

Stebbing and Eddington in the shadow of Bergson

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Stebbing and Eddington in the Shadow of Bergson

Abstract: In this paper, we argue that the French philosopher Henri Bergson was a hidden interlocutor in Susan Stebbing's critique of Arthur Eddington in her *Philosophy and the Physicists*. First, we outline Stebbing's critique of Eddington's philosophical-physical writings with a particular emphasis on her case against Eddington's account of the passage of time. Second, we provide evidence that Eddington's philosophy is, at its core, Bergsonian and make the case that Eddington was directly influenced by Bergson's philosophy of *la durée*. Third, we lay out Stebbing's critique of Bergsonism in her *Pragmatism and French Voluntarism* and identify important similarities with her critique of Eddington over twenty years later. In doing so, we show that it is Eddington's Bergsonism that she is attacking. Finally, we situate Stebbing's criticisms of both Eddington and Bergson within two wider conflicts that emerged in early twentieth century British philosophy: one between an objectively describable time of physics and subjective temporal experience, and the other between science and intuition.

Keywords: Stebbing, Eddington, Bergson, time, intuition

Introduction

In 1937, Susan Stebbing (1885-1943) published *Philosophy and the Physicists*, which included a critique of Arthur Eddington's (1882-1944) account of the passage of time. In this paper, we argue that there was a hidden interlocutor in Stebbing's critique who has, as yet, gone completely unacknowledged: the French thinker Henri Bergson (1859-1941). We argue that appreciating Bergson's underlying role in this critique sheds important light on Stebbing's motivations in writing *Philosophy and the Physicists* and, in particular, her response to

Eddington's claims about the passage of time. We also argue that Stebbing's critique of Eddington should be assessed against the backdrop of wider conflicts regarding the relationship between the time of physics and temporal experience, and that of science and intuition, in early twentieth century British philosophy.

Eddington's philosophy of time, widely read during and just after his lifetime (see for example Dingle 1954; Ritchie 1948) has received less attention in contemporary scholarship.¹ And while Susan Stebbing has received increased interest from historians of philosophy in recent years (see, e.g., Chapman 2013; Coliva 2021; Douglas and Nassim 2021; West 2022a; 2022b; Janssen-Lauret forthcoming) and is occasionally mentioned in critiques of Eddington (see for example Marquis 1976, 138), the attention has tended to focus on her later works, perpetuating the impression that Stebbing's earlier critique of what she calls "French voluntarism" is largely separable from or orthogonal to her later philosophical writings. We aim to correct this impression.

This paper proceeds as follows:

In the first section, we provide an overview of Stebbing's critique of Eddington in *Philosophy and the Physicists*. Eddington held highly idiosyncratic views regarding the way that the human mind accesses the nature of time and reality. He argued that via an awareness of the process of becoming—that is, of ourselves as persisting through time—the human mind gains a "private door" to the fundamental nature of reality. As we demonstrate below, this account was unacceptable to Stebbing as it smacked of pseudo-science, or rather, pseudo-philosophy.

¹ Notable exceptions include Merleau-Ponty's (1965) monograph, Prosser (2016, 36–38), a recent extremely thorough doctoral dissertation by Florian Laguens (2018), as well as a few peer-reviewed papers on his philosophy of science more generally (see Gherab-Martin 2013; Marquis 1976).

In the second section, we argue that the core of Eddington’s philosophy —and especially his philosophy of time— is, in fact, Bergsonian. This claim can be taken in two different senses: either as positing a direct and previously unacknowledged influence of Bergson on Eddington or as an observation of significant similarities between their philosophies of time. The first is a stronger claim, involving a connection of *causal influence* from Bergson to Eddington. The latter is a more moderate claim about a *conceptual* connection between Bergson and Eddington’s thought. The former implies the latter. While we will argue that the stronger claim is in fact well-supported, either will suffice for establishing that it is specifically Eddington’s Bergsonism that Stebbing is attacking in *Philosophy and the Physicists*. That is, even if Eddington’s views only *seem* Bergsonian, it is precisely the Bergsonian moments of his philosophy that Stebbing takes issue with.

In the final section, we appeal to Stebbing’s critique of Bergson’s “intuitional mysticism” (L. Susan Stebbing 1914, 163) in her MA thesis (published in 1914 as *Pragmatism and French Voluntarism*) to demonstrate that it is no coincidence that when she criticises Eddington in the *Philosophy and the Physicists*, she targets precisely those areas of his philosophy that are Bergsonian in nature. We believe this offers an important but generally underappreciated background to her motivations for criticising Eddington over twenty years later.

We conclude by situating Stebbing’s criticism within more general contours of early twentieth century discussions about time, temporal experience, science, and philosophy. Specifically, we position Stebbing’s critique at the intersection of two different schisms regarding the philosophy of time: the first between the time of physics and temporal experience, the second between science and intuition.

1. Stebbing's Critique of Eddington in *Philosophy and the Physicists*

In this section, we outline Stebbing's critique of Eddington in *Philosophy and the Physicists*. We first offer a broad outline of the two concerns Stebbing has with Eddington's popular scientific writing before focusing on her criticism of his claims about the passage of time. It will become clear (in section 3), that these concerns bear a striking (and, we think, telling) resemblance to the criticisms Stebbing had previously levelled against Bergsonism in *Pragmatism and French Voluntarism* over twenty years earlier.

1.1 Careless metaphors and poor inferences

Stebbing has two overarching concerns with Eddington's popular science writings.² Her first complaint concerns his use of metaphors in describing the findings of modern physics. Her view is that, as a widely-read popular scientist, Eddington plays a unique role in public discourse. This role brings with it considerable responsibility. As she puts it, "common readers ... are fitted neither to criticize physical theories nor to decide precisely what are their philosophical implications." (L. S. Stebbing 1937b, ix; see also 1937a, 72) Her point is that understanding the latest developments in physics (or any science) requires expertise. Expertise, in turn, can only be achieved by a considerable input of time and effort (education, training, etc.). Scientific expertise is thus beyond the remit of anyone but professional scientists. Without expertise, the common reader is barely equipped to understand the latest developments in physics, let alone critique them. Therefore, if a reader wishes to know what modern physics tells us about the world, they will have to rely on a *populariser* of science to 'translate' it for her. This is where writers like Eddington come in.

² Stebbing in fact levels these criticisms against both Eddington and James Jeans (1877-1946), another popular scientist. For a detailed overview of the aims of these criticisms, see West (2022a) and Stebbing (1937a).

Stebbing acknowledges that since a popular audience does not have the expertise required to understand modern physics in any depth, painting a metaphorical picture of what science tells us about reality is a useful tool at the popular scientist's disposal (L. S. Stebbing 1937b, 51). However, there are inevitable limits to the kind of knowledge that can be gained from metaphors, and problems arise when they go too far. This is all the more the case when readers are allowed (mistakenly) to form the impression that they have in fact understood *how things really are*. She claims that “*exact thought cannot be conveyed in inexact language; at best it can be but partially conveyed.*” (L. S. Stebbing 1937b, 7, emphasis original; see also 1937a, 72) This is something Eddington fails to appreciate — to the detriment of his writing.

