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## **gaston bachelard and contemporary philosophy**

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There are philosophers whose name sounds familiar, but who very few people know in more than a vague sense. And there are philosophers whose footprints are all over the recent history of philosophy, but who themselves have retreated somewhat in the background. Gaston Bachelard (1884-1962) is a bit of both. Without doubt, he was one of the most prominent French philosophers in the first half of the 20th century, who wrote over twenty books, covering domains as diverse as philosophy of science, poetry, art and metaphysics. His ideas profoundly influenced a wide array of authors including Georges Canguilhem, Gilbert Simondon, Roland Barthes, Michel Foucault, Bruno Latour and Pierre Bourdieu. Up until the 1980s, Bachelard's work was widely read by philosophers, scientists, literary theorists, artists, and even wider audiences and in his public appearances he incarnated one of the most iconic and fascinating icons of a philosopher.

And yet, surprisingly, in recent years the interest in Bachelard's theoretical oeuvre seems to have somewhat waned. Apart from some recent attempts to revive his thinking, the philosopher's oeuvre is rarely discussed outside specialist circles, often only available for those able to read French.<sup>2</sup> In contemporary Anglo-Saxon philosophy the legacy of Bachelard seems to consist mainly in his widely known book *Poetics of Space*. While some of Bachelard's contemporaries, like Georges Canguilhem or Gilbert Simondon (see *Parrhesia*, issue 7), who were profoundly influenced by Bachelard, have been rediscovered, the same has not happened for

Bachelard's philosophical oeuvre.

This special issue aims to redress the balance and to open up his work beyond a small in-crowd of experts and aficionados in France. It aims to stimulate the discovery of new and understudied aspects of Bachelard's work, including aspects of the intellectual milieu he was working in. Fortunately, for this purpose we were able to rely both on renowned Bachelard specialists, such as Hans-Jörg Rheinberger, Cristina Chimisso and Dominique Lecourt, as well as on a number of younger scholars who are discovering their work in a different intellectual context. At the same time we also want to reassess the value of this oeuvre, which also entails examining the reasons and causes of the relative neglect of Bachelard's work in recent times. Has it exhausted its possibilities? Does it have intrinsic limitations that have contributed to the eclipse, as some influential, mainly French, philosophers have more or less explicitly suggested?<sup>3</sup>

Thus we want to open a discussion about the legacy of Bachelard's colourful and multifaceted philosophy, not in order to idolize it, but to rethink the potential relevance of his work for contemporary debates. For while—as with every interesting philosophical oeuvre—there may be good reasons to critically reconsider Bachelard's thinking, there are no good reasons, we claim, to *forget* about Bachelard. He remains one of the most fascinating and productive figures of twentieth century thought. Throughout his oeuvre Bachelard has launched provocative and novel ideas on the then newest scientific developments as well as on the elements and dynamics of the poetic imagination, and he addressed important metaphysical subjects such as the philosophy of time. He gave us concepts such as *phénoménotechique*, *surrationalisme*, *rhythmanalyse*, *métapoétique*, *rupture épistémologique*, *intermatérialisme*, or *obstacle épistémologique*.

To open this debate we have chosen for a twofold approach. On the one hand it traces the manifold afterlives of concepts coined by Bachelard to uncover how his theoretical oeuvre still (explicitly or implicitly) permeates contemporary debates. On the other hand, we revisit concepts and theoretical constellations of Bachelardian origin that have disappeared in the folds of history to see whether and how these concepts could help us rethink contemporary debates in philosophy, science and technology studies, literature theory and cultural studies. Such a twofold approach will allow us both to assess in what way Bachelard's thought can still be relevant today but also what must be taken into account if one wants to understand what is at stake in contemporary French philosophy.

## THE LIFE AND WORK OF BACHELARD

A superficial look at his biography already makes clear that Bachelard never followed standard trajectories. Born on 27 June 1884 in Bar-sur-Aube, at the border between Champagne and Burgundy, he starts his career as a postmaster in his hometown. He performs his military service in telegraphy. This job also brings him to Paris in 1907. At the same time, he starts studying mathematics and natural science. Just before his mobilization for the First World War, he marries Jeanne Rossi, a teacher from his hometown. Bachelard stays for more than four years at the war front. His young wife will die shortly after the war, leaving him a daughter, Suzanne Bachelard. A less well-known fact is that in the fifties and until the eighties, Suzanne Bachelard would also become an important philosopher and epistemologist in her own right, working at the interface of philosophy of science and phenomenology. From the twenties on, the Bachelards will always be together, discussing and influencing each other's ideas, dividing their time between Paris and Burgundy.

In the years after the Great War, Bachelard teaches physics and chemistry in Bar-sur-Aube. Simultaneously, however, he debarks on a study of philosophy, resulting in his *agrégation* in 1922 and his doctorate in 1927 (*thèses* supervised by Abel Rey and Léon Brunschvicg). Shortly afterwards, aged 46, he takes up a position at the university of Dijon.

