In Defense of Causal Presentism

Abstract

In this paper, I defend causal presentism in the historiography of science. In causal presentism, historiography of science studies events, processes and practices that were causally relevant to the development of present science. I argue that causal presentism has three main virtues: First, causal presentism avoids the conceptual problems the historiography of science has recognized in its core. Secondly, causal presentism provides a clear account of what counts as *historical explanatory understanding* about science. Thirdly, causal presentism enables novel ways to address several conceptual and methodological problems in the historiography of science. The conclusion is that causal presentism is distinctively strong position with respect to the historiography of science.

Keywords: Presentism; contingency, history of science; history of knowledge; historical explanation

1. Introduction

Present-centered historiography of science[1] (i.e. *presentism*) is in a two-fold predicament. On the one hand, rejection of presentism is a built-in feature of the historiography of science that is based on well-known considerations. Historiography of science is, as Daston poetically put it, a discipline that "which frowns upon pressing science past into the service of science present" (2017, 133). On the other hand, many scholars have pointed out that (i) presentism in some form or another is unavoidable, and (ii) there are different forms of presentism that have different implications for historiographical practices and results (Hull 1979; Hall 1983; Pickstone 1995; Jardine 2000; Tosh 2003; Moro Abadía 2009; Oreskes 2013; Loison 2016; Chang 2021). As Hasok Chang has recently argued, the merits of different forms of presentism depend on our purposes and goals and have different functions in achieving historical understanding (2021). Different forms of presentism are also associated with different sets of problems (Loison 2016). The merits of "presentism" in the

1 By "historiography" I refer to the study of history, and by "history" I refer to the past.

historiography of science depend on the form of presentism one has in mind and the outright rejection of "presentism" without a further explication of the form of presentism under discussion and its context of application.

While I find this sophisticated plurality as a valuable development towards a more nuanced understanding of the historiography of science, in this paper, I wish to take the matter further and argue that a particular form of presentism, *causal presentism*, is a distinctively strong position among the forms of presentism. I argue that the distinctive strength of causal presentism stems from the fact that it enables us to solve and dissolve many conceptual and methodological problems at the core of the historiography of science. In other words, I argue that the kind of historical understanding that causal presentism provides is valuable not only in relation to just some goals but to the goals that have become essential to the historiography of science since its professionalization. Causal presentism is not merely an unavoidable and possibly insightful but also a valuable and positionally rich approach in the historiography of science, given the nature and state of the field as they have been conceived.

According to causal presentism, the historiography of science is the study of the past events, processes, and practices that have led to the present science, i.e. the study of causal links that lead from the past to the present science. I argue that causal presentism has three main virtues that make it a valuable approach in the historiography of science:

First, causal presentism does not identify the subjects of study of the historiography of science on conceptual basis but rather on ontological basis. What counts as part of the history of science does not depend on concepts, definitions, relevant similarity, stipulations, or any other conceptual machinery but on the causal relations in reality. In this way, causal presentism is a viable opinion in the current atmosphere in the historiography of science where the field has become increasingly skeptical – or even hostile or indifferent – towards anchoring its identity to the category of *science* or other conceptual machinery.

Secondly, causal presentism provides a clear account of what counts as *historical explanatory understanding* about science. Historical understanding has many forms and can be achieved in many ways. The complexity increases once we notice that historical understanding has two directions. It can refer either to our attempts to make the past understandable or to our attempts to make the present understandable through the study of history. However, in the middle of this complexity, there is a clear sense of *explanatory understanding* that corresponds to what the

historiography of science can provide: knowledge of causal relations between different events and processes. Causal presentism provides this kind of understanding when it tracks down the causal history of the present science and therefore enables us to achieve historical understanding in one of its central forms, in the explanatory form.

Thirdly, causal presentism provides novel conceptual resources to tackle many conceptual and methodological problems in the historiography of science. Causal presentism enables us to approach many central issues in the historiography of science in a systematic way, including contingency, the problem of big pictures, triumphinalism and so on. What is remarkable is that causal presentism enables us to tackle these issues even though presentism is often considered as the source of the problems associated with them.

In the following sections, I develop each of these points in detail in order to establish the value of causal presentism.

It is important to note that the goal of this paper is somewhat modest in that I do not wish to provide an imperialistic approach in the historiography of science where nothing outside causal presentism is judged to be relevant for our understanding of science and its history. Rather, I wish to establish that presentism in its causal form is a viable conceptual framework for thinking about the history of science rather than a gateway to historical distortions that are usually associated with presentism. I leave it open to what degree other forms of presentism (or anti-presentism, for that matter) provide historical understanding and I will not discuss those forms except when they are directly relevant for understanding the nature and consequences of causal presentism.

Finally, as was already indicated, the form of presentism I formulate in this paper is a specific form. Its merits and problems, therefore, do not have direct implications for other forms of presentism, especially stronger or weaker forms. Neither can the merits and problems of other forms of presentism be used to justify or discredit causal presentism. The viability of causal presentism requires its own rationale. In this paper, I attempt to establish that rationale along the lines of the three virtues introduced above. I will not discuss the motivations, merits, and problems of other forms of presentism because, as said, causal presentism both requires and has its own defense with respect to its merits and motivations. Even when there are common considerations that support different forms of presentism, the strength of causal presentism lies in considerations that go beyond them.

I proceed as follows. In §2, I discuss how the historiography of science has become increasingly skeptical – or even hostile or indifferent – towards anchoring its identity to the category of *science* or other conceptual machinery. This has resulted in a shift from the historiography of science towards the historiography of knowledge. The section concludes that there is not much hope for having a conceptually grounded identity for what belongs to the history of science and therefore an ontological approach, such as causal presentism, is an option that deserves serious attention. In §3, I argue that we should not abandon the historiography of science despite the difficulties introduced in §2. I rely on considerations that establish how our historiographical goals stem from our present-day interest, i.e. *motivational presentism*. For us, understanding science is so important that it requires its own historiography. I argue that science can be made understandable by providing causal explanations (i.e. *historical explanatory understanding*) of its development. Because we wish to understand the current science (motivational presentism) and because causal explanations provide such understanding, we should follow causal presentism. In §4, I discuss how causal presentism sheds new light on many central issues in the historiography of science. I argue that presentism is preferable for reasons internal to the historiography of science. If we look at particular historical events and processes as parts of a wider causal nexus, many problems in historiography of science, such as questions of contingency of science and what categories can be used to describe past practices, can be answered. The discussion in §4 also further clarifies the causal presentism and points out important aspects of the causal presentist commitments: what it is and what it is not.

2. The Bankruptcy of *Science*

Let's begin with two seemingly simple questions: What, exactly, is the historiography of science about? What can it achieve? Different considerations pull us in different directions.

On the one hand, science is a relatively new invention. The cluster of events now known as scientific revolution happened somewhere around 1500–1800. Only since that revolution, whatever its exact characteristics were, there have been epistemological practices that share recognizable similarities with our science, a point made by Richard S. Westfall:

> [The] question [about the scientific revolution] is whether the enterprise of science as it was carried out after 1687 was radically different from that before 1543. Clearly I think that it was and that the transformation was a once and for all event that has never been reversed. Scientists of today can read and recognize works done after 1687. It takes a historian to comprehend those written before 1543. (2000, 44).

