

## SELF-PRESERVATION AND THE TRANSFORMATION OF NATURE: A RESPONSE TO GARBER

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Garber demonstrates the shortcomings of a popular and idealised version of Baconian scientific method set against his close reading of Bacon's *Novum Organum II*. The results of Garber's analysis show that Bacon had not one but two philosophies, both of which were informed by his matter theory and speculative cosmology. This paper draws out the implications of Garber's reading of Baconian induction in physics transferred to the natural sciences, and draws attention to the ultimate aim of Bacon's philosophical programme as the prolongation of life.

**Keywords:** Francis Bacon, Daniel Garber, scientific method, progress in the sciences, speculative philosophy, unity of the sciences, semi-paracelsian cosmology, forms, latent processes, self-preservation, appetites of nature, transformation of bodies, prolongation of life

## САМОСОХРАНЕНИЕ И ПРЕОБРАЗОВАНИЕ ПРИРОДЫ: ОТВЕТ ДЭНИЕЛУ ГАРБЕРУ

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Гарбер демонстрирует недостатки популярной и идеализированной версии бэконовского научного метода путем внимательного прочтения второй книги «Нового Органона». Результаты анализа Гарбера показывают, что у Бэкона было не одна, а две философии, обе из которых были основаны на его теории материи и спекулятивной космологии. В данной статье рассматриваются возможные выводы из предложенной интерпретации бэконовской индукции в физике перенесенной на естественные науки в широком смысле, и обращается внимание на конечную цель философской программы Бэкона – продление жизни.

**Ключевые слова:** Фрэнсис Бэкон, Даниэл Гарбер, научный метод, прогресс в науках, спекулятивная философия, единство наук, полупарацельсианская космология, формы, скрытые процессы, самосохранение, аппетиты природы, трансформация тел, продление жизни

Dan Garber begins his essay with a reflection on two basic requirements for an *idealised* scientific method, suggesting that Ernan McMullin's textbook account of Baconian 'inductive method' meets these criteria [McMullin, 1990]. First (a) observations and judgements about the natural world should be 'free of assumptions about the way the world is' prior to empirical investigation, and second (b) a scientific method should apply to 'any domain of inquiry'. McMullin's essay begins with a quotation from the *Preface* to Bacon's *Instauratio Magna (IM)*:



That the state of knowledge is not prosperous nor greatly advancing, and that a way must be open to the human understanding entirely different from any hitherto known... [SEH, v. 4, p. 13, IM (1620)]

Bacon's 'method of induction' was presented in his *Novum Organum* (NO) (1620)<sup>1</sup>. It was designed to advance human knowledge and insure progress in the sciences beyond the known world [Vickers, 1992]. It represented the second part of Bacon's *Instauratio Magna*, a six-part plan for a restoration of the sciences, that has never before been tried<sup>2</sup>. Bacon's *Novum Organum* introduces an 'inductive logic' that is driven by a novel concept of the 'interpretation of nature' as an investigative tool to interrogate and discover the truths of nature, to replace Aristotle's *Organon* which was only ever designed to order nature according to axioms and theorems [Serjeantson, 2014]. Kant was so impressed with Bacon's attempt to create a logic for the 'common good' that he began his second edition of the *Critique of Pure Reason* with a 'motto' from Bacon's *Instauratio Magna* [SHE, v. 1, p. 125; Kant, 1787].

Bacon provided a roadmap for how his inductive method should be used. Appended to the *New Organon*, is his *Parasceve ad Historiam Naturalem et Experimentalem* (PAH) [OFB XI, PAH, pp. 448–473] followed by a *Catalogus Historiarum Particularium* (CHP) [ibid. CHP, pp. 474–485], that lists 130 investigations of Nature in descending order: from Histories of the Heavens, Meteors, and Planets, etc.; to The Greater Masses, Elements and Species (metals, plants, fish, and birds, beasts, etc.); finally to the 'Histories of Man' (anatomy, faculties, physiology, excretions, voluntary and involuntary motions, etc.) which make up more than half the total. The *Parasceve* and 130 *Historiae* constitute a systematic research programme that was designed to demonstrate the power of Bacon's 'inductive logic' as an investigative tool to interpret the whole of Nature, and provide a foundation for a 'true Philosophy' that acts as a bridge to part-three of the *Instauratio*: 'The Phenomena of the Universe, of Natural and Experimental History for the Building up of Philosophy'<sup>3</sup>. There can be no doubt that Bacon's 'inductive method' fulfils the second basic requirement of an *idealised* scientific method since as we can see from the *PAH* and *CHP* he intended it to apply to the whole of nature. Garber correctly characterises Bacon's inductive method as