Bachelard's early work is mainly situated within the philosophy of science, and focuses on physics and chemistry. He is especially interested in the recent conceptual revolutions in 20<sup>th</sup> century physics, relativity and quantum mechanics, and their consequences for science's epistemology (*épistémologie*, in the French sense of the term).<sup>4</sup> Apart from detailed studies of specific phases of the history of science, or the early phases of thermodynamics, his most famous books written in the thirties are *Le Nouvel esprit scientifique* (1932) and *La Formation de l'esprit scientifique* (1938). Already in the former it becomes clear that Bachelard's take on epistemology is not a standard one. Notwithstanding the fact that he clearly knows his classics,<sup>5</sup> Bachelard introduces new elements and a new style in the philosophy of science from the start.

Already in *Le Nouvel esprit scientifique*, for instance, Bachelard denies the classic division of labor and territories between philosophy and the human and cultural sciences with respect to the study of knowledge and science. This denial is not

just a theoretical principle, but influences the way he proceeds, exemplified in the exposition of his cases. Bachelard was not the first to blend the history and the philosophy of science, with a little help from the young sciences of man, in fact he may have been inspired in this by his supervisor Brunshvicg. But the way in which the psychology and pedagogy of science intervene in Bachelard's philosophical texts about science, is undeniably inspired by Bachelard's experiences of teaching science to *lycéens* and makes it very concrete and productive. What is at stake is the mindset of the pupil of science, including all the pre-reflexive elements, the 'pre-judgements' that are present in it, and that set *obstacles* for a real understanding of physical and chemical phenomena. Breaking away from transmitted intuitions about a phenomenon, it has to be understood, i.e. to be captured in the net of new and rigorous concepts. Phenomena, moreover, have to be produced, and this is what happens in an experiment that is foremost a technical manipulation intervening in nature, creating effects—a *phénoménotechnique* rather than a phenomenology.

In the 1938 book, *La Formation de l'esprit scientifique*, the notion of 'epistemological obstacle' becomes the focus of Bachelard's attention. Bachelard embarks on a new approach to epistemology that encompasses a 'psychoanalysis of objective knowledge' directed towards the description of the imaginary resistances and fixations that stand in the way of the desired real knowledge of the phenomenon that intrigued us in the first place. Images that occupy the mind are such obstacles. For instance, the image that impels us to see the essence of the phenomenon in terms of *substances*—the element of fire as the substance of heat that is later on in late eighteenth century French chemistry replaced by the fluid called caloric—or the *animist* image of an organism as directed by an *entelecheia*. Prejudices like these are also associated with such obstacles, such as the belief that *general* philosophical knowledge should be more fundamental than specialized inquiry, or with *verbal* obstacles, like seeing a word as the expression of an essence, as in Molière's famous parody of the *virtus dormitiva* of opium. In *When memory flows into reason* the notion of an epistemological obstacle is revisited by Jan Maršálek in order to stress the relevance of the distinction between an epistemological obstacle in the transition of prescience to science, and a similar but distinct type of obstacle that emerges in mature scientific fields.

The aims and tasks now ascribed to epistemology are twofold: on the one hand analyzing obstacles retarding the development of objective knowledge; on the other, showing how the dialectic, even polemical work of rationality—the application of

rigorous concepts and technical manipulations of phenomena in experiments for instance—counteracts against the forces of the imaginary. This results in a new kind of open and dynamic rationalist view, devoid of any desire to settle down in a philosophical system. Science should not be patronized by philosophical *a priori*s. But Bachelard does not just advocate a ‘purification’ of scientific knowledge from all pre-scientific practices, denouncing for instance how the persistent temptation for the primal alchemistic intuition impedes the birth of real chemistry. While denouncing substantialist and other images as false origins of knowledge, Bachelard at the same time calls for a study of the imaginary reality of the natural ‘elements’ in their own right. In this view, the four elements of the first so-called philosophies of nature are the basic ingredients for an imaginative conception of the material universe. Bachelard does not connect these elements to nature itself, but to nature as it is imagined and experienced in literary texts invoking natural phenomena, or in daydreams. Which is to say the elements are elements of poetic imagination, that also must be studied independently. The ‘discovery’ of these elements through a kind of epistemic ‘psychoanalysis’ is not only an occasion for the rationalist’s verdict on the obstacles, but also a starting point for a specific study of the imagination, that will take shape in a second series of works in a new genre, the poetics of the imagination. Each of these well-known monographs circle around special clusters of images and metaphors, gathered from Bachelard’s readings of poets and novelists who are drawn to peculiar elements as machines that produce specific types of metaphors. The volume on fire, *Psychanalyse du feu*, 1938 is almost a companion volume to *La Formation*, others are devoted to air, water, and earth. Apart from the elements, Bachelard also studies imaginary objects as small and imperceptible as a candlelight (*La flamme d’une chandelle*, 1961) and as pervasive as space (*La Poétique de l’espace*, 1957), and phenomena ranging from work (*travail*), to dream (*rêve, reverie*), the will (*La Terre et les rêveries de la volonté*, 1948) and rest (*La Terre et les rêveries du repos*, 1946).