There is a further, related concern at work here regarding Eddington's deployment of metaphorical language. Stebbing writes:

Eddington seldom aids the reader in co-operating in determining how inexactly the thought has been conveyed. He contents himself with remarking that he must not be taken always to mean just what he says. (L. S. Stebbing 1937b, 7)

Her point here is that Eddington *deliberately* talks loosely in order to bring his readers into the discussion in a way that does not immediately take that discussion beyond their comprehension, as would happen if he spoke in the language of physics. Again, that *seems* like a sensible method for communicating high-concept knowledge to an inexpert audience, but Stebbing's concern here is that Eddington is not *transparent* about when he is and is not using that method. She emphasizes the importance of declaring where and how analogies or metaphors break down — lest the readers forget that the language being employed is analogical or metaphorical. Eddington's careless (and, at times, deliberately obscure) use of metaphors, Stebbing argues, thus presents “a grave danger to clear thinking.” (L. S. Stebbing 1937b, 5)

Stebbing's second complaint concerns Eddington's habit of using the truths of physics to infer philosophical claims about the fundamental nature of reality. There are two worries motivating her criticism. First, she thinks that several of Eddington's inferences from physics to metaphysics are simply bad philosophy. His arguments are poorly supported and many of the inferences themselves require a leap of faith. This relates to the second part of Stebbing's criticism: she argues that while Eddington presents himself as an impartial or objective educator (which, given his privileged position in the public sphere, many readers are likely to perceive him to be), he has not, in fact, managed to rid himself of his own religious convictions. This is something Stebbing finds particularly troubling, particularly because, as she sees it, Eddington is at times guilty of manipulating his readers (rather than convincing them with a coherent argument) into taking up his own views.³ For instance, referring to Eddington and Jeans and their audience, "the common reader," she writes:

they seek to rouse his [i.e., the reader's] emotions, thereby inducing a frame of mind inimical to intellectual discernment. Popularizations of such a kind constitute a grave danger to clear thinking. (L. S. Stebbing 1937b, 5)

³ One might think that it is commonplace for authors of popular pieces to try and convince their readers by appealing to their emotions rather than convincing them through rational argument (thanks to the editor of this special edition for raising this point). That certainly seems common in journalistic writing, for instance (as Stebbing notes in the recently republished (S. Stebbing 2022)). Her point, however, is that a popular scientist like Eddington should *know* —and *do*— better. Eddington is not a journalist tasked with writing pieces aimed at increasing a newspaper's readership, he is (as noted above) a *scientist* with a particular responsibility to 'translate' the findings of modern science in a clear and honest way.

Stebbing's point is that writers like Eddington are liable to use their status as experts to promote their own agenda. Eddington, for instance, having explained to the reader that physics tells us the world is merely a set of symbols, then argues that it is not science but mysticism—and, in turn, religion—that can provide us with answers to questions like “what is real?”. He argues that, unlike the entities described by physics, it is possible to have “intimate knowledge” of God through mystical (i.e., not scientifically measurable), religious experiences (Eddington 1928, 322). For Stebbing, this goes beyond what Eddington's position as a *scientist*—and a populariser of science—entitles him to do.

Thus, Stebbing raises serious questions about Eddington's aims and method in writing science for a popular audience. But her concerns also extend to the quality of his philosophical reasoning itself and his tendency to move from developments in modern physics to what our metaphysical views ought to be. For instance, Eddington maintains that “[t]he idea of a universal Mind or Logos would be, I think, a fairly plausible inference from the present state of scientific enquiry” (Eddington 1928, 338) — thus making an inference about *metaphysics* based on developments in physics. But Stebbing points out that this claim is in tension with his view, stated elsewhere (for example Eddington 1928, 51), that physics is in fact incapable of helping us access this fundamental nature of reality.

1.2 The passage of time

A pertinent example of Stebbing's critique of Eddington's philosophical method comes in her response to his discussion of the passage of time. In *The Nature of the Physical World*, Eddington argues that there are two types of time, one of which is familiar to us through our personal experience of the world and another which is part of the world described by physics. Eddington describes the former as “the time familiar to our consciousness” (Eddington 1928, 37) and the latter as “physical time” (Eddington 1928, 36). These two kinds of time, Eddington

argues, are at odds with one another. Physical time provides a backdrop to the events and objects described by physics. Physical time also provides the framework by means of which we can organise events in sequential order and is, in that sense, comparable to space. In Eddington's words:

Our knowledge of space-relations is indirect, like nearly all our knowledge of the external world — a matter of inference and interpretation of the impressions which reach us through our sense organs. We have similar indirect knowledge of the time-relations existing between the events in the world outside us. (Eddington 1928, 51)

However, Eddington argues that our mere access to time-relations does not provide us with full knowledge of the fundamental nature of time (Eddington 1928, 51). This is where our knowledge of the time of consciousness comes in. The time of consciousness is a “knowledge of time not coming through external sense-organs, but taking a short cut into our consciousness.” (Eddington 1928, 51) Our knowledge of the time of consciousness takes the form of a “direct experience of the time-relations that we ourselves are traversing.” (Eddington 1928, 51) His point is that by reflecting on our own process of enduring through time —our own direct experience of time's passage— we can directly access, in a way that bypasses even our sense-perceptions of the external world, the very nature of reality itself. Despite his status as a physicist, Eddington's view is that there are limits to the kind of knowledge we can gain via scientific —that is, publicly observable and verifiable— means. By contrast, he argues, through the process of introspection, where we reflect on our own becoming, we can gain a direct insight into what reality really is.

Stebbing demurs. In her view, Eddington's attempts at explaining how, through an awareness of ourselves as becoming, we can find a “short cut” to the fundamental nature of

reality, is a damning example of *over-analysis*. Pushing back against Eddington's claim that outward experience does not provide us with access to the true nature of things, Stebbing argues that knowledge of time's order and direction is in fact part of the framework of everyday experience (see West 2022a, 137–44). For example, she points out that any scientist who takes measurements or performs experiments does so against the backdrop of their experience of — and, in turn, knowledge of— time's order. She writes:

The experimental physicist had to remember the order in which he took the readings of the thermometers: that is, he had to know which was the earlier, which the later, before he could have detected that entropy increases in an irreversible direction. (L. S. Stebbing 1937b, 195)

Her point is that the order of time is something that has got to be assumed before, in this case, scientific analysis can even get off the ground. In order to discover a physical law, like the second law of thermodynamics (which describes the increase in entropy) it has to be assumed that events are ordered from earlier to later. What's more, Stebbing maintains that awareness of time's order *just is* awareness of time itself. Again, using introspection or intuition to examine our subjective experience of time's *passage*, for Stebbing, constitutes *over-analysis*. Stebbing thus maintains that knowledge of time does not require anything like the introspective activity that Eddington prescribes. Rather, it is the kind of knowledge we acquire along with the rest of our knowledge of the external world, through ordinary everyday experience.

2. Bergson and Eddington

As Stebbing herself notes, “no philosopher springs from the void.” (L. Susan Stebbing 1914, 24) So where did Eddington get his views about time from?

2.1 *The case for a causal connection*

Jacques Merleau-Ponty has observed that there is something peculiar about, on the one hand, the characteristically “Bergsonian” vibe of Eddington’s philosophy, and, on the other hand, an almost complete lack of references to Bergson in Eddington’s writings. He says:

As regards contemporary philosophers outside the narrow circle of epistemology and English authors, Eddington seems to be unaware of them; neither Husserl and phenomenology nor Heidegger or Jaspers are ever cited, not even in passages where their names suggest themselves very strongly. ... Eddington does not seem to be aware that he takes up, with nearly identical terms, one of the central themes of [Bergson's] *Creative Evolution*.⁴ (Merleau-Ponty 1965, 17, our translation)

For Eddington,

the intuition of becoming and the scientific knowledge of evolution ... combine to give us the certainty of this dynamic quality of the real, which Physics expresses so imperfectly

⁴ “Quant aux philosophes contemporains extérieures au cercle étroit de l’épistémologie et celui des auteurs de langue anglais, Eddington paraît les ignorer; ni Husserl et la Phénoménologie, ni Heidegger ou Jaspers, ni Bergson ne sont jamais cités, pas même aux endroits où leurs noms s’imposent presque. ... Il ne paraît s’aviser qu’il retrouve avec des termes presque identiques, l’un des thèmes centraux de l’*Évolution créatrice*.;”

and so indirectly. It is impossible here ... to not think of Bergson, because this convergence between the intimate intuition of becoming and transformist science is that of [Bergson's] *Matter and Memory* and *Creative Evolution*.⁵ (Merleau-Ponty 1965, 65, our translation)

Nevertheless, Merleau-Ponty shies away from affirming a causal connection between Bergson and Eddington. A recent thesis on Eddington's philosophy is also hesitant about whether Bergson did or did not influence Eddington (Laguens 2018, 270–71).

