elements of linguistics with the history of the natural sciences including physics, chemistry, and astronomy, this book offers a new and innovative perspective on the historical development of the natural sciences.

“Following an introductory list of useful linguistic terms, the book is structured in six chapters, which cover important phases in the history of science, dealing with a vast range of scientific terminology from physics, chemistry, geology, astronomy, to cosmology. It also considers, if only briefly, how English - and not, say, Latin or French - developed to become the internationally accepted language of science.

“Contrary to other works dealing with the subject, *The Names of Science* pays serious attention to the historical dimension of scientific language, and to the way in which scientists have, sometimes unconsciously, acted as linguists and neologists in their research work.” (From the Publishers)

More information [HERE](#)

Lalli, R., & Navarro, J. (Eds.) (2024). *Globalizing Physics: One Hundred Years of the International Union of Pure and Applied Physics*. Oxford UK: Oxford University Press. ISBN: 9780198878681 [Open Access]

“Following the centenary of the International Union of Pure and Applied Physics, this volume features contributions from leading science historians from around the world on the changing roles of the institution in international affairs from its foundation in 1922 to the present. The case studies presented in this volume show the multitude of functions that IUPAP had and how these were related to the changing international political contexts.

“The book is divided into three parts. The first discusses the interwar period demonstrating how the exclusion of communities of the Central Powers from international scientific institutions imposed by victorious allied countries made IUPAP ineffective until the end of World War II. The second part analyzes the changing roles assumed by IUPAP starting from its complete renovation after World War II. Case studies covering the role of IUPAP in physics education, in metrology, in joint commissions with other unions and in defining the complex relations between pure and applied physics provide examples of IUPAP's impact on the world of science. Part III squarely addresses the science diplomacy aspects of IUPAP during the Cold War highlighting the importance of IUPAP in furthering diplomatic goals and explaining the origin of the pursuit of the free circulation of scientists as the activity that characterized the main function of international unions during the Cold War.

“Highlighting how often scientific agendas and political imperatives were entangled in the activities of IUPAP, the book analyzes the work of the Union as exercises of science diplomacy, thus contributing to the current debate on the use of science and technology in international relations.” (From the Publishers)

More information [HERE](#)

Loewer, B. (2024). *Laws of Nature and Chances: What Breathes Fire into the Equations*. Oxford, UK: Oxford University Press. ISBN: 9780198907695

“Barry Loewer presents a novel account of the metaphysics of law of nature, chances, fundamental ontology, and the space-time arena they occupy. He calls this the Package Deal Account. This aims to answer Stephen Hawking's question "What is it that breathes fire into the equations and makes a universe for them to describe?" Loewer's account stands on the shoulders of David Lewis's Humean Best Systems Account of laws and chances, but rejects Lewis' Humean ontology of natural properties, and instead lets the criteria that physicists employ for evaluating candidate fundamental theories of everything, together

with reality, determine the universe's fundamental ontology. The Package Deal Account thus advances the project of naturalizing metaphysics.

“Loewer discusses the history of the concept of laws of nature, current philosophical accounts of the metaphysics of laws, and arguments for and against each of these. He then shows how the Package Deal Account overcomes objections to each, and how, unlike Lewis's Humean account and its non-Humean rivals, it is able to accommodate recent developments in physics, including proposals for theories of quantum gravity that reject the fundamentality of space-time. Loewer provides in addition an account of the laws and chances that occur in non-fundamental special sciences and how they are related to those of fundamental physics.” (From the Publishers)

More information [HERE](#)

Miller, S., & Bossomaier, T. (2024). *Cybersecurity, Ethics, and Collective Responsibility*. Oxford, UK: Oxford University Press. ISBN: 9780190058135 [Open access]

“The advent of the Internet, exponential growth in computing power, and rapid developments in artificial intelligence have raised numerous cybersecurity-related ethical questions in various domains. The dual use character of cybertechnology—that it can be used to provide great benefits to humankind but can also do great harm—means that business (data security, data ownership and privacy), public communication (disinformation and computational propaganda), health (privacy, ransomware attacks), law enforcement (data security, predictive policing) and interstate conflict (cyberwar, autonomous weapons) are of vital interest to cybersecurity ethics.