<sup>1</sup> OFB XI, *Novum Organum*, ed. by G. Rees with M. Wakely (2004).

<sup>2</sup> Bacon's Plan of the Work: (i) The Divisions of the Sciences, (ii) The New Organon; or Directions concerning the Interpretation of Nature: (iii) The Phenomena of the Universe; or a Natural and Experimental History for the foundation of Philosophy, (iv) The Ladder of Intellect, (v) The Forerunners; or Anticipations of the New Philosophy, (vi), The New Philosophy; or Active Science [OFB XI, *Distributio operis*, pp. 26–47].

<sup>3</sup> [Jalobeanu, 2015] on Bacon's 'Experimental Natural Philosophy'.



a ‘general tool, like the syllogism, that is applicable everywhere scientific reasoning is needed’ [Garber, p. XX].

All of this is familiar and follows a traditional reading of Bacon’s inductive method. However, problems arise when the first basic requirement of neutrality ‘prior to empirical investigation’ is set against Garber’s close reading of *Novum Organum (NO) Book II*, a largely neglected work. *Book II* begins with an ambitious experimental research agenda that ‘aims to generate and superinduce’ new natures on bodies; discover ‘forms’ and the sources ‘from which a given nature arises’; and to transform ‘bodies of one sort into bodies of another’ (NO II 1). The theoretical and practical programme of *NO Book II* far exceeds the modest aims of the more familiar *NO Book I*, on which most accounts are based, that begins by identifying Man as ‘a servant and interpreter of Nature’ who can only know what he observes (NO I 1). It is clear that the scope of Bacon’s experimental investigations in *NO Book II* presuppose the existence of ‘forms’, ‘simple natures’, ‘latent processes’, and ‘latent schematisms’ as objects of investigation [Fattori, 1983; Pérez-Ramos, 1996].

Garber agrees with Rees, who argues that Bacon ‘disregarded his own methodological principles and systematically built cosmological material into the fabric of the *Instauration*’ which relies on a ‘matter theory’ and esoteric ‘speculative philosophy’ grounded on a Semi-Paracelsian Cosmology, which brings together a hybrid of ‘kinematic principles derived from an Arab supporter of Aristotle [i.e. Alpetragius], a dynamic theory adapted from natural magic and a chemico-physical theory whose origins are found in Paracelsian thought’<sup>4</sup>. It is no wonder that Garber cautions against interpreting Bacon’s account of ‘heat as a motion’ as an anticipation of the kinetic-molecular account of heat<sup>5</sup>. The core argument of Garber’s essay is that ‘far from being a neutral and presuppositionless procedure for decoding all aspects of the world’ Bacon presents an inductive method that advanced his own theory-laden perceptions of the world, which included *a priori* conceptions about the general structure of Matter, Forms, Simple Natures and the Cosmos. In other words, Garber argues that Bacon fails to fulfil the first basic requirement of an *idealised* Baconian inductive method [Garber, p. XX]<sup>6</sup>.

<sup>4</sup> Bacon’s ‘speculative philosophy’ and ‘matter theory’ are elaborated in [Rees, 1975; Rees, 1977; Rees, 1996].

<sup>5</sup> *Contra* [Pérez-Ramos, 1996; Urbach, 1987; Gaukroger, 2001].

<sup>6</sup> He omits a third criterion of McMullin: ‘Induction will work with only *observable* features, and so an exclusively inductive science cannot contain terms referring to invisible entities’. Garber leaves this passage out because *NO Book II* focuses on the search for hidden qualities of nature which are not directly observable. If Garber had included McMullin’s ‘observability’ criterion as a third basic requirement of an *idealised* inductive method, then Bacon would have failed two out of three criteria.