Under close inspection, the possibility that Eddington was not aware of Bergson and his philosophy is extremely difficult to sustain. There are several reasons for this. First, there is the explicit reference to Bergson in the *Nature of the Physical World*, Eddington's Gifford Lectures from 1927 (Eddington 1928, 36–37; for a discussion, see Canales 2015, 176–78). Second, during the period when Eddington was writing his books on the nature of time, Bergson was an “international celebrity” (Vrahimis 2011, 125, 127) engaged in a heated discussion with Einstein, who, in turn, was a close friend of Eddington's (see Canales 2015, 172–73, 178–79). Third, both Eddington and Bergson attended the Congress of Philosophy at Oxford in 1920 ('Minutes of the Proceedings of the Congress of Philosophy at Oxford, September 24th-27th, 1920' 1919; Laguens 2018, 271). It is also likely that Eddington would have been aware of Bergsonism indirectly, through C. D. Broad, Wildon Carr, Hermann Weyl, Bertrand Russell, Oliver Lodge, Herbert Dingle, James Jeans, Samuel Alexander or Henri Poincaré, all of whom Eddington interacted with and all of whom engaged with Bergson's philosophy.

⁵ “L'intuition du devenir et la connaissance scientifique de l'évolution ... se conjugent pour nous donner la certitude de cette qualité dynamique du réel, que la Physique exprime si imparfaitement et si indirectement. Or, il est impossible ici ... de ne pas penser à Bergson car cette convergence entre l'intuition intime du devenir et la science transformiste est celle de *Matière et mémoire* et de *l'Évolution créatrice*.”

We believe that the philosophical similarities that we address below are sufficient to affirm a Bergsonian influence on Eddington. Yet, for our argument, it does not matter whether the connection between Eddington and Bergson is a causal influence or a mere accidental similarity. This is because we primarily argue that Stebbing's later critique of Eddington's thought was motivated by her recognizing Bergsonian features in it. Whether Stebbing's recognition of these features was because Bergson had a direct influence on Eddington or not, her observations concerning their similarity certainly were not misplaced.

2.2 Eddington's Bergsonism

There are two key areas of Eddington's philosophy that bear a striking resemblance to Bergsonism: his claim that the mind has immediate access to temporal becoming—a layer of reality not capturable by science—and the way he articulates the mind's access to such a reality. We address both in turn.

This first ostensibly Bergsonian area of Eddington's philosophy consists of his claim that the mind has a "private door" onto the reality of temporal becoming; a door which is otherwise closed to science. Just a few pages after mentioning Bergson in the *Nature of the Physical World*, Eddington claims that the dynamic character of reality is inaccessible to science, but might be reached through the type of experience we are aware of when introspecting our very own temporal experience:

Consciousness, looking out through a private door, can learn by direct insight an underlying character of the world which physical instruments do not betray. In any attempt to bridge the domains of experience belonging to the spiritual and physical sides of our nature, Time occupies the key position. ... The physicist ... naturally does not

look kindly on private doors, through which all kinds of superstitious fancy might enter unchecked. But is he ready to forgo that knowledge of the going on of time which has reached us through the door, and content himself with the time inferred from sense-impressions which is emaciated of all dynamic quality? (Eddington 1928, 91; for a discussion, see Price 2011, 300–302; Dingle 1954, 30–31; Gherab-Martin 2013, 511)⁶

A particular feature of this “dynamic quality” that our internal temporal experience discloses is the *direction* of time: what Eddington calls “time’s arrow” (Eddington 1928, 68). The characteristic objective relation from earlier to later, Eddington argues, cannot be found in physics, which can (and at the same time feels reluctant to) treat time as irreversible. The dynamical quality of the world, he writes,

is not to be found in the pointer readings, and our only insight into it is in the feeling of “becoming” in our consciousness. “Becoming” like “reasoning” is unknown to us only through its occurrence in our own minds; (Eddington 1928, 260; for a discussion, see Thomas 2020, 109; Williams 1951, 465)

The “arrow of time” is something that only temporal experience can demonstrate to us, and it is not revealed by physical instruments.

Crucially, Eddington also says that time is special in this regard. In addition to the distinction between the “metrical” and the “non-metrical” world, Eddington operates with the distinction between the “physical world” and the “familiar world” that we mentioned in

⁶ Eddington’s views on this are different from those he expressed earlier, for example, regarding relativity which he deems to be purely a physical theory, not having any direct metaphysical import for theories of space and time (see Eddington et al. 1920, 416).

section 1.2. The former is “the world that stands revealed by investigations ... according to the recognized methods of physical science.” (Eddington 1933, 31) The latter, by contrast, is characterised by many “illusions and subjective interpretations which [come] spontaneously into the mind as the result of habitually using our eyes and other sense-organs.” (Eddington 1933, 31) Eddington uses his famous example of the “two tables” to illustrate this.⁷ Pointing at a table in the room, he says that in fact there are two tables there. The first

is a commonplace object of that environment which I call the world. ... It has extension; it is comparatively permanent; it is coloured; above all it is substantial. ... It is a *thing*; not like space, which is a mere region; Table No. 2 is my scientific table. It is a more recent acquaintance and I do not feel so familiar with it. ... My scientific table is mostly emptiness. Sparsely scattered in that emptiness are numerous electric charges rushing about with great speed; but their combined bulk amounts to less than a billionth of the bulk of the table itself. ... There is nothing substantial about my second table. It is nearly all empty space — space pervaded ... by fields of force, but these are assigned to the category of “influences,” not of “things.” (Eddington 1928, ix)

In other words, there is the table of the familiar world (Table No. 1) and the table of the physical world (Table No. 2).

Eddington says that a lot of the information we receive about the physical world is tainted by the fact that it comes to us through the familiar world, “dressed up with conceptions such as colour, substance, spaciousness.” (Eddington 1933, 32) However, Eddington does not classify time in the same category as these:

⁷ For discussion, see Callender (2017, 24).

I am inclined to treat *time* as an exception — the one conceptual characteristic of the physical world with which we may have direct acquaintance. I do not know how direct is the contact of the mind with physical time when we experience in our consciousness the going on of time, but at least there is no evident intervention of a long chain of physical transmission. (Eddington 1933, 32)

Both the claim about the “private door” and the “arrow of time” mirror Bergson’s insistence that the true nature of time cannot be captured by science (especially physics and mathematics). For Bergson, time is primarily a metaphysical problem pertaining to consciousness and experience. This is something even his contemporaries observed. In 1929, Alexander Gunn, who wrote a book and several papers on Bergson, sums the point up as follows: “The Bergsonian treatment of time is a revolt against the introduction into philosophy of a mathematical and physical views of time.” (Gunn 1929, 187) Although this becomes central to Bergson’s treatment of relativity in *Duration and Simultaneity* from 1922 (Bergson 1965), the suspicion about science being able to capture the nature of time, which is inseparable from subjective temporal experience, is a common thread running through the entire Bergsonian corpus (see Bergson 1913, 107; 1988; Riggio 2016). The uni-directional “duration” (*la durée*), “remains outside the calculation and could only be perceived by a consciousness capable of living through the intervals ... instead of merely perceiving their extremities.” (Bergson 1913, 194)⁸

⁸ Curiously, the links between Eddington and Bergson move in both directions. Bergson references Eddington several times in *Duration and Simultaneity* from 1922 and draws a direct link between Minkowski-style representation of the cosmos as a space-time (becoming-less) block and the reversibility of time. For example: “In the block which is *ready-made*, and set free of the duration where it was *being made*, the result, once obtained and cut off, no longer bears the clear stamp of the work by which we obtained it. ... After the house has been built, our imagination can roam all over it and rebuild it just as easily by first setting the roof, and then hitching the stories to it, one at a time.” (Bergson 1965, 147) Bergson references both the 1920’s Cambridge University Press edition of Eddington’s *Time, Space, and Gravitation* (Bergson 2009, 166) and its French translation by Rosignol (Bergson 2009, 107).