However, even the period mentioned by Westfall was mainly a revolution in physics. In chemistry, a revolution began in the late 18th century and is often credited to Lavoisier. Other fields, such as biology and psychology, began to take their somewhat mature forms only much later. For example, Darwin published his *The Origin of Species* in 1859 and Wundt his *Grundzüge der physiologischen Psychologie* [*Principles of Physiological Psychology*] in 1874. Moreover, even in the physics many fundamental developments, such as the formulations of quantum mechanics and the theory of relativity, have occurred in the 20th century. In general, the science in the early 21st century looks very different from what there was at the beginning of the 20th century. How can the history of something so recently developed be written?

The fact that many features of our sciences have developed so recently is not even the main problem. A deeper problem is that relatively recent conceptions of science shape what we think of its past. Historians of science warn us about the dangers of considering, say Newton, as a *scientist* in our sense. The world has changed since the days of Newton, and we should not impose our own ideas of science on Newton's work and practices. It is argued that the past should not be seen from the viewpoint of the present. Ashplant & Wilson (1988) famously argued that, among other unfortunate things, approaching the past from the viewpoint of the present leads to the projection of present categories on the history of science and thus to the distorted use of the sources. The present viewpoint also makes us to see only what is absent in the past and prevents us finding anything concrete from the past. Moreover, Cunningham argues that it can be hardly appropriate that the historians in the present set the criteria what counted as science in the past (1988, 367). Even though it is unclear whether these considerations are targeted against the mere use of present descriptive categories, which Loison (2016, 31) calls *descriptive presentism,* or against a distorted version of *normative presentism* in which the present science is used as the ultimate standard to evaluate the past (Loison 2016, 33), they have been influential, together with considerations discussed below, in establishing the idea that presentism (whatever it exactly means) hinders our understanding of the history of science.

On the other hand, the historiography of science seems necessary in order to understand science. As our current science has developed only recently, the historians must remind us that things have not always been the way they are now. In general, the historiography of science can show the contingency of our science. This point is nicely put by Rée:

> The contemplation of historicity – of the sheer singularity of places and times, situations and conjunctures, including all those you habitually take for granted – will help you see

> that there are different ways of looking at the world, and that what is obvious in one perspective may be ridiculous in another. (1991, 991.)

Moreover, historians must remind us that the ancestors of our present science were not the only candidates to pass their thoughts and practices to the following generations. Complex social and epistemological structures, in a continuous flux themselves, need to be revealed in order to understand the developments of science. This is one of the messages Simon and Schaffer want to convey in *Leviathan and the Air-Pump*:

> Yet we want to show that there was nothing self-evident or inevitable about the series of historical judgments in that context which yielded a natural philosophical consensus in favour of the experimental programme. Given other circumstances bearing upon that philosophical community, Hobbes's views might well have found a different reception. (1985, 13).

However, the focus on the detailed analysis of our ancestors should not blur the fact these people were not intentionally developing science for the future generations, a point made, again, by Cunningham (1988). These people should be studied in their own right and in their own terms. We should also avoid big pictures that imply that the history of science was a coherent and progressive set of developments. (Shapin 2005, 242).

If there is one lesson above all the other, it is that we should not celebrate those people who turned out to be winners or who thought the same way as way do. This lesson was given by Butterfield in *The Whig Interpretation of History* (1931). A related demand is that we should not use our present scientific knowledge to explain the past, since this knowledge is a historical product. Schaffer and Shapin write:

> 'Truth,' 'adequacy,' and 'objectivity' will be dealt with as accomplishments, as historical products, as actors' judgements and categories. They will be topics for our inquiry, not resources unreflectively to be used in that inquiry. (1985, 14)

So the puzzle is this: If there has not been science, as we conceive it, in the past, and if there is no coherent set of developments to be found, what are all the articles and books in the historiography of science about? What do they achieve as historical works about science?

Perhaps the historians study the practices that were sciences *in the past*? Sciences were different in the past, and each of the papers above, for example, discusses a science in a particular era. This has been suggested: "[--] historians of science are as likely, perhaps even more likely, to consider their work part of a conversation about a particular time and place, science in the nineteenth century rather than the nineteenth century's contribution to the history of science" (Findlen 2005, 235). This view can be described as "science-in-the-past view".

The science-in-the-past view has been built in the reflexes of the historians at least since Kuhn published his *Structures*. Kuhn's whole project, with the notion of a paradigm shift, is understandable only with the assumption that there have been different sciences in the past. Kuhn also explicitly writes:

> The more carefully they study, say, Aristotelian dynamics, phlogistic chemistry, or caloric thermodynamics, the more certain they feel that those once current views of nature were, as a whole, neither less scientific nor more the product of human idiosyncrasy than those current today.[2]
>
> Gradually, and often without entirely realizing they are doing so, historians of science have begun to ask new sorts of questions and to trace different, and often less than cumulative, developmental lines for the sciences. Rather than seeking the permanent contributions of an *older science* to our present vantage, they attempt to display the historical integrity of *that science in its own time*. (1970, 2-3 [emphasis added].)

However, there are serious dangers in the science-in-the-past view which suggests abandoning it. First, the view is problematic if we want to understand past *in its own term*. As Cunningham writes:

> But did these people in the past perhaps also describe this self-same activity of theirs as 'science'? The answer must be that until at least 1750, and possibly until as late as 1800, no-one at all described their activity like this. [--]

[2] It must be noted that in the rest of the paragraph Kuhn writes that past practices were more science than myths. Of course, if we need to choose which one of these descriptions is more adequate, the description as "science" is more adequate. This, however, does not change the picture the *Structures* conveys as a whole.

> Thus we customarily take people who, by their own accounts, were engaged in intentional activities other than science, and treat them as having been engaged in science. We mistake one activity for another. As a consequence we also give the wrong identity to what these people said and did. For us to ascribe the activity 'science' to people who were not only not engaged in science but who were actively engaged in another activity altogether, is for us to hijack their actions and statements into our context, a modern-day context, and give them a post factum identity. (1988, 380).

It is questionable whether the intentions of the people in the past should be decisive in defining what they were doing.[3] However, most of the scientific fields, theories, methods (especially statistical), and the institutional structures of science have developed only recently. Once we connect this observation with the right sensitivity to the intentions of past people, Cunningham's demand, that we should not think that there where sciences (in any historically reflective sense) before the 19th century, seems justified. This means that we should avoid describing the past epistemological practices as sciences if we want to describe past in its own terms.

Of course, there can be endless debates whether some past practices were similar to the present sciences with respect to some criteria of *science*. However, this is not the point behind the science-in-the-past view. Rather, the lesson is that science has taken (sometimes radically) different forms in the past, and we should appreciate this fact in our understanding of science. We should learn from the difference, not from the similarity. The changing nature of science is what interests us *historically*. It is hard to deny this intuition: historiography of science would be a rather odd practice if its purpose was to produce checklists that tell what practices in the past were science according to some present-day criteria.

However, the problem with the claim that science has taken different forms in different eras is that this claim presupposes that there is a universal category of science that can be used to describe practices of different eras. But if one takes seriously the idea that different eras should be understood in their own terms, it does not make sense to presuppose universal categories of this

[3] Surely the intentions do not define science in our time. Astrologists are not doing science no matter what their intentions are. Moreover, the practices of CERN are scientific even if it is hard to tell whose intentions would be relevant when judging that.

kind. We should accept that because different eras were different they require different categories and concepts to describe them. Only in this way we can understand the past in its own terms.

Moreover, the *science-in-the-past view* magnifies one fundamental problem, the disunity of science. The problem is that if there is no unity in the practices that historiography of science studies, what makes historiography of science a coherent field? Dear aptly writes:

> [History of science] may comprise any sort of knowledge or human activity to do with the world that we regard as serious, formally organized, and respectable. It could range from gnomons to genomics; from satellites to stalactites; from ancient Kenyan iron-ore smelting to Polynesian navigation. Very little would be off-limits, and a broad vision to encompass it would have little real coherence. (2012, 37.)