Throughout his essay, Garber proceeds to dismantle long held popular conceptions of an idealised Baconian scientific method. Important discoveries of Bacon manuscripts in the British Library<sup>7</sup> and Chatsworth House [Rees, 1984a; Hardwick MS 72A] offer decisive proof that Bacon had not one, but *two* philosophies [Rees, 1996; OFB VI, p. xxxvi]. As Rees remarks:

Now it is still not widely understood that Bacon was the architect not of one but of two bodies of philosophy. Most people know, of course, that he put together a method and program for the regeneration of the sciences by inductive means. But the contents of the Hardwick manuscript have precious little to do with the method and program. Instead, the manuscript expresses aspects of a quite different body of philosophy, a body that is nothing less than a systematic, deductive model of the phenomena of nature. This speculative system, this highly integrated and wide-ranging set of *explanations*, permeates Bacon's writings. In fact, Bacon's philosophical work resembles one of those perspective drawings of the *Gestalt* psychologists. Looked at in one way, the method and program flash upon the eye; but if one looks a bit more intently one begins to discern the outlines of the speculative philosophy, a philosophy that coexists and intersects with the method and program [Rees, 1984b, p. 298].

Garber challenges his readers is to rethink altogether what the *real* method of Baconian induction involves, not simply the idealised version presented by McMullin. A revisionist account of how Bacon's inductive method relates to his speculative philosophy is long overdue, especially since thirty years ago Graham Rees warned that it is 'increasingly apparent that studying Bacon without the speculative philosophy is about as old-fashioned as studying Newton without the alchemical and theological writings' [Rees, 1984a, p. 22]. Garber is right to insist on understanding Bacon's natural philosophy and scientific method as a whole. However, this proves challenging because, as Garber claims, Bacon's 'speculative philosophy' imposes a 'very significant commitment' to Bacon's conception of what constitutes a *body*, which includes ontological commitments to the existence of forms, simple natures, latent processes and latent schematisms. Garber considers an appeal to Popper, who claims that all scientific observations are preceded by *some* hypothesis based on theory or speculation, so one should not impose neutrality too strictly. However, this solution does not quite work, because Bacon's ontological commitments are bound up with an entire cosmological system, not just a transient hypothesis. All of Bacon's observations and experiments are theory-laden. His inductive method is not simply joined to his speculative philosophy as a piece of rhetoric, or an art of logic, but it emerges by necessity out of Bacon's matter theory.

<sup>7</sup> Rees, 1981, British Library, Add. MS, 38, 693, fols. 29r-52v.



Gigliani provides an account of how this works [Gigliani, 2013, pp. 41–72]. Bacon’s inductive method grows out of the principles of his *matter theory* which are embedded in his *speculative philosophy*. Bacon’s concept of matter presupposes that the entire universe is material and inherently alive as a vital substratum, the ultimate source of energy which has primordial appetites aimed at *self-preservation*. Baconian ‘matter’ is unlike any modern conception of matter, since it has ‘appetites’, ‘passions’, and ‘perceptions’ that give it the ability to discriminate between what will lead to its *self-preservation* and survival, or its destruction. Baconian *matter* has ‘agency’ and ‘perception’ (*perceptio*) that will always, by necessity, move toward *self-preservation*. According to Bacon, all material things have perception, since it marks the first ‘activity of matter’, which is uniformly distributed across the universe. In Bacon’s cosmos, the next level of ‘activity of matter’ after perception is ‘sensation’ (*sensus*), which is a defining characteristic of animal nature, including human nature. Bacon’s account of ‘learning’ (*scientia*) is a natural development or tendency toward *self-preservation*.

‘If *perceptio* is the discerning tendency inherent in the original desires of matter, then *sensus* is an awareness of animal desires and aversions, while learning (*scientia*) is knowledge acquired of reality through experience’ [ibid., p. 45].