What's more, Eddington is also in agreement with Bergson in affirming the existence of, and our access to, the "world behind the symbols." As we saw above, Eddington specifically distinguishes between the "metrical" and the "non-metrical" world. All that science has access to, he argues, are just combinations and recombinations of different values and measurements. The world-as-it-is is inaccessible to the scientific method. In *The Mathematical Theory of Relativity*, Eddington proposes that "A physical quantity is defined by the series of operations of which it is the result" (Eddington 1923, 3); and it is only these measurements that physics can ever produce since it is concerned with purely the metrical aspect of reality. Nevertheless, he affirms that non-metrical reality is equally existent, despite the "cleavage ... between the metrical and the non-metrical aspects of the world." (Eddington 1926, 200)

To a reader unfamiliar with Eddington, the type of dualism Eddington presents in the previous quote may sound deeply Kantian: Eddington seems to be positing a noumenal realm of "the world behind the symbols" which is accessible to science merely at a phenomenal level. And the idea that Eddington's views are a version of Kant's has indeed been proposed in the literature (see Dingle 1954, 39; Passmore 1994, 333).⁹ However, the textual evidence suggests Bergson was the real influence here. Unlike Kant, Eddington very clearly says that the world behind the symbols *is* accessible, as we have seen above in the case of the arrow of time — a feature of this world that science simply cannot observe. Science ends up running in a vicious circle by making measurements about reality dependent on one another, but, as Gherab-Martin observes, "Eddington maintained, ... that a conscious mind was capable of breaking out of the

⁹ It is worth noting that Dingle's 'Modern Aristotelianism' (Dingle 1937), where he discusses Eddington, is actually quoted by Stebbing in *Philosophy and the Physicists* (L. S. Stebbing 1937b, 207, footnote 1).

circle and assigning meanings.” (Gherab-Martin 2013, 503) Similarly, like Eddington, Bergson also says that the boundary between the world-in-itself and the world-for-us-(scientists) can be crossed. To give just one example, Bergson writes:

Duration, as duration, and motion, as motion, elude the grasp of mathematics: of time everything slips through its fingers but simultaneity, and of movement everything but mobility. This is what the Kantians and even their opponents do not seem to have perceived: in this so-called phenomenal world, which, we are told, is a world cut out for scientific knowledge, all the relations which cannot be translated into simultaneity, i.e., space, are scientifically unknowable. (Bergson 1913, 235)

And a little later adds:

Kant preferred to ... raise an impassable barrier between the world of phenomena, which he hands over root and branch to our understanding, and the world of things in themselves, which he forbids us to enter. But perhaps this distinction is too sharply drawn and perhaps the barrier is easier to cross than he supposed. (Bergson 1913, 235)

The inability of symbols to capture the reality of dynamical becoming is not just an accidental feature of Bergsonism but forms one of the central themes of Bergson’s treatment of duration in both *Time and Free Will* (see Bergson 1913, 179–80) and *An Introduction to Metaphysics*. In one of the central passages of the latter, Bergson gives the example of the way mechanics tries to capture the reality of movement:

Take, for example, the movement of an object in space. I perceive it differently according to the point of view from which I look at it, whether from that of mobility or immobility. I express it differently, furthermore, as I relate it to the system of axes or reference points, that is to say, according to the symbols by which I translate it. ... When I speak of an absolute movement, it means that I attribute to the mobile an inner being and, as it were, states of soul; it also means that I am in harmony with these states and enter into them by an effort of imagination. (Bergson 2007, 133; see also Riggio 2016, 219)

For Bergson, “absolute movement” is only accessible through intuition, through the way that the subject itself becomes part of the object it is observing, not through an external spatial construction as is the case with mechanics.

The second reason why Eddington’s philosophy bears more similarities to Bergson's than to Kant's is the way they both articulate the mechanics of the mind’s access to the scientifically inaccessible reality and how they think that reality can be communicated. For Bergson, the point of contact with dynamic temporal reality is through introspecting our internal experience of duration. This might at first glance appear radically different from Eddington, who posits the existence of hypothetical “entropy-clocks” in the brain:

Our consciousness somehow manages to keep in close touch with the material world, and we must suppose that its record of the flight of time is the reading of some kind of a clock in the material of the brain — possibly a clock which is a rather bad time-keeper. ... It seems to me, therefore, that consciousness with its insistence on time’s arrow and its rather erratic ideas of time-measurement may be guided by entropy-clocks in some

portion of the brain. Entropy-gradient is then the direct equivalent of the time of consciousness in both its aspects. Duration measured by physical clocks (time-like interval) is only remotely connected. (Eddington 1928, 100–101)

However, as Dingle summarises, Eddington’s entropy has a further, more nuanced metaphysical role:

Entropy, which is a physical quantity, measured in terms of “physical time” among other things had the characteristic of the “time of consciousness” that it always went in one direction. ... Entropy in some way partakes of both symbolical appearance and the real unknowable time. In physics pure and simple it is one of the ordinary quantities that represents “conditions of the world” of the same nature as heat and temperature. But it also belongs to the non-metrical concepts, such as beauty and melody, and so it acts as a sort of link between physics and aesthetics. (Dingle 1954, 30–31)

Eddington in the end opens up a realm inaccessible to science —eventually not just time but also the soul and other mystical notions find their way into it. This dynamic reality cannot be neatly captured by literal language, which explains why the *Nature of the Physical World* is full of various metaphors for describing time, “time’s arrow” being the most famous of them. In understanding dynamic reality, Eddington claims, we must rely on our own subjective experience and not on the scientific intellect. And we need to resort to metaphors in describing it.

As a matter of fact, Bergson’s reception in England at the beginning of the twentieth century was inseparable from a strongly polarising lens that saw his philosophy as irrational or at least “anti-intellectual” (see J. E. Russell 1912), and overly relying on metaphor for conveying its meaning. Bertrand Russell in particular dedicates a large chunk of his

‘Philosophy of Bergson’ (B. Russell 1912) to criticising the role that metaphors play in Bergson’s philosophical system. Whether or not ascribing anti-intellectualism to Bergson is fair,¹⁰ Bergson’s books certainly lend themselves to this interpretation. In particular, his *Introduction to Metaphysics* —published later as part of Bergson (2007) and widely quoted by British philosophers interacting with Bergson during this period— posits an inherent conflict between two ways of approaching reality: “analysis” (the domain of intellect, science, and literal language), which distorts the nature of time and can only ever be relative, and “intuition,” which is absolute and reveals the true nature of dynamical reality. It is private. But metaphorical language can point us towards it and we can place ourselves “directly, by an effort of intuition, in the concrete flowing of duration.” (Bergson 2007, 157)

Why did Eddington not refer to Bergson more? Our speculation is that by the time Eddington began to deal with the philosophical implications of what physics has to say about time, Bergson had already fallen out of favour in British philosophy. Eddington gave the Gifford lectures at Edinburgh between 1926 and 1927, by which time Bergson had already published his *Duration and Simultaneity* and had the infamous 1922 exchange with Einstein. Bergson began to look suspicious. And it is likely that Eddington, inferring philosophical conclusions based on premises of physics, might not have wanted to associate himself with Bergson whose views, particularly about time, were already regarded with scepticism. This would also explain why the one passage where Bergson *is* mentioned in the *Nature of the Physical World* presents such an ambiguous judgement of him by Eddington —even when the rest of the chapter argues for a deeply Bergsonian point.