This a pressing problem for the *science-in-the-past view*. The assumption that the sciences of different eras were different from one another implies that there is no unity in the practices that are studied in historiography of science. Therefore, the *science-in-the-past view* builds in historiography of science the unattainability of a coherent picture. The *science-in-the-past view*, then, not only leaves the problem of disunity unsolved but makes it unsolvable. It is difficult to find any reason not to abandon a discipline that cannot in principle produce any coherent pictures from its separate results. The *science-in-the-past view* cannot save historiography of science.

The problems of the science-in-the-past view have has not gone unnoticed. Perhaps the idea of historiography of science is a relic from an age when the past was not understood correctly and when science was thought to be a universally applicable category. Perhaps the term “science” in the journals and books lives only due to institutional inertia. Daston pointed out that “Historians of premodern science grew increasingly skittish about calling what they studied science at all, and the word *scientist* when applied to Archimedes or Galileo set their teeth on edge” (2009, 806).

Perhaps science is just one way of knowing the world, and the history of science is a study of the ways the world was known in the past. Renn writes:

> For many historians of science, science no longer seems distinguishable from other forms of cultural practices. It has ceased to be a paradigm of universal rationality and presents itself as just one more object of study for cultural history or social anthropology. Even the most fundamental aspects of the classical image of science -- proof, experimentation, data, objectivity or rationality -- have turned out to be deeply historical in nature. This

> insight has opened up many new perspectives on the study of the history of science, which is turning more and more into a history of knowledge. It thus includes not only academic practices, but also the production and reproduction of knowledge far removed from traditional academic settings, for instance, in artisanal and artistic practices, or even in family and household practices. (2015, 37–38.)

It is becoming more and more acknowledged that the historiography of science is not literally about *science* but about ways of knowing the world, i.e. epistemological practices in general. This has become evident in the explicit shift from the historiography of science to the historiography of knowledge during recent years. Even though there has been debates concerning the nature of the historiography of knowledge and its relation to the historiography of science (Daston 2017; Bergwik & Holmberg 2020; Östling & Heidenblad 2020; Mulsow 2018; Burke 2020), it is widely agreed that it is futile to attempt to identify the history of science by using some conceptual machinery build around the category of *science*, no matter how historically sophisticated that machinery is. As Daston has argued,

> The original disciplinary narrative of the history of science is simply untenable on scholarly grounds, undermined by the careful historicism and aversion to anachronism and teleology that has characterized the most rigorous and imaginative work in the field for the last forty years. [--] Following the trail of practices has intertwined science with its ambient cultural context in tangled ways. There is no way of unweaving this web, of excising science cleanly from other ways of knowing and doing. (2017, 144-145.)

However, even if there is no way of excising science from other ways of knowing in the past, this does not mean that there cannot be historiography of science. It only means that there is no way to define the discipline through a shared conceptual basis. There is another completely intelligible way of defining a historiographical discipline. *The historiography of something* can be understood as a description of the development of that something through time. Such descriptions fulfill some of our deepest historical needs. As Hall puts it ‘The most obvious of all historical questions is: "How did we arrive at the condition we are now in?’ (1983, 54). Following these lines, we can define the historiography of science as the study of the development of the present science. This is what causal presentism suggests when it defines the historiography of science as the study of the causal history of the present science. If we conceive the historiography of science in these terms, we do not need to rely on any conceptual machinery to identify the subjects of study. Rather, we can leave that task to the causal relations in the history. That is why I classify causal presentism as an “ontological”

approach in the historiography of science in contrast to "conceptual" approaches: what counts as a part of the history of science does not depend on our conceptual machinery but on the causal features of world.

Of course, there is not much point in pointing out that an alternative to conceptual approaches is possible in the form of causal presentism if (i) we do not think that the present science is significant enough to deserve its own historical treatment, or (ii) if the ontological approach leads to types of distortions that the historiography of science was supposed to dispel. In the next section, I argue that the present science deserves a historical treatment and that such treatment provides explanatory understanding. In §4, I argue that causal presentism does not lead to the feared distortions but rather solves them. If these considerations hit their mark, causal presentism, an ontological approach to historiography, provides a fruitful way of thinking about the nature of the historiography of science.

3. Causal Presentism and Explanatory Understanding

The approach I offer is *causal presentism*. According to causal presentism, the historiography of science is the study of the events, processes, and practices that have led to the present science.[4] In other words, the historiography of science is the study of events, processes, and practices that were causally relevant to the development of what is now known as science. Nick Tosh (2003) is a notable defender of this approach. According to Tosh, the historiography of science is a study of past activities ancestral to modern science: "Modern science has a causal history, and [the historiography of science] could reasonably be structured around a causal backbone of past activities which helped to bring it into being." (2003, 648.)

It is helpful to use Lorraine Daston's words[5] as a guideline to the causal presentist approach: "[the historians of science] must explain how [the distinctive] character [of science] crystallized out of practices, both intellectual and manual, designed for other purposes". (Daston 2009, 807). The past practices that the historiography of science studies do not have to be sciences themselves, and we

[4] Of course, there are many different sciences. However, using the term "present science" does not affect the argument here.

[5] Of course, I do not want to suggest that Daston is a presentist.

should not force them under the concept of science, as this would lead to the impasse discussed in the previous section. All that is required is that these practices are causally connected to the present science. By following causal presentism, we avoid the dangers of science-in-the-past thinking and the impossibility of establishing conceptual machinery to excise science from other ways of knowing in the past. The question whether the activities that belong to the history of science were scientific or not simply does not arise in causal presentism.

However, avoiding the conceptual problems that has grown in the core of the historiography of science is not the only motivation behind causal presentism. Arguably, the main goal of science studies[6] is (or at least should be) to understand the present scientific practices. The reason for this is that we can affect the world around us only at the present moment. Scientific practices can be evaluated and changed only at the present. Our present science is a wide collection of achievements that has been built through the history. Together with these achievements, a remarkable range of ethical, political, theoretical, methodological, and conceptual problems have emerged in science and in our science-related life. We, in the present, live with the achievements and problems that the history of science has generated. These achievements and problems cannot be ignored as we are surrounded by them. Passages from Richard S. Westfall are worth quoting in length here:

> Recall the world about us. To me it appears that the existence of modern science is the precondition for most of the central features of our society. I think of such things as means of communication, from the mass media that bring the world to our homes each morning to individual devices such as the telephone and e-mail, which together have so expanded our lives in comparison with those of the people I know from the seventeenth century. Ease of transportation enabled scholars from all over the country and beyond to gather in New Mexico to hear Dobbs's lecture; we have incorporated the various dimensions of ready transportation into our lives to the extent that we have forgotten it was not always there. The level of material plenty has lifted the burden of poverty from the great majority. Modern medicine has more than doubled the average life span and driven pain and disease, once familiar members of every circle, to the margins of our existence. These features of our life are not evenly spread around the globe. In general, they prevail where modern science flourishes and are in shorter supply elsewhere.

[6] Including the historiography and philosophy of science.

> Most people think of these characteristics as benefits. Almost no one considers other features of our world that are also derivative from science as benefits, though they are no less central. Scientifically based technology has accelerated the consumption of nonrenewable resources until we stand already face to face with their exhaustion. It has produced products that nature cannot degrade, so that we are well on the way to choking on our own refuse. It has conjured up weapons of mass destruction more hideous than earlier ages were able even to imagine. I do not think that I have compiled a partisan list. Every item on it appears incontrovertably true, and I am convinced that I could go on indefinitely listing similar ways in which science impinges, both positively and negatively, on our lives until I had more than satisfied everyone who finds my list wanting in some respect. (2000, 42–43.)