This developmental account of matter’s ‘appetites’, ‘perceptions’, and ‘sensations’ is fundamental to Bacon’s account of induction, which is the movement from animal awareness (*sensus*) to learning (*scientia*) as a means of *self-preservation*. As Gigliani argues, the ‘half-Telesian, half-Stoic notion of a perfect order in nature which comes about through the irrepressible tendency to self-preservation is behind Bacon’s concept of induction’ [ibid., pp. 52–53]. Bacon assigns the capacity of ‘induction’ to animals and human beings alike, celebrating the origin of induction to ‘brute beasts, quadrupeds, birds, fishes, and serpents, as the doctors of sciences, rather than men’ (SEH IV, *De Aug.* V 2). Bacon asserts that true induction neither relies solely or chiefly on the powers of the mind, nor does it store up experiences of nature unaltered (NO II 95). Animals and all living beings who practice induction learn from their experiences. In an extraordinary passage, Bacon claims that a Goat who cures its wounds by eating dittany, or a Raven dropping stones into a hollow tree to raise the water to sip with its beak, is practicing a purer method of induction than ‘the logicians who describe it’ and pass judgement only on the enumeration of bare particulars (SEH IV, *De Aug.* V 2). I am certain that this account of ‘inductive method’ is not something that McMullin or Popper would embrace, or even recognise as Baconian induction, since it puts Goats and Ravens ahead of logicians. The gap between an *idealised* twentieth-century version of Baconian induction is too distorted to be reconciled with an account that emerges from a close reading of Bacon’s seventeenth-century texts.



Garber points to an example of ‘true Induction’ in the context of understanding the ‘transformation of bodies of one sort into bodies of another’ in *NO Book II*, and by imagining ‘the separation and dissolution of bodies’ not by fire but ‘by reason and True Induction’ (NO II 7). The example Bacon gives is one of lead to the gold, treated in the manner of an alchemical analysis. Yet Bacon has a more general and wide-ranging interest in the ‘transformation of bodies of one sort into bodies of another’ as an aim of experimental natural philosophy that goes beyond the *New Organon*, since it appears throughout his *corpus*, especially in the *Sylva Sylvarum* (SS) and *Latin Natural Histories*. For instance, one way in which Bacon claims we can gain insight into the ‘transformation of bodies of one sort into bodies of another’ is by investigating the *latent processes* and *latent schematism* of matter, and manipulating these hidden and secret underlying *processes* of nature, such as distillation<sup>8</sup>, decomposition<sup>9</sup>, putrefaction<sup>10</sup>, transmutation<sup>11</sup>, maturation<sup>12</sup>, consumption<sup>13</sup>, desiccation<sup>14</sup>, percolation<sup>15</sup>, etc., all of which depend upon making sense of the relationship between Bacon’s matter theory (*tangible* and *pneumatic*) and his idea of *spiritus*<sup>16</sup>. The implications of Bacon’s analysis of the form of ‘heat’ in the *New Organon* had applications in the natural sciences and medicine, since the cosmos is alive and full of *spiritus* [Walker, 1972]. Bacon promoted the idea of a ‘unity of the sciences’ in which all of the sciences are nourish by the common source of an active natural

<sup>8</sup> NO II 7, I 85, II 13.3, II 20, II 40 (Prerogative Instance *qua* Summoning Instance), II 46 (Prerogative Instance *qua* Instances of the Course), II 48 (Prerogative Instance *qua* Instances of Strife), SS 99 (‘the power of heat is best perceived in distillations’). See also [Kodera, 2012].

<sup>9</sup> On Boyle’s reading of Bacon on decomposition and transformation see [Newman, 2014, p. 67].

<sup>10</sup> NO II 12, SS Cent. IV 329–351 and OFB XII, *Historia Vitae et Mortis* (HVM), pp. 144/145, 156/157, 164/165, 176/177 (putrefaction and innate spirit).

<sup>11</sup> NO II 48 (Perogative Instance of Strife: 4th Motion of Matter), SS Century I 27 (air into water); SS Cent. IV 518 ff. (transmutation of plants one into another).