Given the above evidence, we think the contention that there is a causal connection between Bergson and Eddington’s philosophy is well-supported. If this is true, then it is not

¹⁰ Husson (1947), for example, forcefully argued that it was not.

surprising that Stebbing directed her critique at Eddington's philosophy as she had earlier criticised Bergson. We turn to this critique in the next section.

3. Stebbing's Critique of Bergson in *Pragmatism and French Voluntarism*

In this section, we show that there are striking similarities between Stebbing's criticism of Eddington, his account of the passage of time in *Philosophy and the Physicists*, and her much earlier criticism of Bergsonian "intuitionism" in *Pragmatism and French Voluntarism* (1914).¹¹ Alongside the case we made for Bergson's influence on Eddington in the previous section, we argue that this provides evidence that Stebbing is critiquing what she perceives to be Eddington's Bergsonism.

While recent years have seen a considerable uptick of work on Stebbing's philosophy, there is still very little scholarship on *Pragmatism and French Voluntarism*, her first published work.¹² In terms of the development of Stebbing's thought, *Pragmatism and French Voluntarism* is a particularly interesting text. Above all, it is notable that a figure like Stebbing—co-founder of the journal *Analysis* and typically construed as a clear-cut example of an early analytic philosopher (Beaney 2017, 76–91; Beaney and Chapman 2021)—began her philosophical career by producing a careful history of French philosophy from the eighteenth-century up to Bergson and his contemporaries.¹³ Part of our aim in this paper is to show that this is not just a brief excursion into continental thought, but that Stebbing's engagement with Bergson, in particular, would later influence her response to Eddington's philosophical-physical writings.

¹¹ For reviews by Stebbing's contemporaries, see Sait (1916); Thorne (1915).

¹² Vrahimis (2022, chapter 7) and Chapman (2013, 23–32) are exceptions.

¹³ As the title suggests, the text is concerned with *two* schools of thought: "pragmatism" and "French voluntarism." Stebbing's aim is to show that the two approaches to knowledge identifiable within these schools are incompatible and that an "intellectualist" approach to knowledge is preferable to both. We leave aside Stebbing's discussion of pragmatism here.

Stebbing makes it clear in the preface to this work that her aim is to offer a charitable critique of Bergson's philosophy, one that does not fall into the trend of several other "indiscriminating" and "unjustifiable" criticisms (L. Susan Stebbing 1914, v). Stebbing notes that it seems to be in vogue (at the time of writing), amongst Anglophone philosophers, to be overly critical of Bergson's philosophy. But Stebbing wants her criticisms to be fair:

In the present state of public opinion ... I venture to offer this essay which, although written from the "intellectualistic" standpoint diametrically opposed to M. Bergson's, is nevertheless not blind to the interest and importance of his work. (L. Susan Stebbing 1914, v)¹⁴

In a chapter on French voluntarism and its history, Stebbing provides a careful exposition of Bergson's views on knowledge and reality, including a discussion of various developments of those views—such as the role of evolution in our understanding of reality—between his earlier *An Introduction to Metaphysics* and his later *Creative Evolution* (L. Susan Stebbing 1914, 41). This indicates that she was familiar with a range of his works.

Stebbing characterises Bergsonian "intuitionism" as "a tendency to disparage the intellect as the faculty of conceptual knowledge and to turn to some higher form of 'perception' as giving direct contact with reality." (L. Susan Stebbing 1914, 4) She also claims that,

¹⁴ A letter that Stebbing wrote to Bergson on 8th July 1914 further evidences her fondness for his work – even if she ultimately disagreed with it. In the letter, attached to a copy of *Pragmatism and French Voluntarism* that she posted to Bergson, she writes: "It would give me great pleasure if you would do me the honour to accept a copy of my little book on 'Pragmatism and French Voluntarism'... It is impossible for me to say how much I have enjoyed my reading of French Philosophy." (L. S. Stebbing 1914) As Siobhan Chapman (2013, 6) notes, very few of Stebbing's correspondences survive today, so this early letter to Bergson is a rare insight into her early enthusiasm for French philosophy.

according to the Bergsonian intuitionist, only the “fundamental self ... pierces reality” and that “Bergson looks downward to penetrate the reality that flows beneath the activities of daily life.” (L. Susan Stebbing 1914, 9–10) In Stebbing’s reading, then, “intuitionism” involves a commitment to the idea that fundamental reality is something that can only be accessed by a kind of inward or “downwards” interior “perception” (or introspection) into one’s self. We saw previously (in section 1.2) that Stebbing takes issue with the idea that everyday experience is *not* the experience of reality in and of itself. In her critique of Eddington, Stebbing argued that when an “experimenter” takes a metre reading, they are doing so with an awareness of time’s order (L. S. Stebbing 1937b, 195). And, what’s more, her view is that awareness of time’s order *just is* awareness of time itself. She rejects Eddington’s claim that everyday experiences only provide us with indirect knowledge of time via “metre readings” and instead argues that having an everyday awareness of time as part of the backdrop to events just is part of what it means to have a perceptual experience (see West 2022a, 137–44). Similarly, she takes issue with the Bergsonian view that “penetrating reality” requires going beyond or beneath “the activities of daily life.” (L. Susan Stebbing 1914, 9–10)

There are two components of Stebbing’s critique of Bergsonism that map neatly onto the criticisms of the two Bergsonian tendencies of Eddington’s thought discussed in Section 2.2. We think this is convincing evidence that Stebbing’s critique specifically attacks Eddington’s Bergsonism. The first part of Stebbing’s critique concerns the intuitive method of knowledge-acquisition and its failure to provide publicly verifiable knowledge claims.¹⁵ The

¹⁵ Stebbing levels a similar criticism at Whitehead’s “process philosophy” in papers on his account of perception and in reviews of his various texts (see L. S. Stebbing 1924; 1926; L. Susan Stebbing 1926; 1927; 1930; S. 1928). Like her critique of Bergsonism, these critiques can be seen as part of Stebbing’s endorsement of the “intellectual” or “analytic” approach to knowledge, which places considerable emphasis on knowledge that is publicly communicable and verifiable. Bergson’s explicit influence on Whitehead has been widely acknowledged (see Lowe 1949; Quinton 2011). It is therefore

second concerns Bergson's approach to communicating the findings of intuitive knowledge which, she argues, is overly and inexpugnably reliant on metaphors.

As regards the first of these objections, responding directly to Bergson's talk of duration, Stebbing explains that it "is not what we ordinarily mean by time, nor is it what we ordinarily mean by duration." (L. Susan Stebbing 1914, 38) Rather:

M. Bergson makes Duration the stuff, or substance, of Reality itself, and Truth he regards as but another name for Reality. In order then, to know truth the knower must be one with it, inserted within the reality that is to be known. Hence is necessitated the plunge into the "stream of time" or "flux", that constitutes the Bergsonian regression. (L. Susan Stebbing 1914, 158)

Stebbing's point here is that on the Bergsonian account of knowledge, the only way to truly know reality is to be part of it. This is because reality is reducible to duration, and duration is something we can know only via an immediate awareness of *ourselves* as enduring. Knowledge attained in this manner—that is, knowledge gained by *being* that which is known—is intuitive. It is not the kind of knowledge that could be attained "intellectually," logically, or scientifically, in what Stebbing calls a "material" —that is, publicly observable and verifiable— way (L. Susan Stebbing 1914, 142).