That we are so intertwined with science does direct our historical reflections. As Chang has pointed out, "Presentism in historiography is inevitable in a basic sense: the historian is quite simply stuck in the present, and it does not make sense to attempt to escape the present" (2021, 98). This point about the relationship between the historiography and the present state of the world is formulated eloquently also by Naomi Oreskes in the paper "Why I Am a Presentist?" (2013). Oreskes formulates *motivational presentism* and writes:

> What matters to us about the past has everything to do with who we are, where we live, and what we think is important – to us, here and now, in the present. Our motivations are inescapably presentist. Thus, to qualify the deliberately provocative title of this paper, I am a motivational presentist, and I believe all historians are. (2013, 603).

However, we should not only look the past through our present interests. Understanding the past is necessary for us to understand the present. The importance of understanding the history of the present science has been noted by philosophers of science. For example, Schickore argues that

> [--] a history of the present should remain part and parcel of our present efforts to understand the sciences. Fully to understand the concepts, practices, and methodological and epistemological goals and commitments of present science, we need to trace how they have come into being. (2011, 477.)

Moreover, Psillos concludes that

> [--] what science tells us about the world, as well as the reasons to take what it tells us seriously, are issues that are determined historically, by looking at the patterns of convergence in the scientific image of the world. (2012, 101).

It is important to notice that one can be a motivational presentist without being a causal presentist. There are many ways in which studying the past enables us to understand the present, some of which might be completely indifferent to causal relations. One might compare the present science with some past activity that has no causal connection to it, or one might study an activity that is causally relevant to present science without being interested in the causal connection. For example, Chang argues that giving attention "to the bits of past science that modern scientists consider unimportant, outdated, or simply wrong" enables us to see that "the current dominant system in a field of science is not the only good approach to the understanding of nature, and looking at the past is one of the possible ways of finding other good ones" (2021, 107). Causal presentism is not committed to the claim that such ways to study the past do not have a great value. However, what motivates causal presentism is that it is unclear in what sense these different ways of studying the past provide *historical* understanding.[7] Almost any study of human activities can be relevant to our understanding of science, as science is a human activity and shares similarities with other activities. However, not all human sciences are historiography of science. I do not wish to suggest that there is no reading of *historical understanding* that could capture what the "causally indifferent" studies in the historical study of science can provide. What I wish to suggest is that these different senses of *historical understanding* should be made explicit and systematized. Meanwhile, I will point out that there is a rather straightforward sense of *historical understanding* in which causal presentism provides historical understanding.

[7] An anonymous referee pointed out, in a thought-experiment, that if we were to find out that an alien civilization has developed science, we could learn interesting things about science by studying that causally unrelated science. The referee concluded that this speaks against causal presentism. I would like to draw the opposite conclusion. The study of the alien civilization is clearly not a historiographical study. Therefore, the thought-experiment shows exactly that not all understanding is historical understanding. That causal presentism cannot provide understanding through the study of an alien civilization is a consequences of the fact that causal presentism attempts to capture how can we understand science *historically*.

Causal presentism provides historical understanding in a very clear sense. It provides causal explanations and answers what Hall calls "the most obvious of all historical questions: 'How did we arrive at the condition we are now in?'" (1983, 54). I call this kind of understanding *historical explanatory understanding*. Causal presentism combines the need to understand the present situation with the fact that causal explanations provide understanding. In other words, if one follows causal presentism, one achieves historical understanding of science in explanatory form. While we cannot settle here what is the best way of analyzing the notion of *causal explanation in historiography*, it is important to note that such analyses have been developed recently on the bases of influential frameworks in other areas of the philosophy of science. For example, Glennan (2010) has explicated the notion in terms of ephemeral mechanisms, and Virmajoki (forthcoming) has explicated the notion in terms of counterfactual dependencies. This means that there are works on causal explanation in historiography on which causal presentism can be conceptually based. It is also interesting to note that both Glennan (2010) and Virmajoki (forthcoming) explicitly discuss the issue of historical contingency. As we will see in the next section, this issue is one of the main themes in the historiography of science. The fact that the accounts of causal explanation in historiography tackle such issues gives us a great hope that causal presentism has interesting contributions to be made on conceptual and methodological issues in the historiography of science. But, as said, we shall wait until the next section to discuss this in detail.

To both some flesh on the central ideas of causal presentism, consider the study "Distrust and Discovery: The Case of the Heavy Bosons at CERN" by John Krige (2011). In this study, Krige describes "the microhistorical process whereby different groups of scientific actors [--] came to claim that a new fundamental particle (the W boson) had been discovered at CERN" (2001, 517). The study points out a complex set of factors that were causally relevant to the announcement of the discovery: the personal trust between the actors; the local technological environment; the methodological and theoretical complexity of the scientific work at hand; the limited possibilities that expensive science leaves open to the scientists especially under political pressures, and so on. Krige's study shows that we can explain the science around the W boson and the announcement of the results by focusing on these factors. We need the historical explanatory perspective. Moreover, Krige's study provides us very detailed understanding of the development of a particular piece of science. While more general works[8] about the experiments in the history of science deserve their

[8] Such the *Leviathan and the Air-Pump* by Simon and Schaffer (1985).

place, studies that give detailed explanations of our present situation are crucial for our understanding of science. Causal presentism captures these insights.

Krige's study shows how one piece of our present worldview came to be established. In this sense, it is about an epistemological aspect of the present science. We saw above that Schickore and Psillos give illustrative lists about epistemological aspects of science that are worth historical inquiry. However, causal presentism is not limited to the historical study of these epistemological aspects. Science has other significant features as well. In addition to the epistemological aspects, the historiography of science can fruitfully deal (at least) with the following aspects of science (and their interconnections):

> *Social*: How is science organized? What kind of social roles there are in the sciences and how do these roles guide the practices? What and whose values are built in the science?
>
> *Science and society*: What are the relationships between science and politics, science and economy, science and different social groups? How global/local science is? How accessible science is for different groups? How are the results of science communicated to and understood by society in general? What and whose values are built in the science?
>
> *Science and culture*: What are the relationships between science and other parts of culture (religion, for example)? What and whose values are built in the science?
>
> *Science and technology*: What is the role of science in the development of new technologies? How does technology shape scientific practices?
>
> *Psychological*: How do individual scientists understand themselves? What kind of thoughts and emotions do scientists have in their work and about their work?

This list is far from exhaustive, but it gives an idea of what can be studied in historiography of science according to causal presentism. Present science is an enormous global practice that has these multiple dimensions in it. Thus, the multitude of the aspects of science that the historiography of science can focus on follows naturally from causal presentism.

We should also note that even if someone does not view the present science as epistemically special (for whatever reason), that person would change from a (perhaps reasonable) skeptic to a complete nihilist if she did not acknowledge that the present science has a multitude of interesting

connections to many aspects of our lives. Nothing in causal presentism itself forbids us from asking, for example, "Why are scientific theories produced by power structures rather than by sound methods?" or "Why is the misconception about the epistemological soundness of science so widespread?" Motivational presentism does not mean that we are interested in science only because of its positive aspects. We can be equally motivated in understanding the problematic features of science. In this way, causal presentism is suitable for anyone who is not a nihilist and acknowledges the significance of science. As we will see in the next section, causal presentism does not commit to a celebratory attitude towards the present science.