In the early thirties Bachelard also wrote two intriguing books that can be situated in between his epistemological and poetical works: *L’intuition de l’instant* (1932) and *La dialectique de la durée* (1936). Here he advances the intriguing thesis that time is constructed out of singular instants: if anything deserves to be called real and immediate, it is the instant. The temporal continuum is only a temporal construction, an assemblage of instants that are strung together. This is a complete reversal of the, at the time, immensely popular Bergsonian philosophy of duration, where the instantaneous moment was considered as a secondary construction (and a spatialized fixation, for that matter, linked to clock time) abstracted

from the only reality, the continuous flow of duration.

At the beginning of the Second World War, in 1940, Bachelard receives a professorship at the Sorbonne in the history and philosophy of science, as the successor of Abel Rey.<sup>6</sup> During the war, Bachelard also takes up Rey's presidency of the *Institut d'histoire des sciences et des techniques* in Paris (later called *Institut d'histoire et de philosophie des sciences et des techniques*, currently a CNRS group within the framework of Paris-I). At the same time, he is increasingly well-known for his series of books on poetics. While this may add up to a somewhat strange public image, there is no chronological break between the poetical and the epistemological Bachelard. He continues to write three more works on the philosophy of science: *Le rationalisme appliqué* (1949), *L'activité rationaliste de la physique contemporaine* (1951), and *Le matérialisme rationnel* (1953) along with his work on poetics. Evidently, Bachelard's firm belief that poetic imagination should be separated from scientific thought did not refrain him from working in both fields, never ceasing to express his unrestricted admiration for his two types of heroes: the scientist and the poet.

Eventually, Bachelard retires in 1954, with Georges Canguilhem as his successor at the Sorbonne as well as at the *Institut d'histoire et de philosophie des sciences et des techniques*.<sup>7</sup> In 1955, Bachelard is elected as a member of the *Académie des sciences morales et politiques* and he continued writing until his death on 16 October 1962 in Paris. Among his latest works is *La Poétique de l'espace* (1957), a book that, possibly under the influence also of his daughter, brought him closer to phenomenology. This book would make him posthumously famous outside the French-speaking world. At the end of his life, he was also working on a complete revision of the very first of his 'psychoanalytic files,' the one on fire. Suzanne Bachelard posthumously edited these reflections in *Fragments d'une poétique du feu* (1988), about, among other things, resurrection and the figure of the phoenix, a forgotten mythical persona rising from the ashes of oblivion—who symbolizes our current undertaking...

## THE FRENCH RECEPTION OF BACHELARD'S WORK

To fully grasp the importance of Bachelard's oeuvre, its reception both in France and abroad must be taken into account. Although he was very productive since the end of the 1920s, the first more substantial reception of his work occurs after the Second World War. Apart from occasional brief mentions and references, the

first real articles on his work would only date from the 1950s, for instance by Jean Hyppolite or in Bachelard's *liber amicorum*, published in 1957.<sup>8</sup> Of course, this does not mean that his work went unnoticed before: Bachelard was very present and well-known among his colleagues, students and friends—presumably too present to already become an object of study. And, despite the fact that Paris was more inclined towards existentialism in those years, his classes were massively attended, by students, scientists and artists.

It is evident that the initial interest for Bachelard in France was divided between his epistemology and his work on imagination. In the 1960s there were major publications on Bachelard's views of the imaginary and *rêverie*.<sup>9</sup> Many of these publications are linked with the French New Criticism or *nouvelle critique*, with authors such as Roland Barthes, who saw Bachelard as one of their main inspirations. At the same time Bachelard's writings on historical epistemology and philosophy of science were picked up by a new generation of philosophers and scientists. Authors such as Georges Canguilhem or François Dagognet wrote early studies on his philosophy of science.<sup>10</sup> Similarly, many of his epistemological concepts played a role in the work of Alexandre Koyré, Jean-Toussaint Desanti or Michel Foucault. Foucault, for example, famously placed Bachelard on “the line that separates a philosophy of experience, of sense, and of subject and a philosophy of knowledge, of rationality and of concept” where “one network is that of Sartre and Merleau-Ponty” while the other is “that of Cavailles, Bachelard and Canguilhem.”<sup>11</sup>

Considering the case of Foucault already makes clear that Bachelard's influence is not limited to thought about the natural sciences, but that his work proved to be a productive philosophy for the social sciences as well. This is also clear in the work of Gilles-Gaston Granger, student of Bachelard and Cavailles, who applied insights from Bachelard, combined with structuralism and analytic philosophy, to the philosophy of the social sciences.<sup>12</sup> But equally unexplored is Bachelard's legacy in fields like sociology, through the work of authors such as Georges Gurvitch and Pierre Bourdieu. The latter's ‘handbook’ for sociology, has, for instance, been described as “almost exclusively built on Bachelard's philosophy of science.”<sup>13</sup> Although Bruno Latour himself expressed it as criticism of Bourdieu's work, this remark does not seem unwarranted. Latour is part of a new generation of Francophone philosophers of science that critically revisit Bachelard's work. This is especially true for Michel Serres, one of Latour's main sources of inspiration. Serres started out as a master student of Bachelard, but became very critical from the 1970s onwards. A good example of his critique can be found in the text

*The Reformation and the Seven Sins* (“*La Réforme et les sept péchés*”), for the first time translated in this special issue, in which Serres critiques his former tutor’s wish to subject epistemic practices to a thorough purification before they could aspire to be conceived of as science. Similar criticisms and attitudes can be found in the work of Latour and Isabelle Stengers.