The problem here, from Stebbing's point of view, is that "[t]he object of philosophy is the attainment *and communication* of knowledge of Reality." (L. Susan Stebbing 1914, 148, our emphasis) We pursue philosophy, she thinks, to attain knowledge *and share it with others*. But "intuitive" knowledge, she maintains, is not suitable for achieving this end and it brings

not surprising that he ends up, just like Bergson himself and (as we have argued) the implicitly Bergsonian Eddington, a target of Stebbing's critique.

with it a worry of “individualism” (L. Susan Stebbing 1914, 147). What troubles her about Bergson’s approach to knowledge of reality is that when “we have dived down into the living duration that is the object of Bergsonian intuition, we cannot state the result of that experience.” (L. Susan Stebbing 1914, 149) Even if we could attain knowledge of reality via Bergson’s intuitive method, we could never share that knowledge, or test and compare it alongside other people’s own intuitive insights.¹⁶ It is intrinsically private —and therefore inevitably *not* intersubjective— knowledge. Thus, drawing on the implicit premise that if knowledge is intrinsically private then scepticism follows and the explicit premise that intuitive knowledge cannot be communicated, Stebbing argues that “[t]he conclusion is forced upon us that the result of the Bergsonian Intuitionism is scepticism.” (L. Susan Stebbing 1914, 151)¹⁷

The second part of Stebbing’s critique of Bergsonism concerns, again, the use of metaphors. This worry is related to her concern about the intrinsically private nature of intuitive

¹⁶ Bergson explicitly denies this criticism in several places, though not in any that Stebbing would likely have been aware of. For example, in his lectures at the Collège de France from 1901-1902 – which have been reconstructed from notes and published only in the past few years – he says: “We cannot go, Gentlemen, too far in this direction, it would be very dangerous to go too far. If purely logical thought is to be transcended to attain this absolute reality, it is clear that we cannot transcend it in an arbitrary manner, that we must always keep a certain point of contact with conceptual thought. This work of the spirit which transcends logic cannot be illogical, and must always reduce the greatest part of ourselves in logical terms in a way that there is always in this effort something clearly expressible and communicable.” (“Il ne faudrait pas aller, Messieurs, trop loin dans cette voie, il serait très dangereux d’aller trop loin. Si ... la pensée purement logique, doit être transcendée pour atteindre cette réalité absolue, il est clair que ce n’est pas d’une manière arbitraire que nous devons la transcender, que nous devons garder toujours un certain point de contact avec cette pensée conceptuelle Ce travail de l’esprit qui transcende la logique, ne doit pas être illogique, et doit pouvoir toujours réduire la plus grande partie de nous mêmes en termes logiques; de telle sorte qu’il y a toujours dans ce travail quelque chose de clairement exprimable et communicable.”) (Bergson 2019, 81–82, our translation)

¹⁷ Scepticism here seems to mean something like a state wherein one person’s knowledge claims cannot be compared with —and, in turn, supported or undermined by (L. Susan Stebbing 1914, 146)— another’s, rather than a Pyrrhonian scepticism where we cannot be said to know anything at all.

knowledge. Since, on the Bergsonian picture of things, our access to reality is private and introspective, the *findings* of intuitive knowledge can only be communicated with the help of metaphors. By Bergson's own lights, our immediate access to *la durée* goes beyond the realm of symbols since symbols belong to the realm of indirect knowledge. This means that one's intuitive knowledge of *la durée* —that is, the immediate experience one has of oneself as enduring through time and being subject to time's passage— cannot be articulated, at least not in a manner that is able to adequately capture the reality of that experience. For as soon as one attempts to articulate such an experience, one is back in the realm of symbols; and so the reality of the experience becomes mediated. Thus, Stebbing writes:

it is not by chance that M. Bergson expresses himself by metaphor piled upon metaphor. He is forced by the necessity of his method to suggest by metaphor what escapes the limits of clear thought. (L. Susan Stebbing 1914, 146)

In fact, Stebbing claims, Bergson's method is so reliant on metaphorical language that he is, as she puts it, "as much an artist as a metaphysician." (L. Susan Stebbing 1914, 24)

It is worth noting that there is a difference between the use of metaphors in Bergson's writing and the use of metaphors in Eddington's work, even if it does not undermine our contention that Stebbing's criticisms of both are related. As Stebbing notes, the findings of knowledge via Bergsonian intuition *can only be expressed* via metaphor because of the intrinsically private nature of the intuitive method. The same does not seem to be true of the subject matters of Eddington's metaphorical language. The kinds of metaphors that Stebbing takes issue with in Eddington's work are used to describe the physical realm — specifically, what is going on at the level of the micro-physical structure of reality. For instance, Eddington explains that when I step into a room with a wooden floor I am "really" (i.e.,

according to physics) stepping onto “a plank travelling at twenty miles a second around the sun ... it is like stepping on a swarm of flies.” (Eddington 1928, 342) It does not seem to be the case that such claims must *necessarily* be expressed metaphorically or that such knowledge is required via a private or subjective method — as is the case with Bergsonian knowledge of *la durée*. Nonetheless, Stebbing’s concern in both cases is that use of metaphors —without the support of *non-metaphorical* (i.e., “exact” (L. S. Stebbing 1937b, 7)) language— constitutes a barrier to clear thinking. The “knowledge” one can attain via a metaphor, she argues, can only go so far.

In section two, we identified two key areas where Eddington’s philosophy bears a striking resemblance to Bergsonism. First, in the idea that reality can only be accessed intuitively — by turning inwards and making ourselves aware of ourselves as enduring through time. Second, in the manner that knowledge of reality attained in this way is articulated, in particular, by means of metaphors. By now, it should be clear that these are the same concerns that Stebbing raises about “Bergsonian intuitionism” in *Pragmatism and French Voluntarism* (L. Susan Stebbing 1914, 151). Stebbing argues that the Bergsonian method of turning inwards cannot produce verifiable or communicable knowledge and that reliance on metaphors to articulate such knowledge constitutes a barrier to clear thinking. The evidence, we think, suggests that this is no coincidence. Stebbing’s concerns with Bergsonian intuitionism did not dissipate after *Pragmatism and French Voluntarism* was published in 1914. As we have shown, they arose once again, over twenty years later, in her response to Eddington in *Philosophy and the Physicists*.

Conclusion

Putting all of this together, it seems not only that Bergson was a hidden feature in Eddington's philosophy but that it was precisely his Bergsonism that Stebbing criticises when writing about time: explicitly in *Pragmatism and French Voluntarism* and later implicitly in *Philosophy and the Physicists*. Stebbing's engagement with and response to Bergsonism is thus not restricted to her first work but also underlies her reception of Eddington's philosophy over twenty years later. We would like to conclude this paper by briefly mentioning the wider contours in which Stebbing's critique is situated.

An emerging theme in discussions about the nature of time in early twentieth century British metaphysics was a growing split between views based primarily on physics and those based primarily on philosophy. A particularly poignant illustration of this is the "Time, Space, and Material" symposium that took place in 1919 with contributions from A. N. Whitehead, Oliver Lodge, J. W. Nicholson, Henry Head, Karin Costelloe-Stephen and Wildon Carr (Stephen et al. 1919). While this symposium was supposed to bring together philosophers and physicists to answer questions about the nature of time, when reading the proceedings of the symposium, one immediately gets the sense that most of the attendees ended up talking past each other, with very few points of overlap.