Finally, one might wonder how causal presentism is able to identify the present science. Defining science is a notoriously difficult task even without a historical dimension, as the age-old discussion on the problem of demarcation has proven (see Laudan 1983; and Boudry & Pigliucci 2013A). Is causal presentism committed to heavy conceptual machinery after all? It is not. One does not need to define *science* in order to get causal presentism off the ground. We can simply take the practices of our society that have a scientific status and study the history of these practices. The ethical, political, methodological, and conceptual problems of science that are significant to us are problems of *those practices*. It would be nonsense to suggest that we should consider some other existing practices as *really* scientific.[9] This would not solve our problems but change their name. Moreover, as philosophers working on the demarcation problem have noted, there exists widespread agreement about what practices count as science even if formulating the criteria to separate science from non-science is an extremely challenging task (e.g. Pigliucci & Boudry 2013B, 2; Hansson 2013, 61). Thus, telling which practices count as science in our society is not too difficult a task and does not bring back heavy conceptual machinery through the backdoor.

In this section, we have explicated causal presentism and discussed how it provides explanatory understanding. The motivation for the study of the history of science is in the significance of science in our life, i.e., in motivational presentism. The historiography of science has a significant

[9] Of course, we can ask whether science could be improved. This, however, does not affect which of our *existing practices* are the scientific ones. Moreover, we may even have wrong beliefs about the nature of scientific practices, but this does not change the fact that *these practices* are the ones we want to understand in the science studies (and thus in the historiography of science). In fact, science studies would become a redundant field if we already knew the exact nature of those practices that we consider as science.

value and should not be abandoned in the face of conceptual problems discussed in §2. Given this, causal presentism provides a viable approach in the historiography of science because it enables us to both avoid the conceptual problems and achieve historical (explanatory) understanding. The only challenge left is to analyze whether causal presentism generates historiographical distortions that are usually associated with presentism or whether it enables to dispel those distortions. We now turn to that issue.

4. Dispelling Distortions in the Historiography of Science

Next, I discuss a set of problems associated with the historiography of science and especially with presentism. This discussion shows that the problems are not a serious threat to causal presentism. On the contrary, in many cases, causal presentism turns out to be the most promising way to avoid problems that are recognized in the historiography of science. Moreover, the following discussion further clarifies causal presentism and points out important aspects of the causal presentist commitments: what it is and what it is not.

Contingency: One could perhaps argue that if the history of science is only a study of causal histories of the present science, the history of science loses its grip on understanding how things were different in the past and how they could be different in the present. It is one of the main tasks of historians – the objection continues – to show that the present state of things is only contingent and that the ways societies have organized their epistemological practices have varied greatly. Rée writes:

> The contemplation of historicity – of the sheer singularity of places and times, situations and conjunctures, including all those you habitually take for granted – will help you see that there are different ways of looking at the world, and that what is obvious in one perspective may be ridiculous in another. (1991, 991.)

I agree that there is some force in this objection – understanding how the past has been different gives us tools to *imagine* how things could be at present. Yet this kind of imagination does not give us any idea of what should have happened in the past in order for things to be different at present. However, if we study the causal history of the present science, and if we understand causation as difference-making (e.g. Menzies 2004, Beebee et al. 2017), then a historiographical explanation automatically tells us when things would have been different (see Virmajoki [forthcoming]). Therefore, causal presentism with its causal explanation is a rather powerful tool for understanding

the contingency of our own scientific practices. Causal presentism allows us to pinpoint on which historical events, processes, and practices our present practices are based. (Virmajoki 2018).

In connection with this objection, one could also argue that how science became conceptualized (i.e. what practice fell under the concept "science") is itself historical and thus a contingent fact (e.g. Dear 2005; 2012). It could have been the case that we took as scientific different practices than we actually do. This observation is not a problem for causal presentism. Causal presentists can accept that the line between science and non-science could have been drawn differently, but once the line has been drawn, the historiography of science studies the history of practices that are conceptualized as scientific as a result of this contingent process. We need to separate the history of scientific practices and the history of our conceptualization of science. Even if it is contingent which practices we conceptualize as scientific and which not, the only practices in which we are interested when we analyze and evaluate science are those that fall under our actual conception of science.

Consider an analogy. Our conceptualization of different species of animals has developed historically. However, the evolution of *those species* is a completely different matter. These things need to be studied separately– in fact, only because this separation is possible, have we been able to revise our conceptions of species (taking into account their evolutionary histories). Now, without a doubt, the history of our conceptualization of science is an interesting process that must be studied. However, this is a project different from the study of the history of scientific practices. Moreover, we need to make a further distinction between the conceptualization of science (i.e. which practices fall under the concept of "science") and our explicit beliefs (or "ideology", as Dear [2012, 38] puts it) about the nature of science, as there might be a mismatch between our conception and the ideas we associate "science". For example, one may think (after reading Popper) that science must be falsifiable and still think that science exists, even though nothing, strictly speaking, is falsifiable. Such a person would have a false belief concerning science. It would be an interesting project to study the history of beliefs associated with "science". However, this is a project different from the study of the history of how certain fields came to be considered as sciences. To continue the analogy, we can have a false belief about a species of animals and still know which animals belong to the species. I may have the false belief that a particular snake is poisonous and still classify it as an Emerald tree boa. Why I had the belief and why I included the individual into the species can require different explanations. To assume that the history of explicit beliefs concerning science reveals why certain activities fall under the concept of science is clearly a mistake based on exaggeration of the power of abstract ideas to unambiguously impose order on the social world.

Moreover, the distinction between the conceptualization and explicit beliefs grounds the possibility of there being false beliefs concerning science. If our explicit beliefs determined what counts as science, then those beliefs could never be wrong. This clearly is not the case.

The analysis above also means that, even if the conception of science changes or is revised[10] and if the historians of science begin to study the history of activities that fall under this new conception, this has no implications whatsoever to the question of which activities are reasonable to study in the historiography of science in *our society*. Of course, one could worry that if our conception of science changes, then different practices might count as parts of the history of science according to causal presentism. This is true, but there is no mystery here. The past remains the same but different parts of that past become explanatory due to the change in the *explanandum*. That different *explananda* require different explanations is nothing to be worried about. Moreover, nothing forbids historians from studying other parts of the past than those which have led to present science. Of course, such a study would not be a historiography of science according to causal presentism but causal presentism is not committed to the claim that only historiography of science, causally understood, is valuable.

Finally, causal presentism can easily admit that the way in which the boundaries of science are drawn can affect science. We can say, for example, that "had the people P not been excluded from what is seen as science, the discussions concerning theory T would have been different and so would the results". However, here we are not explaining when we would have had different boundaries of science but when we would have had an alternative to some feature of present science (e.g. different results). In the example, a different conceptualization would have led to an alternative to the present science (the conceptualization is an *explanans*, not an *explanandum*) and the way in which science has been bounded belongs, therefore, to the same historical plane as the rest of the history of science: it is part of the causal history of the present science. Moreover, the beliefs that some scientists have about science are sometimes significant enough to require an explanation. Therefore, beliefs about science can be an *explanandum* in the historiography of science according

[10] And if we still want to maintain that the new conception is a conception of science, which is debatable. The aim of the argument here is to show what presentism implies if we allow that the conception of *science* may change.

to causal presentism. In such cases the *explanandum* is derived from our interest in the present science, not from an interest in the history of beliefs concerning science.

A boring list of causes: Someone might worry that causal presentism reduces the historiography of science to the practice of listing the causally relevant factors in the development of the present science and ignores interesting details and nuances of the past.