Bachelard’s work was also mobilized in a somewhat surprising context: Marxism. Louis Althusser, the new rising star of the left and a student of Bachelard, used Bachelard’s ideas to support his radically new view on Marx’s oeuvre, claiming that there exists a fundamental divide between the early humanist writings of Marx and his later ‘scientific’ work. To define this divide, Althusser invoked a notion from Bachelard’s work: the epistemological break (*coupure épistémologique*). Although Bachelard himself never used the notion of ‘break’ (*coupure*) and only rarely that of ‘rupture,’ the term suddenly came to be conceived of as one of the philosopher’s main concepts.<sup>14</sup> Many authors have, based on more or less the same ‘argument’ (but not for the same reasons) considered Bachelard as a Kuhnian-*avant-la-lettre*: this observation already suffices to seriously question the significance of analogies of the kind.<sup>15</sup> It is a fact that at least two types of discontinuities play an important role in Bachelard’s own epistemology: the ‘synchronic’ discontinuity between science and common sense (or primary intuitions), and the ‘diachronic’ discontinuity separating prescientific phases of a field of epistemic activity from the scientific stage (from which, in turn, a ‘new scientific mindset’ would eventually emerge). In his contribution about the relation between Bachelard and Althusser, *David Maruzzella* argues that although the early Althusser was inspired by Bachelard, his philosophy paradoxically became more truly Bachelardian in his later work, when he breaks with his earlier epistemological ambitions in order to pursue a more political project.

In the 1960s and 70s, the work of Bachelard was thus suddenly drawn into the center of the philosophical debates in France, including the larger discussion on Marxism and Structuralism.<sup>16</sup> Althusser took up a leading role in the development of a scientific reformulation and regeneration of Marxism by proposing that Marxism become Structuralism, in the hope that, this way, Structuralism would become Marxism. Other students of Althusser soon took up the notion of *coupure*, and/or *rupture* attributed to Bachelard.<sup>17</sup> One of those students was Dominique Lecourt, who wrote his doctoral thesis *L’epistemologie historique de Gaston Bachelard* under the supervision of Canguilhem, The companion volume *Bachelard ou Le jour et la nuit* would define the way Bachelard has been read in the 70s and



the 80s as a crypto-Marxists thinker.<sup>18</sup> In “Anti-Bachelardianism in Contemporary French Philosophy” Lecourt himself historically contextualizes and critically reflects on this kind of once dominant reading of Bachelard, and argues that the time has come to develop a more complex understanding of the latter’s significance. Lecourt’s writings have also played an important role in the strict division of Bachelard’s thinking into epistemological work, or ‘Bachelard of the day,’ and his writing on poetical imagination, the ‘Bachelard of the night.’<sup>19</sup> As a result, many authors who have taken up Bachelard’s work focus only on half of his work, ignoring the other part.

In recent years, however, we can witness a countermovement in France. A range of authors has refused to reduce Bachelard to either an epistemologist or an aesthetic theorist highlighting instead the metaphysical and philosophical theories that fuel his thinking in both domains. This has been one of the main merits of the work of Jean-Jacques Wunenburger, linked with the International Gaston Bachelard Association (*Association Internationale Gaston Bachelard, A.I.G.B*), founded in 1984.<sup>20</sup> From 1998 onwards, the association has also been publishing a range of *Cahiers Gaston Bachelard*, dealing with specific topics ranging from Bachelard’s relation to German philosophy, to the influence of psychoanalysis on his work. One of the most productive discussions in this context has been a revived interest in Bachelard’s metaphysically oriented works, such as *L’intuition de l’instant* and *Dialectique de la durée*. Bachelard’s philosophy of time influences both his subsequent writings on epistemology and on imagination. Entering into a polemical debate with the work of Henri Bergson, Bachelard develops a time that is dialectical and discontinuous. The fierceness of his tone, however, raises questions to what extent his own work is indebted to Bergson.<sup>21</sup> In “Towards an Interdisciplinary Anthropology?” Johannes D.M. Schick focuses on the similarities in the thinking of Bachelard and Bergson, and Georges Simondon as a figure who allows for an escape from the theoretical deadlock between the two contemporaries. In “Becoming Rhythm,” *Jonas Rutgeerts* proposes a more nuanced understanding of the polemical discussion between Bergson and Bachelard by exploring the importance of the notion of rhythm in both philosophical systems.