There is, however, another split that we think is more suitable for assessing early twentieth century discussions about time: this split is intra-philosophical and concerns questions about the extent to which a philosopher should or should not rely on temporal experience and the role of the mind in discussing time. Looking at the same landscape from this second viewpoint reveals two primary approaches. The first approach emphasized temporal experience and intuition and saw the type of description of time in physics as either derivative, insufficient, or even misleading. This was exemplified by Bergson and Eddington, but there were others (including Karin Costelloe-Stephen, Hilda Oakeley, and May Sinclair) who thought the same, united by an affinity for

Bergson's philosophy (for discussion, see Moravec forthcoming). This approach eventually became associated—at least in the eyes of many analytic philosophers—with religion, mysticism, and charlatanism (see Canales 2015, 30).¹⁸ Indeed, Stebbing herself suggested that the Bergsonian method of accessing *la durée* “is essentially akin to religious intuition.” (L. Susan Stebbing 1914, 149) The second approach, by contrast, attempted to provide a rudimentary conceptual analysis of time. This was the approach adopted by those who saw themselves as working within the analytic tradition, like Stebbing and Russell. This approach goes in the opposite direction and was intended to push against an excessive emphasis on the idea that temporal experience—at least insofar as it was understood in the sense of *becoming*—reveals something fundamental about the nature of reality (B. Russell 1959, 21–22).

When it comes to Bergson's position with regards to these splits, the Bergson-Einstein controversy (see Canales 2015; Lévy-Leblond 2007; Riggio 2016) has tended to overshadow lesser-known figures. For instance, Eddington's role in these schisms is more complicated than has generally been thought. On the one hand, he is a physicist. But he is also a philosopher interested in mysticism and religion. Whyte (1928) has argued that the primary schism lies between Einstein and Eddington on the one hand and Bergson and Whitehead on the other, emphasising the division between philosophy and physics. But then, just over 20 years later and contrary to Whyte, D. C. Williams' seminal paper “Myth of Passage” classifies both Bergson and Eddington in the same way: as the “time snobs” who put excessive emphasis

¹⁸ For example, J. W. Dunne's *Experiment with Time* which was published in numerous editions between 1919 and 1950 and argues, among other things, for our cognitive access to the future through future-telling dreams and the existence of telepathy (Dunne 1929, 207–8) quotes parts of Eddington's (Dunne 1929, 109, 127, 193–96) and Bergson's (Dunne 1929, 49, 56, 119–21) philosophies. Eddington himself wrote an approving letter to Dunne about his theory of *serialism* that was published in the preface to the 1929 edition.

on temporal experience (see Williams 1951, 461). A close analysis of Eddington’s writings, however, suggests that this kind of approach hides important nuances in his and others’ work.

Stebbing’s role in this growing division has only just begun to be appreciated (see West 2022a), but it offers a more nuanced approach: on the one hand emphasising the central role of *both* philosophy and physics in answering questions about time and temporality but at the same time of cautioning against illegitimate philosophical moves in appealing to it. As we have seen, this is not coincidental. Stebbing wanted to provide a charitable and fair critique of Bergson that did not fall into “anti-intuitionist, pro-intellectualist” tropes that were already emerging at the time of writing. Her critique of Bergsonism in *Pragmatism and French Voluntarism* is thus less acerbic than other more well-known critiques of Bergson’s purported “irrationalism” (see for example Elliot 1912) or anti-intellectualism (for a recent discussion, see Dougherty 2021). It also adds further evidence to the recently defended claim that Bergson’s influence in early 20th-century British philosophy goes way beyond his rejection by Russell in 1913 (see Moravec forthcoming).

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References

- Beany, Michael. 2017. *Analytic Philosophy: A Very Short Introduction*. Oxford: Oxford University Press.
- Beany, Michael, and Siobhan Chapman. 2021. ‘Susan Stebbing’. In *Stanford Encyclopedia of Philosophy*, edited by Edward N. Zalta.
<https://plato.stanford.edu/archives/sum2021/entries/stebbing/>.
- Bergson, Henri. 1913. *Time and Free Will. An Essay on the Immediate Data of*

- Consciousness*. Translated by F. L. Pogson. London: George Allen & Co.
- . 1965. *Duration and Simultaneity. With Reference to Einstein's Theory. With an Introduction by Herbert Dingle*. Translated by Leon Jacobson. Indianapolis, New York, and Kansas City: Bobbs-Merrill.
- . 1988. *Matter and Memory*. Translated by W. Scott Palmer and N. M Paul. New York: Zone Books.
- . 2007. *The Creative Mind*. Translated by Mabelle L. Andison. New York: Dover Publications.
- . 2009. *Durée et Simultanéité. À Propos de La Théorie d'Einstein*. Edited by Élie During. Paris: Presses Universitaires de France.
- . 2019. *L'idée de temps. Cours au Collège de France 1901-1902*. Edited by Gabriel Meyer-Bisch. Paris: Presses Universitaires de France.
- Callender, Craig. 2017. *What Makes Time Special?* Oxford: Oxford University Press.
<https://doi.org/10.1093/oso/9780198797302.001.0001>.
- Canales, Jimena. 2015. *The Physicist and the Philosopher. Einstein, Bergson, and the Debate That Changed Our Understanding of Time*. Princeton: Princeton University Press.
- Chapman, Siobhan. 2013. *Susan Stebbing and the Language of Common Sense*. London: Palgrave Macmillan. <https://doi.org/10.1057/9781137313102>.
- Coliva, Annalisa. 2021. 'Stebbing, Moore (and Wittgenstein) on Common Sense and Metaphysical Analysis'. *British Journal for the History of Philosophy* 29 (5): 914–34.
<https://doi.org/10.1080/09608788.2021.1936447>.
- Dingle, Herbert. 1937. 'Modern Aristotelianism'. *Nature* 139 (3523): 784–86.
<https://doi.org/10.1038/139784a0>.
- . 1954. *The Sources of Eddington's Philosophy*. Cambridge: Cambridge University Press.
- Dougherty, Matt. 2021. 'Anti-Intellectualism'. In *The Bergsonian Mind*, edited by Mark Sinclair and Yaron Wolf. Abingdon and New York: Routledge.
- Douglas, Alexander X., and Jonathan Nassim. 2021. 'Susan Stebbing's Logical Interventionism'. *History and Philosophy of Logic* 42 (2): 101–17.
<https://doi.org/10.1080/01445340.2021.1883381>.
- Dunne, J. W. 1929. *An Experiment With Time*. Second edition. London: A & C Black.
- Eddington, A. S. 1923. *The Mathematical Theory of Relativity*. Cambridge: Cambridge University Press.
- . 1926. 'The Domain of Physical Science'. In *Science, Religion, and Reality*, edited by Joseph Needham. London: Sheldon Press.
- . 1928. *The Nature of The Physical World*. Cambridge: Cambridge University Press.
- . 1933. 'Physics and Philosophy'. *Philosophy* 8 (29): 30–34.
- Eddington, A. S., W. D. Ross, C. D. Broad, and F. A. Lindemann. 1920. 'The Philosophical Aspect of the Theory of Relativity: A Symposium'. *Mind* 29 (116): 415–45.
- Elliot, Hugh S. R. 1912. *Modern Science and the Illusions of Professor Bergson*. London: Longmans, Green.
- Gherab-Martin, Karim J. 2013. 'From Structuralism to Neutral Monism in Arthur S. Eddington's Philosophy of Physics'. *Studies in History and Philosophy of Science Part B: Studies in History and Philosophy of Modern Physics* 44 (4): 500–512.
<https://doi.org/10.1016/j.shpsb.2013.09.006>.
- Gunn, J. Alexander. 1929. 'The Problem of Time'. *Philosophy* 4 (14): 180–91.
<https://doi.org/10.1017/S0031819100031430>.
- Husson, M. Léon. 1947. *L'intellectualisme de Bergson : genèse et développement de la notion bergsonienne d'intuition*. Paris: Presses Universitaires de France.
- Janssen-Lauret, Frederique. forthcoming. 'Susan Stebbing's Metaphysics and the Status of Common Sense Truths'. In *Women in the History of Analytic Philosophy*, edited by Jeanne Peijnenburg and Sander Verhaegh. Springer.