“This work analyses the key ethical concepts in the field, such as privacy, freedom of communication, security, and the right to self-defence, and develops sets of ethical guidelines for the regulation of cyberspace in these various domains. From a liberal democratic perspective, Seumas Miller and Terry Bossomaier seek to protect individual rights while ensuring the collective good of

cybersecurity. They also pay close attention to institutionally embedded collective moral responsibilities that function as 'webs of prevention' against cyberattacks. These webs, they argue, need new regulation and the redesign of institutional roles, as well as technical countermeasures to cyberattacks, such as passwords, encryption, firewalls, and 'patching.' At times, webs of prevention also involve offensive and defensive measures. In their expert analysis and guidance, Miller and Bossomaier reinforce just how much is at stake in the field of cybersecurity ethics.” /From the Publishers)

More information [HERE](#)

Morris, P.J.T., & Reed, P. (2024). *Henry Enfield Roscoe: The Campaigning Chemist*. Oxford UK: Oxford University Press. ISBN: 9780190844257

“Little known today, Henry Enfield Roscoe was one of the most prominent chemists and educational reformers in Victorian Britain. Having studied in Heidelberg, he worked to transform English education by using Germany as a model. He made Owens College, Manchester, viable and converted it into Victoria University (now the University of Manchester).

“He then campaigned for the reform of technical education in an alliance with like-minded campaigners which resulted in the Technical Instruction Act of 1889. Roscoe was also the Liberal MP for South Manchester between 1885 and 1895, one of the few academic chemists to become a member of the House of Commons. In his "retirement," he helped found the Lister Institute of Preventive Medicine.

“Yet, despite his extensive impact on Britain at the time and our society today, he remains largely forgotten. In this detailed biography, authors Morris and Reed provide a timely and original contribution to the history of nineteenth-century British science and its relation to education, industry, and government policy, highlighting Roscoe's significant contributions and legacy as one of the leading

scientists of his generation.” (From the Publishers)

More information [HERE](#)

Naylor, S. (2024). *The Observatory Experiment: Meteorology in Britain and Its Empire*. Cambridge: Cambridge University Press. ISBN: 9781009207225

“In this innovative history of the science of meteorology, Simon Naylor focuses our attention on the spaces in which it was pursued: meteorological observatories. During the nineteenth century, meteorologists established or converted sites where observers and their instruments could be housed, where they collected and analysed data and developed meteorological theories. He examines a number of these sites around the British Empire, along with the governmental, military and commercial networks connecting them.

“Taking many shapes to capture the weather in different environments, these observatories brought various social groups into contact with the practice of science, including sailors on naval surveying vessels, climbers ascending Scottish peaks, and families checking their rain gauges at home. Through a study of these spaces, Naylor argues for the treatment of meteorology as an experimental observatory science, on which the development of knowledge about local, regional, national and global weather and climate relied.” (From the Publishers)

More information [HERE](#)

Reynolds, M. (2024). *Reading Practice: The Pursuit of Natural Knowledge from Manuscript to Print*. Chicago, IL: The University of Chicago Press. ISBN: 9780226834894

“*Reading Practice* tells the story of how ordinary people grew comfortable learning from commonplace manuscripts and printed books, such as almanacs, medical recipe collections, and herbals. From the turn of the fifteenth century to the close of the sixteenth century, these were the books English people read when they wanted to attend to their health or understand their place in the universe.

Before then, these works had largely been the purview of those who could read Latin. Around 1400, however, medical and scientific texts became available in Middle English while manuscripts became less expensive. These vernacular manuscripts invited their readers into a very old and learned conversation: Hippocrates and Galen weren't distant authorities whose word was law, they were trusted guides, whose advice could be excerpted, rearranged, recombined, and even altered to suit a manuscript compiler's needs.

"This conversation continued even after the printing press arrived in England in 1476. Printers mined manuscripts for medical and scientific texts that they would publish throughout the sixteenth century, though the pressures of a commercial printing market encouraged printers to package these old texts in new ways. Without the weight of authority conditioning their reactions and responses to very old knowledge, and with so many editions of practical books to choose from, English readers grew into confident critics and purveyors of natural knowledge in their own right.

"Melissa Reynolds reconstructs shifting attitudes toward medicine and science over two centuries of seismic change within English culture, attending especially to the effects of the Reformation on attitudes toward nature and the human body. Her study shows how readers learned to be discerning and selective consumers of knowledge gradually, through everyday interactions with utilitarian books." (From the Publishers)

More information [HERE](#)

von Hardenberg, W. G. (2024). *Sea Level: A History*. Chicago, IL: The University of Chicago Press. ISBN: 9780226831831

"News reports warn of rising sea levels spurred by climate change. Waters inch ever higher, disrupting delicate ecosystems and threatening island and coastal communities. The baseline for these measurements—sea level—may seem unremarkable, a long-familiar zero point for altitude. But as Wilko Graf von Hardenberg reveals, the history of defining and measuring

sea level is intertwined with national ambitions, commercial concerns, and shifting relationships between people and the ocean.