Another of Bachelard’s notions that blurs the distinction between science and art—day and night—is *surrationalism*. Bachelard launched the term in a text of 1936, and it pops up in later texts, such as in his *Philosophie du non* (1940). Next to its obvious reference to surrealism (a movement Bachelard had frequented for some years), the term is also closely linked to Bachelard’s idea of an ‘open ratio-

nalism.' In Bachelard's view, the rationality of science is a dynamic and open one, operating in the modus of a permanent rectification of concepts and theories. Such a dynamic openness can be found both in his work on science and in that of poetics. The thesis has been taken up again in a recent book by Zbigniew Kotowicz, who argues that for Bachelard philosophy "is not the business of contemplating reality but of surpassing it."<sup>22</sup> Kotowicz also provides an English translation of the text on surrationalism as an appendix to his first chapter. Massimiliano Simons' text "Surrationalism after Bachelard" takes up this notion in order to re-read the relation between Bachelard and Michel Serres, with a focus on the latter's early project of writing about the *nouveau nouvel esprit scientifique*, an attempt to update Bachelard through new scientific findings in information theory and molecular biology. Through this attempted update Serres would come to one of his later criticisms of Bachelard. Simons shows that, despite Serres' self-proclaimed turn away from Bachelard, there are still significant parallels between Serres and his predecessor.

## THE ANGLO-SAXON RECEPTION OF HIS WORK

The reception of Bachelard's work abroad, especially in the Anglo-Saxon context is probably even more capricious than the French one.<sup>23</sup> Bachelard himself has hardly published anything in English, except for a text in a *Festschrift* for Albert Einstein.<sup>24</sup> The Anglo-Saxon world therefore had to rely on secondary works and translations, both profoundly coloring its reception.

One of the elements that heavily influenced the Bachelard reception in the Anglo-Saxon world is the fact that, while all the major works on poetics and imagination have been translated early on, Bachelard's epistemological works have only slowly and selectively found their way to Anglophone audiences.<sup>25</sup> The first translations of *The Poetics of Space* and *The Psychoanalysis of Fire* (both in 1964) were followed by *The Philosophy of No*, dealing with epistemology, in 1968. In 1981, inspired by its director Joanne H. Stroud, the Dallas Institute of Humanities and Culture contracted a project with the editor José Corti to translate all of Bachelard's books on the imagination. This resulted in eight additional translations, such as *Air and Dreams: An Essay on the Imagination of Movement* (1988), *The Flame of a Candle* (1989) and *The Right to Dream* (1990). During this period, no epistemological works were translated, except for *The New Scientific Spirit*, appearing in 1988.

Only more recently, a few new translations have been published, such as *The Formation of the Scientific Mind* (2002), *Intuition of the Instant* (2013), and *Dialectic of Duration* (2018).<sup>26</sup> However, several of Bachelard's major books in philosophy of science are to this date not yet available for international audiences. In the Anglo-Saxon context, this situation has contributed to an image of his work as only or largely dealing with imagination and literature. Taking at least a small step to overcome this lacuna, this special issue includes the translation of the first chapter of *Intuitions Atomistiques* (1933): "The Metaphysics of Dust" in which Bachelard analyses the various shapes of dust and their relation to a philosophy of atomism. Written in 1933, in between *L'Intuition de l'instant* and *La Dialectique de la durée*, Bachelard's essay on atomism can be seen as one of his first ventures into metaphysics. At the same time, however, it also prefigures Bachelard's passion for poetic imagery. Despite the fact that Bachelard condemns the "traditional principles of atomism" for being essentialist, i.e. ascribing essential characteristics to the atoms, and advocates to replace this essentialist vision with a mathematical one, in which the atoms derive their properties from their constellation, "The Metaphysics of Dust" still displays a great interest in all those traditional versions of atomism. Rather than simply brushing over obsolete ideas, Bachelard describes the image of dust in great detail. Here, we can already witness the germs of his fascination for the 'natural elements' to which he will devote several books.

In the Anglo-Saxon secondary literature, a second bias can be pointed at. It has, for instance, been proven crucial that one of the first books on Bachelard available in English was precisely a translation of the work of Dominique Lecourt.<sup>27</sup> Together with early translations of Althusser's own work, such as *For Marx* (in 1969) and *Reading Capital* (in 1970), Lecourt's book has contributed the incorrect view that Bachelard himself was a Marxist-inspired philosopher of science and even led some to claim that Bachelard's work aimed to "portray scientists as a proletariat exploited by bourgeois philosophers who held them accountable to standards not of their own making."<sup>28</sup>

A similar bias exists within the field of Science and Technology Studies (STS), due to the fact that many of Latour's books were available in English long before those of Bachelard. In *Laboratory Life* (1979), written together with Steve Woolgar, Latour introduces the notion of *phénoménotechnique* to argue that within scientific practices it "is not simply that phenomena depend on certain material instrumentation; rather, the phenomena are thoroughly constituted by the material setting of the laboratory."<sup>29</sup> According to some, the result was an incorrect "association,

made by social constructivists, between phenomenotechnique and their own claims concerning the socially determined character of scientific practices.”<sup>30</sup> In “Gaston Bachelard’s Philosophy of Science: Between Project and Practice” Bas de Boer looks at contemporary debates into science studies through the lens of phenomenotechnique. With Bachelard, de Boer stresses that science is neither completely ahistorical and rational, nor completely situated and constructed. Rather, science is the particular execution of a universal project.<sup>31</sup>