The worry can be mitigated: First, nothing in causal presentism forbids the study of the working environment of Einstein, for example, for its own sake. It does not matter that such a study might not have a direct explanatory motivation. Actually, this kind of "basic research" in the historiography of science is highly valuable. The better we know and understand the past, the easier it is to find answers to explanation-seeking questions when asked. Secondly, it is not true that explanation-seeking questions can be answered easily, just by taking a quick look at the archives. Finding out relevant factors requires substantial study. What is more, to establish a causal connection between two factors in the history requires argumentation that is based on detailed descriptions of the past. It is clear that this kind of argumentation requires enormous amounts of historical knowledge and detailed descriptions.[11]

However, it must be noted that not every aspect of the working environment of Einstein, to continue the example, counts as a part of the history of science from the causal presentist point of view, even if studying them is necessary for the historiography of science. Only those parts of the environment that are causally relevant to the present state of science can be considered and presented as parts of

[11] Take a passage from existing historiography to exemplify the issue presented here. Cohen writes: "Why the Golden Age came to an end when it did, roughly by the mid-2nd century BCE, is a question hard to answer with assurance in view of the *scantiness and unreliability* of the evidence. Still, two major causal factors that we shall meet in our later cases *can confidently be ruled out* for Greece. At the time, about halfway between Alexander and the armed establishment of Roman supremacy, no invasion or military conquest was so destructive as to disrupt the entire culture. And of sacrilege, in the sense of a widely shared perception of current nature-knowledge trespassing religious boundaries, there was very little question. Nor was any further handling of the various branches of mathematical science bound to be fruitless." (2010, 29-30 [emphasis added].)

the history of science.[12] The point can be put as follows: providing causal explanations is the true task of the study of the historiography of the science, but these studies must also display more or less complicated argumentative structure and accurate description of the past to warrant the claims about causal dependencies.[13] And this is how it should be. It is important to distinguish between explanatory accounts, descriptive accounts, and justificatory considerations in the historiography in the same way as in other disciplines. Not all aspects of historiography provide understanding, at least not in the same sense. Causal presentism allows us to make these important distinctions.

The past in its own term. *Presentism*[14] has a bad connotation for anyone who is committed to studying the past on its own terms. Ashplant and Wilson famously warned us about the dangers of presentism. Among other unfortunate things, presentism leads to the projection of present categories on the history of science and thus to the distorted use of the sources. It also makes us see only what is absent in the past and prevents us from finding anything concrete from the past. (1988, 255–266.) Also Cunningham (1988) argues that we should not describe historical actors by using present concepts. In short, we should understand the past on its own terms but viewing the past from the point of view of the present makes such understanding impossible.

The answer to these worries can be found in Tosh (2003, 656): "The selection of criteria we adopt when defining a discipline need not affect *how* the selected material is then investigated." Furthermore, Loison (2016, 33) points out that these are problems for what he calls *descriptive*

[12] If one is puzzled by this, consider: If a car gets into an accident, the causes of the accident can be established only by investigating a variety of factors. Yet not all of the factors are part of the causal history of the accident.

[13] The idea of separating the main thesis of a historical text from the arguments for the thesis is presented argued for by Kuukkanen (2015).

[14] When I use the term "presentism" in this unspecified way, I refer to (somewhat unclear) ideas concerning presentism in literature. My argument is that causal presentism does not face the problems associated with these vague forms of presentism.

presentism, not for causal presentism defended in this paper.[15] Loison defines *descriptive presentism* as "the comparison/transcription/translation of the structure of a past explanation in terms that are understandable in the present" (2016, 31). We can generalize descriptive presentism here – as we are not dealing solely with explanations but many different kinds of factors - to be *the comparison/transcription/translation of the structure of some cognitive product or process of the past in terms that are understandable in the present.* Tosh and Loison are right. Causal and descriptive presentism are independent positions. We can do justice to a historical actor and see the world from her point of view even if we study her as a part of the developments that led to the present science. The claim that an actor was involved in non-scientific (or proto-scientific) activities does not demean these practices or the actor. It is not obvious why one should consider scientific practices to be the most valuable ones, and even if the scientific practices were the most valuable ones, we would not do justice to a historical actor by changing the conception of science in such a way that it can be used to describe the actor. If science is valuable when understood in the present sense, it may not be valuable when understood in some other sense. Moreover, we have seen that it would be a serious historical distortion to describe the past practices as *the sciences in the past*. We also saw that causal presentism is tailor-made to avoid such distortive descriptions.

However, it must be noted, again, that not everything studied in close relation to the history of science is relevant to the developments of the present science. Only certain parts of the actions of the past actors have turned out to be relevant to the development of the present science and thus count as parts of the history of science. (Notice, however, that there is not a straightforward connection between the causal relevance and getting things right, as we shall see below). Surely, the actors could not have known which aspects of their practices would turn out to be relevant to the development of science and they were not intentionally planting seeds for the future science. However, this is irrelevant to the actual influence they had. Thus, we must adjust Tosh's point: Past practices can be studied on their own terms, but we must distinguish which aspects of these practices count as explanatory parts of the history of science and which aspects deserve to be described for some other reason. In other words, we can study every aspect of past actors and practices in their own terms but – from the presentist point of view – not every aspect should be studied and presented as an explanatory part of the history of science. To repeat the point made in

[15] On the issue of descriptive presentism, the reader might also consult the papers of Hall (1983), Hull (1979), Moro Abadía (2009), and Pickstone (1995).

connection with the objection of *boring list of causes*: pinpointing causally relevant factors is the true task of the study of the historiography of the science, but these studies must also display more or less complicated argumentative structures and accurate descriptions of the past that warrant the claims about causal dependencies.

Moreover, as historians are always products of their own historical context and as they always write to their contemporaries, it is impossible – and even undesirable – to write about the past completely on its own terms (e.g. Hull 1979; Chang 2021). Thus, it is difficult to tell when a description of the past is adequate and when it is distorted by the present viewpoint of a historian. An advantage of causal presentism is that it can answer this question: *a description is distorted when it does not capture the causal structure of the given historical situation correctly*. For example, if someone claims that Darwin's theory was accepted because its truth must have been obvious to the readers, we have not even begun to capture the complexities of the process leading to the acceptance of the theory. Debate about Darwin's evidence and even his moral status were important factors in the process (see Bellon 2011). The claim, that Darwin's theory was accepted because it was obviously true, would be unacceptable since it would not bring us a correct understanding about the causal structure of the history of science. Thus, causal presentism is not only compatible with the idea that science of the past must be understood in its own terms but also explains why and when such descriptions are needed.

As a final note, we should notice that descriptive presentism was defined above as "the comparison/transcription/translation of the structure of some *cognitive product or process* of the past in terms that are understandable in the present". We now see why. This follows from the criterion that *a description is distorted when it does not capture the causal structure of the given historical situation correctly*. The historiography of science makes the history understandable for us in the present and therefore explanations must be based on our explanatory resources. This is called *empirical presentism* by Loison (2016). We cannot go beyond our own conditions; neither can we turn back the clock. Historiography of science attempts to build a picture of the causal networks of the past on the basis of current knowledge. Almost all of the causal structure of the past must be described in our own terms, not in terms of historical agents, since the only causal picture of universe we currently have is described in our own terms. However, this is not the end of the story. Historiography of science fits the historical actors into a causal nexus of the past as we conceive it. That the historical actors had different ways of thinking is a component of our conception of the causal nexus of the past and, therefore, we would distort our picture if we did not recognize how the historical actors were thinking (unlike us). The cognitive products and process are therefore a

special case: they must be described in their own terms if we want to achieve a correct understanding of the causal structure of the past. Notice, however, that in the process the cognitive products and process of the past are incorporated as parts of our causal worldview. In the end of the process, there is no difference between "their own terms" and "our own terms" when it comes to the cognitive products and processes of the past.