<sup>12</sup> NO II 46, (coupled with the operations of attraction, repulsion, attenuation, compissation, dilatation, astriction, dissipation), SS Cent. I 98 (Experiments Touching the Secret Processes of Nature), Cent. IV 312–324.

<sup>13</sup> NO II 50 (Perogative Instance of General Use, coupled with rarefaction, and desiccation), compare OFB XII, HVM, pp. 161–173.

<sup>14</sup> NO II 50, OFB XII, HVM pp. 161–173. Major Observations 2. ‘The process of desiccation and consumption is performed by three actions, which are derived from the innate spirit of bodies’.

<sup>15</sup> NO II 50, SS Cent. I 1, I 3. The close relationship between the experimental investigations of latent processes and schematisms introduced in NO are followed out in an operational way in SS.

<sup>16</sup> Fattori (1980) argues ‘*spiritus*’ is a principal object of investigation in the *Novum Organum*.



philosophy, so that progress in one science will reveal discoveries in others [McRae, 1957, pp. 27–34]<sup>17</sup>.

And generally let this be a Rule, that all partitions of knowledges, be accepted rather for lines & veines, then for sections and separations: and that the continuance and entirenes of knowledge be preserued. For the contrary hereof hath made particular Sciences, to become barren, shallow, & erroneous: while they haue not bin Nourished and Maintained from the common fountaine<sup>18</sup>.

Bacon's analysis of 'heat' and its regulation dominated his physics, especially with respect to the conservation of bodies, but it also had important implications for his investigations in the life sciences, including biology, zoology, botany, medicine, and physiology. For instance, Bacon's speculative philosophy in *NO Book II* is closely intertwined with his desire to understand how the regulation of a heat, 'vital heat', the 'vestal flame' (*ignis vestalis*, *spiritus vitalis*, or *flamma vitalis*), could extend human life to 999 years<sup>19</sup>. In fact, Bacon was so preoccupied with the investigation of 'vital heat' and 'spiritus' that in 1622 he broke off the completion of his *New Organon*, to write an *Experimental Natural History of Life and Death*, as a matter of great urgency. Bacon remarks that his shift from 'logic' to 'the prolongation of life' was on account of its exceptional utility of 'which the slightest loss of time should be counted precious.' [OFB XII, pp. 142–143; Gemelli, 2019]

Bacon's interest in matter theory and speculative philosophy was never motivated solely by theoretical concerns about 'forms' or knowledge of the natural world. *NO II 49* shows that Bacon was constantly searching for things that especially benefited mankind, which he called *Intimating Instances*, as an *Instance of Special Powers (no. 25)*, since he hoped that his natural philosophy would ultimately be useful to human life, and 'Bring things down to Practice', and provide 'Lists of things human, or *Desiderata*' [OFB XI, pp. 416–419]. Bacon's turn from his inductive logic to his *Historia Vitae et Mortis (HVM)* demonstrates that he trusted that his theoretical investigations into forms, simple natures, and latent processes would uncover secrets to the 'Prolongation of Life', which he claimed was the ultimate end of his natural philosophy [Rees, 1996, p. 141]. Bacon's *Historia Vitae et Mortis* brings together his two philosophies, speculative and operative, in a single text. It is an example *par excellence* of how knowledge of the form of 'heat' could be useful when investigating the 'prolongation of life' [Rees, 1983]. Bacon's two philosophies were always intended to make progress in the sciences that yielded practical benefits to mankind, as we can see from his *Parasceve*

<sup>17</sup> See Valerius Terminus (1620) for "universal Sapience".

<sup>18</sup> OFB IV, *Advancement of Learning*, II, p. 93

<sup>19</sup> OFB XII, *Historia Vitae et Mortis*, pp. 140–377.



and *Catalogue of Particular Histories*, as well as his ‘*Desiderata List*’ or *Magnalia Naturae* (MN) appended to the *New Atlantis* (1627) which included ‘The prolongation of life. The restitution of youth in some degree. The retardation of age’ as investigations of the highest order [SEH III, NA pp. 167–168]. Bacon’s preoccupation with the ‘transformation of bodies of one sort into bodies of another’ was also represented in the MN list as transforming ‘Versions of bodies into other bodies’, ‘Making of new species’, ‘Transplanting of one species into another’ [ibid.].