In light of this, Bachelard’s work has been taken up by a range of scholars under the banner of ‘historical epistemology,’ for instance in the work of Ian Hacking or Hans-Jörg Rheinberger.<sup>32</sup> The notion of phenomenotechnique is one of the central Bachelardian concepts in this tradition and demonstrates an interesting tension between historical epistemologists and STS. Whereas the first group tends to be positive about Bachelard, the second has become quite critical, although both groups do not necessarily diverge substantially about the positions they defend. Thus it remains an open question to what extent there is an actual conflict between Bachelard and fields such as ‘science studies’ or to what extent they could enrich one another.<sup>33</sup>

Within STS, however, the notion of phenomenotechnique has also been linked to another concept, that of ‘technoscience,’ often falsely attributed to Bachelard.<sup>34</sup> The concept of ‘technoscience’ itself was originally coined by Gilbert Hottois in the 1970s, but was later popularized by authors such as Jean-François Lyotard and Latour, both partly inspired by Bachelard.<sup>35</sup> Technoscience refers to how science is always linked with applications and with broader societal goals, such as efficiency and performativity. Bachelard himself never used the concept, but it approximates some of his ideas related to *phenomenotechnique* and his ‘applied rationalism.’ On the one hand, the role of concepts and theories within the contemporary sciences is highlighted, on the other hand, concepts and theories can no longer be clearly demarcated from technical applications and conditions.

In “The new axiomatic method: Bachelard on the meaning and deformation of concepts,” *Boris Demarest* stresses that one must be weary of all-too facile equations such as of phenomenotechnique with technoscience. Instead, Demarest argues that for Bachelard phenomenotechnique must be linked first of all to concept formation, which must be understood in connection with David Hilbert’s axiomatic method. For Demarest, contemporary re-readings of notions such as phenomenotechnique ought to be subjected to a substantial dose of skepticism.

## WHAT CAN WE LEARN FROM BACHELARD TODAY?

Given this state of the art, numerous questions can be raised about the influences, interactions and relations of Bachelard and his contemporaries, subsequent generations, and broader scientific and cultural developments. As with Bergson, one may wonder how Bachelard's philosophy relates to classic authors such as Descartes, Spinoza, Hegel or Nietzsche, all of whom seem to play a role in Bachelard's work and are occasionally referred to by him. Similar questions can be raised about interactions with his contemporaries and immediate predecessors or successors, such as Léon Brunschvicg, Emile Meyerson, Jean Cavailles, Ferdinand Gonseth or Hélène Metzger. And how to estimate Bachelard's use of then recent scientific domains such as quantum mechanics and the theory of relativity? His 'new scientific spirit' was nothing else than an attempt to grasp the novelty of these new sciences. But how to map his interpretation of these novel sciences among the many possible (and actual) interpretations that have been given? What about his comments on the scientific and philosophical views of, for example, Einstein or Louis de Broglie? What about his views on earlier phases of sciences, *e.g.* on sciences that already took their great leap forward before the advent of the so-called new scientific spirit? Chemistry, for instance, was crucial in the education of Bachelard and many of his contemporaries, such as Meyerson, Metzger and Duhem, or more recently, François Dagognet, Isabelle Stengers and Bernadette Bensaude-Vincent.<sup>36</sup>

Then again, this is not a plea to just shift the focus back to the context of epistemology: similar questions must be asked about Bachelard's attitude towards psychoanalysis, existentialism or phenomenology. It is important even to look beyond the field of philosophy proper, and review Bachelard's relations with artists and scientist. In his article, Rheinberger attempts to analyze one of those 'external relations,' as he explores the fruitful collaboration between the French philosopher and the relatively unknown engraver Albert Flocon. This will hopefully stimulate a contemporary audience to not only consider Bachelard's 'new scientific spirit' in relation to the cultural, philosophical and scientific developments of his own time, but also in relation to the sciences and cultures as they are happening, in our time and into the future.