Blind alleys: It might be argued that we can learn many things about science by studying past developments that turned out to be blind alleys. Causal presentism ignores these blind alleys.

In order to answer this worry, we must separate two versions of this objection. The first one is that there have been research programs in the history that (seemingly) turned out to be on the wrong tracks and were then replaced by (seemingly) more progressive programs. This case is not a problem for causal presentism. The process of replacement surely is a causal process that contributes to the development of science. More generally, this also means that Kuhn's worry that

> Scientific development becomes the piecemeal process by which these items have been added, singly and in combination, to the ever growing stockpile that constitutes scientific technique and knowledge. And [historiography] of science becomes the discipline that chronicles both these successive increments and the obstacles that have inhibited their accumulation. (1970, 1-2.)

does not arise in causal presentism. [16] The view that the history of science must be explained causally does not imply anything about progress, cumulativity, or linearity. Which turns have taken place and which kind of causes have been at work in the history of science is an empirical question and must be answered case-by-case. Replacements and steps backward (whatever that means) surely can be parts of the causal history of science.

The second version is that there have been research programs that ended for some reason and were never replaced but just faded away. There are two possible answers. The first is to say that these blind alleys can be causally relevant to the development of science in the sense that they may have

[16] Kuhn's worry also relates to the objections, *The past on its own terms* and *The history of winners and triumphalism* (see below).

informed people what they should not attempt to do. That a blind alley provides information is surely a causal connection. If this is the case, these blind alleys can be studied as a part of the history of science. The second answer is to bite the bullet: the study of the blind alleys that have no causal relevance to the present science does not belong to the historiography of science as long as the discipline seeks to provide explanatory understanding. The causally irrelevant blind alleys can be studied for their own sake, we can even learn and find inspiration from them (Chang 2009, 256), and we can even accept that they provide historical understanding in non-explanatory form, but the study of such blind alleys is not explanatory relevant, in the sense explicated in §3. Causal presentism does not claim that the study of causally irrelevant blind alleys cannot be valuable. The problem is that they do not provide historical explanatory understanding and therefore do not belong to the historiography of science (see also the discussion around Footnote 7 above).

Notice that the distinctions between different types of blind alleys are based on their causal role in the history of science. Such distinctions are important to our historical understanding of those blind alleys and to our general views of science.[17] For example, both phrenology and the phlogiston theory seem like blind alleys. However, their respective roles in the development of science, the factors behind the abandonment of the theories, and our retrospective views on the theories differ.[18] Equating phrenology and the phlogiston theory because they were blind alleys does not seem to serve any real historiographical insight. Therefore, causally structured historiography of science has an advantage in its ability to make those distinctions.

History of winners and triumphalism: It could be argued that presentism only finds the winners from the history and celebrates those who got things right and contributed to the present science. This point was made famous by Herbert Butterfield in his legendary work *The Whig Interpretation of History* (1931).

This is closely related to the two previous objections. In order to answer, we must notice that there are two ways of judging who was a winner at a certain point in time. We can consider as a winner a

[17] For example, the theoretical continuity between successive theories is an important topic in the debates concerning scientific realism. See Psillos (1999).

[18] See Parssinen (1974) and Chang (2009).

person whose thoughts influenced the following generation the most. It is obvious that, from the causal presentist point of view, these persons should capture our attention in the history of science. Yet these persons could have been completely wrong from our point of view and thus their scientific achievements are not worth celebrating. Alternatively, we can consider as winners those who were right from our point of view. These persons could be celebrated if one wishes to do so (personally, I do not see any reason for that) but it is clearly possible that these persons were not very influential and thus do not deserve our attention as a part of the history of science. Thus, the set of people we might celebrate and the set of people who are important parts of the causal history of science are not coextensive.[19]

To be sure, one of the main advantages of causal presentism is that it gives objective criteria for which practices and person count as parts of the history of science. Causal presentism makes sure that one cannot pick one's subjects of study as one wishes and, therefore, causal presentism restricts the possibility of celebrating the historical actors one happens to favor for some reason. If the choice of the subjects of study was purely a matter of convention, it would be possible to ignore some historical actors who deserve attention. This kind of ignorance, based on an ideology or a subjective bias, is surely something that every respectable historian of science wants to get rid of. Causal presentism has concrete tools to avoid these biases.

The problem of Big Picture: One could argue that presentism is a form of big-picture thinking since it defines the history of science as a comprehensive account of the developments that have led to present science. This kind of big-picture should be rejected (Shapin 2005, 242).

It is true that the ideal goal of causal presentism is a comprehensive account of the causal history of present science. Yet it is not committed to the usual sins that make the big-picture thinking questionable. Shapin (2005, 242) writes: “Big pictures imply coherence [and] in old versions of scientific coherence [mean] the conceptual unity and universality of science, narratives of rational and linear progress, a specifiable and efficacious scientific method [--].” Causal presentism is not committed to the claim that the history of science has progressed linearly or that the development of science is driven by rational decision-making and by the use of clear methods. What kind of causes

[19] The formulation of the answer is based on the points made by Hasok Chang (2009).

have been at work in the history of science is an empirical question and must be answered case-by-case.

We can say even more: Compare causal presentism to some other framework in which a historian approaches the history of science by some (perhaps implicit or intuitive) definition of science. If we allow this kind of approach to the history of science, it is hard to say what prohibits a historian to define science as a rational practice that is driven by clear methods. Thus, the distortions of the big-picture reappear since it is possible for the historian to describe the history of science as consisting of activities driven by rationality and clear methodology. This description would follow directly from the definition the historian has chosen. Again, one of the main advantages of causal presentism is that it gives ontological criteria for which practices count as parts of the history of science. Causal presentism makes sure that one cannot pick one's subjects of study as one wishes. Causal presentism can get rid of the biases of considering the history of science as a history of rational activities driven by clear methodology (and any other unjustified biases, for that matter).

In this section, we have seen how causal presentism enables us to approach central issues in the historiography of science from a new angle. Rather than generating distortions, causal presentism enables us to (i) understand the possible contingency of science, (ii) see how explanatory and descriptive considerations work together, (iii) understand when and why descriptive and empirical presentism are required, and (iv) avoid biases and misleading narratives. In this way, causal presentism can be defended on the basis of considerations internal to the historiography of science.

5. Conclusion

In this paper, I have argued that causal presentism is a valuable and positionally rich approach in the historiography of science. The strength of causal presentism is based on its three main virtues: 1. Causal presentism does not identify the subjects of study of the historiography of science on a conceptual basis but rather on an ontological basis. 2. Causal presentism provides a clear account of what counts as *historical explanatory understanding* concerning science. 3. Causal presentism provides novel conceptual resources to tackle many conceptual and methodological problems in the historiography of science. These features make it possible to combine our inevitable present-

centeredness, the need to understand science historically, and the writing of conceptually and methodologically sound historiography.

Finally, one might wonder whether causal presentism is applicable in other areas of historiography. If causal presentism is not applicable in those areas, is it not ad hoc to develop such an approach with respect to the historiography of science? I do not have the expertise to judge whether other areas of historiography face similar impasses with their conceptual machinery as the historiography of science. There might not be a *need* for such radical rethinking in those areas. However, there still might be *great value* in applying causal presentism in other areas of historiography:

First, causal presentism does not lead, as we have seen, to the usual problems associated with presentism. On the contrary, causal presentism allows us to avoid biases that stem from our conviction that we can recognize real historical trajectories through our conceptual machinery, as we saw in the previous section. As the development of the historiography of science has shown, what at first appears as a transparent historical phenomenon with evident features, such as science and its conceptual and methodological unity, often turns out to be a mirage produced by our own historical conditions. This means that causal presentism can provide more solid unity (in the form of a causal trajectory) for a historiographical discipline than the customary way of classifying apparently similar phenomena from different eras together, at least in some cases.