"*Sea Level* provides a detailed and innovative account of how mean sea level was first defined, how it became the prime reference point for surveying and cartography, and how it emerged as a powerful mark of humanity's impact on the earth. With Hardenberg as our guide, we traverse the muddy spaces of Venice and Amsterdam, the coasts of the Baltic Sea, the Panama and Suez canals, and the Himalayan foothills.

"Born out of Enlightenment studies of physics and quantification, sea level became key to state-sponsored public works, colonial expansion, Cold War development of satellite technologies, and recognizing the climate crisis. Mean sea level, Hardenberg reveals, is not a natural occurrence—it has always been contingent, the product of people, places, politics, and evolving technologies. As global warming transforms the globe, Hardenberg reminds us that a holistic understanding of the ocean and its changes requires a multiplicity of reference points.

"A fascinating story that revises our assumptions about land and ocean alike, *Sea Level* calls for a more nuanced understanding of this baseline, one that allows for new methods and interpretations as we navigate an era of unstable seas." (From the Publishers)

More information [HERE](#)

Wright, A. S. (2014). *More than Nothing; A History of the Vacuum in Theoretical Physics, 1925-1980*. Oxford, UK: Oxford University Press. ISBN: 9780190062804

"The vacuum is central to physicists' best theories of subatomic particles, gravitation, and cosmology. Nothingness provides the reference point with which to compare new particle creation and annihilation. Cosmologists use empty universes to study the causal structure of spacetime. Paradoxically, our best physical theories of particles, gravity, and spacetime are theories of nothingness. Stranger still, the physicists' vacuum is a hive of activity.



Quantum fluctuations fill empty space with particles, and astronomers measure gravitational waves, the vibrations of empty spacetime itself.

“*More than Nothing* uses the history of the vacuum to show how technical concepts in physics are made real through everyday practice. It provides new insight into the development of twentieth-century theoretical physics through sustained analysis of understudied figures including John Wheeler's geometrodynamics and Sidney Coleman's false vacuum. It reveals the surprising influence on physicists from the psychology of impossible objects to drawings of the black hole, and the ways in which the development of the physics of the vacuum became inseparable from the development of larger cultural movements in aesthetics, art, psychology, and fiction. Across decades and across disciplines, *More than Nothing* shows how physicists over and over again chose to study the vacuum for insight into the world around them.

“Drawing on newly unearthed laboratory notes, private letters, and published material, *More than Nothing* offers a scoping history of the vacuum as a lens into the development of modern physics.” (From the Publishers)

More information [HERE](#)

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

## # PhD Award in HPS&ST

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

## # Coming HPS&ST Related Conferences

July 17-19, 2024, British Society for Philosophy of Science, York.

Details: [HERE](#)

August 1-8, 2024, 25th World Congress of Philosophy, Rome

Details [HERE](#)

August 28-30, 2024, European Network for Philosophy of the Social Sciences (ENPOSS), 13<sup>th</sup> Conference, University of Bergen, Norway

Details: [HERE](#)

September 2-6, 2024, International History, Philosophy and Science Teaching Group

Details: [HERE](#)

September 16-20, 2024, Eighth International Conference on the History of Mathematics Education (ICHME-8), Warsaw

Details: Organiser [Karolina Karpinska](#)

September 17-19, 2024, Forum on Philosophy, Engineering and Technology, Karlsruhe Institute of Technology

Details: [HERE](#)

October 28-30, 2024, Conference on Philosophy of Technology, Maastricht University, the Netherlands

Details: either

[darryl.cressman@maastrichtuniversity.nl](mailto:darryl.cressman@maastrichtuniversity.nl) or [massimiliano.simons@maastrichtuniversity.nl](mailto:massimiliano.simons@maastrichtuniversity.nl)

September 4-7, 2024, 11<sup>th</sup> European Society for History of Science conference, Barcelona

Details [HERE](#)

December 5-7, 2024, 8th Pan-Hellenic Conference on Philosophy of Science, Athens

Details: [HERE](#)

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

Details: [HERE](#)

March 23-26, 2025, NARST Annual Conference, National Harbour, Maryland, USA

Details: [HERE](#)

March 27-29, 2025, Integrated History and Philosophy of Science, 10<sup>th</sup> conference. CIT Pasadena, CA

Details: [HERE](#)

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

Details: [HERE](#)

August 25-29, 2025, European Science Education Research Association, biennial conference, Copenhagen

Details: [HERE](#)

22-25 June 2026, 8<sup>th</sup> ICASE World Conference on Science & Technology Education, University College, Cork, Ireland