## NOTES

1. This special issue and several of its contributions result from a bilingual conference entitled ‘Bachelard Today/Bachelard Aujourd’hui: Gaston Bachelard and Contemporary Philosophy,’ held at the Institute of Philosophy (Hoger Instituut voor Wijsbegeerte, HIW) at the KU Leuven, Belgium at 24 and 25 April 2017. The contributors were Francesco Carpanini (University of Bologna), Cristina Chimisso (Open University), Paul Cortois (KU Leuven), Bas De Boer (University of Twente), Boris Demarest (University of Amsterdam), Lucie Fabry (ENS), Gilles Hieronimus (Université de Lyon III), Julien Lamy (Université de Lyon III), Jan Maršálek (Institute of Philosophy of the Academy of Sciences of the Czech Republic), David Maruzzella (DePaul University), Julien Pieron (Université de Liège), Hans-Jörg Rheinberger (Max Planck Institute for the History of Science), Jonas Rutgeerts (KU Leuven), Ilaria Salonna (University of Warsaw), Johannes Schick (a.r.t.e.s. Graduate School for the Humanities Cologne), Massimiliano Simons (KU Leuven) and David Webb (Staffordshire University). An additional word of thanks goes to Florence Caeymaex (Université de Liège), Jens De Vleminck (University of Ghent), Darian Meacham (Maastricht University), Jonathan Sholl (Aarhus University), Getrudis Van de Vijver (University of Ghent), Maarten Van Dyck (University of Ghent) and Hanna Vandebussche (KU Leuven) for contributing to the organization of the conference. Finally, we wish to thank the Institute of Philosophy, KU Leuven and the Flanders Research Foundations (FWO) for their financial support.
2. See for example, Cristina Chimisso, *Gaston Bachelard: Critic of science and the imagination*. London: Routledge, 2001; Zbigniew Kotowicz, *Gaston Bachelard: A Philosophy of the Surreal*. Edinburgh: Edinburgh University Press, 2016; Roch Smith, *Gaston Bachelard, Revised and Updated: Philosopher of Science and Imagination*. SUNY Press, 2016; Eileen Rizo-Patron, Edward S. Casey, Jason M. Wirth (eds.), *Adventures in Phenomenology: Gaston Bachelard*, New York: SUNY, 2017; Miles Kennedy, *Home: A Bachelardian Concrete Metaphysics*, Oxford: Peter Lang, 2011.
3. See Bruno Latour, *We Have Never Been Modern*. Cambridge (Mass.): Harvard University Press, 1993; Michel Serres and Bruno Latour, *Conversations on science, culture and time*. Ann Arbor: Michigan university press, 1995.
4. *I.e.*, as ‘history and philosophy of [the] science[s],’ rather than as a general theory of knowledge.
5. One specific ‘classic’ that has a major influence on Bachelard’s work was his teacher Léon Brunschvicg (1869-1945). Recently scholars seem to come to agree that Bachelard was much more influenced by his master than was earlier thought, See e.g. Cristina Chimisso, “From phenomenology to phenomenotechnique” in *Stud. Hist. Phil. Sci* 39(2008), p. 384-392, §2.
6. Bachelard’s daughter Suzanne is at that moment one of the prominent pupils of his friend Jean Cavaillès, the mathematical philosopher and Resistance hero who was killed in 1944: among these pupils are such fellow epistemologists and philosophers of science as Gilles Gaston Granger, Jean-Toussaint Desanti, Tran duc Thao, and Jules Vuillemin. A select club of Bachelard’s and Cavaillès’ students and friends (notably also Albert Lautman, killed in 1943, aged 36, and posthumously one of the important inspiring figures for Gilles Deleuze) has been involved in far-reaching clandestine activities at that time.
7. Canguilhem was himself succeeded there by Suzanne Bachelard in 1972.
8. Jean Hyppolite, “Gaston Bachelard ou le romantisme de l’intelligence,” *Revue Philosophique de la France et de l’Étranger*, 144 (1954) : 85-96 ; *Hommage à Gaston Bachelard : études de philosophie et d’histoire des sciences*. Eds. Georges Bouligand, P. Costabel and Georges Canguilhem. Paris : PUF, 1957.

9. Micel Mansuy, *Gaston Bachelard et les éléments*. Paris : Corti, 1967; François Pire, *De l'imagination poétique dans l'œuvre de Gaston Bachelard*, 1967; Jacques Gagey, *Gaston Bachelard ou La conversion à l'imaginaire*. Paris : Rivière, 1969; Julien Naud, *Structure et sens du symbole: L'imaginaire chez Gaston Bachelard*. Tournai : Desclée, 1971.
10. Georges Canguilhem, "L'Histoire des Sciences dans l'œuvre épistémologique de Gaston Bachelard," *Annales de L'université de Paris* 33 (1963) : 24-39 ; François Dagognet, *Gaston Bachelard: Sa vie, son œuvre, avec un exposé de sa philosophie*. Paris : PUF, 1965.
11. Michel Foucault, "Introduction," in Georges Canguilhem, *The Normal and the Pathological*. New York: Zone Books, 1991, 8.
12. Gilles-Gaston Granger, *Formal thought and the sciences of man*. Dordrecht: Reidel, 1983.
13. Bruno Latour, *Reassembling the social: An introduction to actor-network theory*. Oxford: Oxford University Press, 2005, 41 n36. See Pierre Bourdieu, Jean-Claude Chamboredon and Jean-Claude Passeron, *The Craft of Sociology : Epistemological preliminaries*. Berlin/New York : Walter de Gruyter, 1991.
14. Louis Althusser, *For Marx*. Harmondsworth: Penguin books, 1969.
15. For the relation between Kuhn and French epistemologists such as Bachelard, see Massimiliano Simons, "The Many Encounters of Thomas Kuhn and French Epistemology," *Studies in History and Philosophy of Science* 61 (2017): 41-50.
16. Michel Vadée, *Gaston Bachelard ou Le nouvel idéalisme épistémologique*. Paris : Ed. sociales, 1975.
17. Michel Pêcheux and Michel Fichant, *Sur l'histoire des sciences*. Paris : François Maspero; Etienne Balibar, "From Bachelard to Althusser: the concept of 'epistemological break,'" *Economy and Society* 7, no. 3 (1978): 207-237; Pierre Macherey, "Althusser and the Concept of the Spontaneous Philosophy of Scientists," *Parrhesia* 6 (2009): 14-27.
18. His doctoral thesis (published in 1969) is translated together with another book from 1972 as Dominique Lecourt, *Marxism and Epistemology: Bachelard, Canguilhem and Foucault*. London: NLB, 1975. See also Dominique Lecourt, *Bachelard ou Le jour et la nuit: un essai du matérialisme dialectique*. Paris : Grasset, 1974.
19. Lecourt, *Le jour et la nuit*.
20. See Jean-Jacques Wunenburger, *Gaston Bachelard, poétique des images*. Paris : Mimesis, 2012. For the organization, see <https://gastonbachelard.org/association/>.
21. Compare Frederic Worms and Jean-Jacques Wunenburger, *Bachelard et Bergson: Continuité et discontinuité*, Paris : PUF, 2008.
22. Kotowicz, *Gaston Bachelard*, 12.
23. For Bachelard's reception in other contexts, see Jean Gayon and Jean-Jacques Wunenburger, Jean-Jacques, *Bachelard dans le monde*. Paris: PUF, 2000.
24. See Gaston Bachelard, "The Philosophic Dialectic of the Concepts of Relativity," in *Albert Einstein, Philosopher and Scientist*, ed. P. A. Schilpp. New York: Tudor (1951): 565-580. This could have been different. Bachelard was for instance invited to write a text on 'philosophy of science in France' for a volume, published in 1950, but he was "accidentally prevented from writing" his chapter and replaced by an annotated bibliography by André Lalande. See *Philosophical Thought in France and the United States: Essays representing major trends in contemporary French and American philosophy*, ed. Marvin Farber. New York: University of Buffalo Publications in Philosophy, 1950.
25. This in contrast, for instance, to the work of other epistemologists such as Emile Meyerson and Pierre Duhem, whose work is more fully translated, often from an early date onwards. See Emile Meyerson, *Identity and Reality*, translated by Kate Loewenberg. London: Allen & Unwin Ltd., 1930; Pierre Duhem, *The Aim and Structure of Physical Theory*, translated by P.P. Wiener. Princeton:

Princeton University Press, 1954.

26. There have also been some selected chapters of other books been translated, for instance a chapter from *L'Activité rationaliste de la physique contemporaine*, see *Phenomenology and the natural sciences: Essays and translations*, ed. Joseph Kockelmans and Theodore Kisiel. Evanston: Northwestern university press, 1970. A part of his doctoral thesis *Essai sur la connaissance approchée* is also translated in *Continental philosophy of science*, ed. Gary Gutting. Oxford: Blackwell, 2005. Similarly, many of Bachelard's articles have never been translated, with the exception of Gaston Bachelard, "Noumena and Microphysics," *Angelaki* 10, no. 2 (2005): 73-78.

27. See Lecourt, *Marxism and Epistemology*.

28. Steve Fuller, *Social epistemology*. Bloomington: Indiana university press, 2002, 24-25.

29. Bruno Latour and Steve, *Laboratory Life: the construction of scientific facts*. Princeton: Princeton University Press, 1986, 64.

30. Teresa Castelao-Lawless, "Phenomenotechnique in Historical Perspective: Its Origins and Implications for Philosophy of Science," *Philosophy of science* 62, no. 1 (1995): 56.

31. The notion of phenomenotechnique indeed addresses a broader issue than mere social constructivism, namely that of the role of intervention and construction in science. Hans Radder even calls this the "Bachelardian challenge," referring to "the question how scientific knowledge can be about a human-independent reality, if this reality is so thoroughly dependent on human work." See Hans Radder, "Science, realization and reality: the fundamental issues," *Studies in History and Philosophy of Science* 24, no. 3 (1993): 328. Social constructivism is merely one possible reply to this question, namely by negating the idea that such an access to a human-independent reality is possible. More options are available, and the notion of phenomenotechnique precisely forces us to examine them.

32. Ian Hacking, *Historical ontology*. Cambridge (Mass.): Harvard university press, 2002; Hans-Jörg Rheinberger, *On historicizing epistemology: An essay*. Stanford: Stanford university press, 2010 and Hans-Jörg Rheinberger, *An Epistemology of the Concrete: Twentieth-Century Histories of Life*. Durham: Duke University Press, 2010.

33. Mary Tiles, "Is Historical Epistemology Part of the 'Modernist Settlement'?" *Erkenntnis* 75, no. 3 (2011): 525-543.

34. See for example Don Ihde *Expanding hermeneutics: Visualism in science*. Evanston: Northwestern University Press, 1998, 8.

35. Gilbert Hottois, "La technoscience: De l'origine du mot à ses usages actuels," *Recherche En Soins Infirmiers* 86 (2006) : 24-32 ; Jean-François Lyotard, *The postmodern explained : Correspondence 1982-1985*. Minneapolis (Minn.): University of Minnesota, 1993; Bruno Latour, *Science in action: How to follow scientists and engineers through society*. Cambridge (Mass.): Harvard university press, 1987.

36. See Bernadette Bensaude-Vincent, "Chemistry in the French tradition of philosophy of science: Duhem, Meyerson, Metzger and Bachelard," *Studies in History and Philosophy of Science* 36, no. 4 (2005): 627-649; Bernadette Bensaude-Vincent and Isabelle Stengers, *A History of Chemistry*. Cambridge, Mass./London: Harvard University Press, 1997.