Secondly, causal presentism provides clear criteria for when we have achieved historical (explanatory) understanding. When we understand the causal relations between historical events, processes, and practices, i.e., when we understand the causal nexus of the past, we have explanatory understanding in historiography. Even if there are other forms of historical understanding, explanatory understanding certainly is one of the most central forms. In fact, it would not be too far-fetched to claim that, if we wish to stay faithful for the historical order of things in our understanding, we should first understand the causal relations between historical events, processes, and practices and only then ask how to name and classify historical phenomena. The ontological structure of the history is certainly much more important and interesting than our conceptual machinery.

References

Ashplant, T.G. & Wilson, Adrian (1988). ”Present-Centred History and the Problem of Historical Knowledge”. *The Historical Journal* 31 (2). 253–274.

Beebee, Helen & Hitchcock Cristopher & Price, Huw. (2017). *Making a Difference: Essays on the Philosophy of Causation*. Oxford University Press.

Bellon, Richard (2011). "Inspiration in the Harness of Daily Labor: Darwin, Botany, and the Triumph of Evolution, 1859–1868". *Isis: A Journal of the History of Science* 102. 393-420.

Bergwik, Staffan & Holmberg, Linn (2020): "Concluding reflections. Standing on whose shoulders?". In Östling, J. & Larsson Heidenblad, D. & Nilsson Hammar, A. (eds.) *Forms of Knowledge*.

Boudry, Maarten & Pigliucci, Massimo (2013A). *Philosophy of Pseudoscience: Reconsidering the Demarcation Problem*. University of Chicago Press.

Burke, Peter. 2020. "Response". *Journal for the History of Knowledge* 1 (1)

Chang, Hasok (2009) "We Have Never Been Whiggish (about Phlogiston)". *Centaurus* 51 (4). 239–264.

Chang, Hasok (2021). "Presentist History for Pluralist Science". *Journal for General Philosophy of Science / Zeitschrift für Allgemeine Wissenschaftstheorie* 52 (1). 97-114.

Cohen, H. Floris (2010). *How Modern Science Came into the World: Four Civilizations, One 17th-Century Breakthrough*. Amsterdam University Press.

Cunningham, Andrew (1988). "Getting the game right: Some plain words on the identity and invention of science". *Studies in History and Philosophy of Science Part A* 19 (3). 365–389.

Daston, Lorraine (2009). "Science Studies and the History of Science". *Critical Inquiry* 35 (4). 798–813.

Daston, Lorraine. (2017). "The history of science and the history of knowledge". *KNOW: A Journal on the Formation of Knowledge* 1 (1).

Dear, Peter (2005). "What Is the History of Science the History Of?". *Isis* 96 (3):390-406.

Dear, Peter (2012). "Science Is Dead; Long Live Science." *Osiris* 27 (1). 37–55

Findlen, Paula (2005). "The Two Cultures of Scholarship?". *Isis* 96 (2) 230–237.

Glennan, Stuart (2010). “Ephemeral Mechanisms and Historical Explanation”. *Erkenntnis* 72 (2):251-266.

Hall, A. Rupert (1983). ”On Whiggism”. *History of science*, xxi. 45–59.

Hansson, Sven Ove (2013). “Defining Pseudoscience and Science”. In Boudry & Pigliucci (eds.) *Philosophy of Pseudoscience: Reconsidering the Demarcation Problem*. University Of Chicago Press. 61-77

Hull, David (1979). “In Defense of Presentism”. *History and Theory* 18 (1) 1–15.

Jardine, Nick (2000). “Uses and abuses of anachronism in the history of the sciences”. *History of Science* 38 (3). 251-270.

Krige, John (2001). “Distrust and Discovery: The Case of the Heavy Bosons at CERN”. *Isis* 92 (3).

Kuhn, Thomas S. (1970). *The Structure of Scientific Revolutions* [2nd ed.]. The University of Chicago Press.

Kuukkanen, Jouni-Matti. (2015). *Postnarrativist Philosophy of Historiography*. Palgrave Macmillan UK.

Laudan, Larry (1983). “The Demise of the Demarcation Problem”. Cohen, R. S. & Laudan, L. *Physics, Philosophy and Psychoanalysis*. Springer Netherlands.

Menzies, Peter (2004). “Difference-making in context”. In J. Collins, N. Hall & L. Paul (eds.), *Causation and Counterfactuals*. MIT Press. 139-180.

Moro-Abadia, Oscar (2009). “Thinking about 'presentism' from a historian's perspective: Herbert Butterfield and Hélène Metzger”. *History of Science* 47 (1) 55–77.

Mulsow, Martin (2018). “History of Knowledge”. In Burke, P & Tamm, M. (eds.) *Debating New Approaches to History.*

Oreskes, Naomi (2013). “Why I Am a Presentist”. *Science in Context* 26 (4). 595-609.

Parssinen, T. (1974) “Popular science and society: The phrenology movement in early Victorian Britain”. *Journal of Social History* 8 (1). 1–20.

Pickstone, John V. (1995). “Past and present knowledges in the practice of the history of science”. *History of Science* 33 (100):203–224

Pigliucci, Massimo & Boudry, Maarten (2013B). “Introduction: Why the Demarcation Problem Matters”. In Boudry & Pigliucci (eds.) *Philosophy of Pseudoscience: Reconsidering the Demarcation Problem*. University of Chicago Press. 1-6

Psillos, Stathis (1999). *Scientific Realism: How Science Tracks Truth*. Routledge.

Psillos, Stathis (2012). ”What is General Philosophy of Science?”. J*ournal for General Philosophy of Science / Zeitschrift für Allgemeine Wissenschaftstheorie* 43 (1). 93–103.

Rée, Jonathan (1991). "The Vanity of Historicism." *New Literary History* 22, no. 4. 961-83

Renn, J. (2015). “From the History of Science to the History of Knowledge – and Back”. Centaurus, 57: 37–53

Schickore, Jutta (2011). ”More Thoughts on HPS: Another 20 Years Later”. *Perspectives on Science* 19 (4). 453–481.

Shapin, Steven & Schaffer, Simon (1985). *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*. Princeton University Press.

Shapin, Steven (2005). “Hyperprofessionalism and the Crisis of Readership in the History of Science”. *Isis* 96 (2). 238–243

Tosh, Nick (2003). ”Anachronism and retrospective explanation: In defence of a present-centred history of science”. *Studies in History and Philosophy of Science* 34A. 647–659.

Virmajoki, Veli (forthcoming). ”What Should We Require from an Account of Explanation in Historiography?”. *Journal of the Philosophy of History*.

Virmajoki, Veli (2018). “Could Science Be Interestingly Different”. *Journal of the Philosophy of History* 12 (2).

Westfall, Richard S. (2000). ”The Scientific Revolution Reasserted”. In Osler, Margaret J. (ed.) *Rethinking the Scientific Revolution*. Cambridge University Press. 41-55.

Östling, Johan, and Larsson Heidenblad, David. 2020. “Fulfilling the Promise of the History of Knowledge: Key Approaches for the 2020s”. *Journal for the History of Knowledge* 1 (1).