Details: [HERE](#)

## # HPS&ST Related Organisations and Websites

[IUHPST](#) – International Union of History, Philosophy, Science, and Technology  
[DLMPST](#) – Division of Logic, Mathematics, Philosophy, Science, and Technology  
[DHST](#) – Division of History, Science, and Technology  
[IHPST](#) – International History, Philosophy, and Science Teaching Group  
[NARST](#) - National Association for Research in Science Teaching  
[ESERA](#) - European Science Education Research Association  
[ASERA](#) - Australasian Science Education Research Association  
[ICASE](#) - International Council of Associations for Science Education  
[UNESCO](#) – Education  
[HSS](#) – History of Science Society  
[ESHS](#) – European Society for the History of Science  
[AHA](#) – American History Association  
[FHPP APS](#) - Forum on History and Philosophy of Physics of the American Physical Society  
[HAD AAS](#) - Historical Astronomy Division of the American Astronomical Society.  
[ACS HIST](#) – American Chemical Society Division of the History of Chemistry  
[GWMT](#) - Gesellschaft für Geschichte der Wissenschaften, der Medizin und der Technik  
[ISHEASTME](#) – International Society for the History of East Asian History of Science Technology and Medicine

[EASE](#) - East-Asian Association for Science Education  
[BSHS](#) – British Society for History of Science  
[EPSA](#) - European Philosophy of Science Association  
[AAHPSSS](#) - The Australasian Association for the History, Philosophy, and Social Studies of Science  
[HOPOS](#) – International Society for the History of Philosophy of Science  
[PSA](#)– Philosophy of Science Association  
[BAHPS](#) - Baltic Association for the History and Philosophy of Science  
[BSPS](#) – The British Society for the Philosophy of Science  
[SPSP](#)- The Society for Philosophy of Science in Practice  
[ISHPSB](#) - The International Society for the History, Philosophy, and Social Studies of Biology  
[PES](#)– The Philosophy of Education Society (USA)

The above list is updated and kept on the HPS&ST website at: [HERE](#)

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

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[Repeated endnotes from Opinion Page.]

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- <sup>i</sup> Hardman, Riordan & Hetherington, 2022; Hetherington, Hardman, Noakes & Wegerif, 2018; Hetherington & Wegerif, 2018; Milne & Scantlebury, 2019.
- <sup>ii</sup> See e.g. Gamble, Hanan & Nail, 2019.
- <sup>iii</sup> See e.g. Scantlebury, Danielsson, Hussénius, Gullberg & Andersson, 2019; Scantlebury & Milne, 2019.
- <sup>iv</sup> Hetherington et al. 2018, Hetherington & Wegerif, 2018, Scantlebury et al. 2019; Scantlebury & Milne, 2019.
- <sup>v</sup> Hardman et al. (2022), Hetherington et al. (2018), Hetherington and Wegerif (2018), Milne (2019), and Scantlebury et al. (2019)
- <sup>vi</sup> Hardman et al., 2022, Hetherington et al., 2018; Hetherington & Wegerif, 2018, Milne, 2019; Scantlebury et al. 2019; Scantlebury & Milne, 2019)
- <sup>vii</sup> Scantlebury et al., 2019; Scantlebury & Milne, 2019; Hardman et al., 2022; Hetherington et al. 2018; Hetherington & Wegerif, 2018)
- <sup>viii</sup> Scantlebury & Milne, 2019)
- <sup>ix</sup> See e.g. Faye & Jakslund, 2021; Hollin, Forsyth, Giraud & Potts, 2017; Jakslund, 2021.
- <sup>x</sup> See Jakslund 2021, and Faye & Jakslund, 2021 for a detailed analysis.
- <sup>xi</sup> For similar difficulties, see review by Pinch, 2011.
- <sup>xii</sup> Buekens & Boudry, 2015, Elster, 2012, Moberger, 2020, Sokal & Bricmont, 1998, Matthews 2015, pp.415-419.
- <sup>xiii</sup> Hardman et al. 2022; Hetherington et al. 2018; Hetherington & Wegerif, 2018.
- <sup>xiv</sup> See e.g. Faye & Jakslund, 2021; Jakslund, 2021.
- <sup>xv</sup> Hardman et al. 2022; Hetherington et al. 2018; Hetherington & Wegerif, 2018.
- <sup>xvi</sup> See e.g. Hollin et al. 2017; Jakslund, 2021; Schaffer & Barreto Lemos, 2021; Waldner 2017.
- <sup>xvii</sup> Buekens & Boudry, 2015; Elster, 2012; Moberger, 2020; Sokal & Bricmont, 1998.