- Laguens, Florian. 2018. 'Eddington philosophe. La nature et la portée de la science physique d'après Arthur S. Eddington'. Doctoral dissertation, Paris: Université Paris I Panthéon-Sorbonne.
- Lévy-Leblond, Jean-Marc. 2007. 'Le Boulet d'Einstein et les boulettes de Bergson'. In *Annales bergsoniennes*, edited by Frédéric Worms, 3:237–58. Paris: Presses Universitaires de France.
- Lowe, Victor. 1949. 'The Influence of Bergson, James and Alexander on Whitehead'. *Journal of the History of Ideas* 10 (2): 267. <https://doi.org/10.2307/2707418>.
- Marquis, Donald B. 1976. 'In Defense of Sir Arthur Eddington'. *The Southwestern Journal of Philosophy* 7 (1): 137–43.
- Merleau-Ponty, Jacques. 1965. *Philosophie et Théorie Physique Chez Eddington*. Paris: Presses Universitaires de France.
- 'Minutes of the Proceedings of the Congress of Philosophy at Oxford, September 24th-27th, 1920'. 1919. *Proceedings of the Aristotelian Society* 20: 304–6. <https://doi.org/10.1093/aristotelian/20.1.304>.
- Moravec, Matyáš. forthcoming. 'Taking Time Seriously: The Bergsonism of Karin Costelloe-Stephen, Hilda Oakeley, and May Sinclair'. *British Journal for the History of Philosophy*. <https://doi.org/10.1080/09608788.2022.2030670>.
- Passmore, John. 1994. *A Hundred Years of Philosophy*. Harmondsworth: Penguin.
- Price, Huw. 2011. 'The Flow of Time'. In *The Oxford Handbook of Philosophy of Time*, edited by Craig Callender, 276–310. Oxford: Oxford University Press.
- Prosser, Simon. 2016. *Experiencing Time*. Oxford: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780198748946.001.0001>.
- Quinton, Anthony. 2011. 'Bergson and Whitehead'. In *Of Men and Manners. Essays Historical and Philosophical*, edited by Anthony Quinton and Anthony Kenny. Oxford: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199694556.001.0001>.
- Riggio, Adam. 2016. 'Lessons for the Relationship of Philosophy and Science From the Legacy of Henri Bergson'. *Social Epistemology* 30 (2): 213–26. <https://doi.org/10.1080/02691728.2014.971916>.
- Ritchie, A. D. 1948. *Reflections on the Philosophy of Sir Arthur Eddington. With an Introduction by C. E. Raven*. Cambridge: Cambridge University Press.
- Russell, Bertrand. 1912. 'The Philosophy of Bergson'. *The Monist* 22 (3): 321–47. <https://doi.org/10.5840/monist191222324>.
- . 1959. *Mysticism and Logic and Other Essays*. George Allen & Unwin: London.
- Russell, John E. 1912. 'Bergson's Anti-Intellectualism'. *The Journal of Philosophy, Psychology and Scientific Methods* 9 (5): 129–31. <https://doi.org/10.2307/2013424>
- S., L. S. 1928. 'Review of Symbolism: Its Meaning and Effect. By A. N. Whitehead'. *Mind* 37 (147): 371–72. <https://doi.org/10.1093/mind/XXXVII.147.371>.
- Sait, Una Bernard. 1916. 'Review of Pragmatism and French Voluntarism. With Especial Reference to the Notion of Truth in the Development of French Philosophy from Maine de Biran to Professor Bergson.' *The Journal of Philosophy, Psychology and Scientific Methods* 13 (8): 219. <https://doi.org/10.2307/2012921>.
- Stebbing, L. S. 1914. 'Letter to Henri Bergson', 8 July 1914. Bibliothèque littéraire Jacques Doucet, Paris. Fonds Henri Bergson.
- . 1924. 'Mind and Nature in Prof. Whitehead's Philosophy'. *Mind* 33 (131): 289–303. <https://doi.org/10.1093/mind/XXXIII.131.289>.
- . 1926. 'Professor Whitehead's "Perceptual Object"'. *Journal of Philosophy* 23 (8): 197–213.
- . 1937a. 'Nebulous Philosophy - Jeans and Eddington'. *The American Scholar* 6 (1): 71–84.
- . 1937b. *Philosophy and the Physicists*. London: Penguin.

- Stebbing, L. Susan. 1914. *Pragmatism and French Voluntarism*. Girton College Studies. Cambridge: Cambridge University Press.
- . 1926. ‘Review of Science and the Modern World. By Alfred North Whitehead’. *Philosophy* 1 (3): 380–85. <https://doi.org/10.1017/S0031819100023585>.
- . 1927. ‘Review of Religion in the Making. By A. N. Whitehead’. *Philosophy* 2 (6): 234–39. <https://doi.org/10.1017/S0031819100015278>.
- . 1930. ‘Review of Process and Reality: An Essay in Cosmology. By A. N. Whitehead’. *Mind* 39 (156): 466–75. <https://doi.org/10.1093/mind/XXXIX.156.466>.
- Stebbing, Susan. 2022. *Thinking to Some Purpose*. Routledge.
- Stephen, Karin, Alfred North Whitehead, Oliver Lodge, J. W. Nicholson, Henry Head, and H. Wildon Carr. 1919. ‘Symposium: Time, Space, and Material: Are They, and If so in What Sense, the Ultimate Data of Science?’ *Proceedings of The Aristotelian Society* 2: 44–108.
- Thomas, Emily. 2020. ‘Time and Subtle Pictures in the History of Philosophy’. *Proceedings of the Aristotelian Society* 120 (2): 97–121. <https://doi.org/10.1093/arisoc/aoaa007>.
- Thorne, Alma Rosa. 1915. ‘Review of Pragmatism and French Voluntarism’. *The Philosophical Review* 24 (2): 220. <https://doi.org/10.2307/2178241>.
- Vrahimis, Andreas. 2011. ‘Russell’s Critique of Bergson and the Divide Between “Analytic” and “Continental” Philosophy’. *Balkan Journal of Philosophy* 3 (1): 123. <https://doi.org/10.5840/bjp20113123>.
- . 2022. *Bergsonism and the History of Analytic Philosophy*. Cham: Palgrave Macmillan. <https://doi.org/10.1007/978-3-030-80755-9>
- West, Peter. 2022a. ‘The Philosopher versus the Physicist: Susan Stebbing on Eddington and the Passage of Time’. *British Journal for the History of Philosophy* 30 (1): 130–51. <https://doi.org/10.1080/09608788.2021.1985962>.
- . 2022b. ‘L. Susan Stebbing Philosophy and the Physicists (1937): A Re- Appraisal’. *British Journal for the History of Philosophy* 30 (5), 859–873. <https://doi.org/10.1080/09608788.2022.2025761>.
- Whyte, L. L. 1928. *Archimedes. Or The Future of Physics*. London: Kegan Paul.
- Williams, Donald C. 1951. ‘The Myth of Passage’. *The Journal of Philosophy* 48 (15): 457–72. <https://doi.org/10.2307/2021694>.