Garber compares the work of Bacon’s ideal natural philosopher to that of a Bee, who by his own special power (*propria facultate*), converts and digests (*vertit et digerit*) one substance into another<sup>20</sup>. The work of a Bee is a perfect example, both methodologically and ontologically, of the ‘transformation of bodies of one sort into bodies of another’, a recurring theme of *NO Book II*. The process of ‘*vertit et digerit*’ stands parallel to, and is an instantiation of, Bacon’s aim to generate and superinduce (*generare et superinducere*) a ‘new nature or new natures on a body’, which Bacon claims is the principle aim of any inquiry into nature (NO II 1). The language of *vertit et digerit* also signals that even the *activity of collecting* the contents of natural histories requires a special kind of perception, processing, ordering, and generating new information, not simply gathering and storing it unevaluated like the Ant<sup>21</sup>. The Bee moves from animal awareness (*sensus*) to learning (*scientia*) by its own special power (*propria facultate*) as a means of *self-preservation*. The Bee not only collects pollen and transforms it into another substance, honey, but it also eats the substance it produces for its own nourishment and self-preservation<sup>22</sup>: just like the philosopher who seeks knowledge for the benefit of mankind and learns the secrets of Nature to live 999 years.

The Ant *only* (*tantum*) collects and uses (*congerunt et utuntur*), like the logician who only considers the enumeration of bare particulars. The Spiders spin theories only from their entrails, so there is no possibility of generating or transforming one substance into another. The true

<sup>20</sup> [Rossi, 1984] remains the best historical account.

<sup>21</sup> The use of ‘*vertit et digerit*’ as related to *generation* here is significant because Bacon uses this conjunction again in his *Instances with Special Powers* in *NO II 48* regarding ‘Assimilation or Simple Generation’ of spirits, which is ‘always working to *digest* and *convert* the grosser parts into more spirit’ (*digerat et vertat in Spiritum*). OFB XI, pp. 402–403. Manzo (2014) reminds us that Bacon’s use of *degero* is also relevant to his dual aim of reforming Law and Natural Philosophy. Bacon had ambitions to rewrite Justinian’s *Digest*, which would have ‘converted and digested’ Justinian’s *Code of Roman Law* into *English Law*. It was an ongoing project; cf. Bacon’s first public statement on law reform (1593, ‘Speech to the Parliament’, SHE, vol. 8, pp. 214 ff.) and his last proposal to the King (1621, ‘An Offer to the King of a Digest to be Made of the Laws of England’, SHE, vol. 14, pp. 357–364).

<sup>22</sup> A fact that would be included in a ‘Natural History of Honey’; OFB XI, *Catalogus Historiarum Naturalium* 86, *Historia Mellis*, pp. 482–483.





philosopher, like the Bee, not only converts and digests (*vertit et digerit*) one substance into another, but also transforms and elaborates (*mutatam et subactam*) the results of experiments, storing them in the intellect (*intellectu*) altered and transformed (NO I 95). Bacon holds out hope that his new philosophy will forge a closer and more sacred alliance (*arctiore et sanctiore foedere*) of these two faculties, namely the experimental and the rational (*experimentalis scilicet et rationalis*)<sup>23</sup>, that produces an inductive method of logic that has never before been achieved<sup>24</sup>.

If Garber's aim was to encourage a re-evaluation Bacon's inductive method in the context of his *two* philosophies, then he has succeeded. He has identified the weaknesses of McMullin's *idealised* interpretation of Bacon's inductive method and Popper's 'Positivistic' reading. Yet he has also demonstrated the difficulties of giving an account of Baconian Induction without empirical evidence of speculative entities, such as 'simple natures' and 'forms', or the fundamental 'motions and appetites of matter.' Garber's suggestion of using Bacon's *Abecedarium* as scaffolding for a '*methodological anticipation*' does not solve the problem, because even if it were implemented it would only be a provisional solution. A 'preparative' to Part IV's 'Ladder of the Intellect' leaves us only at the threshold of Parts IV–VI of Bacon's six-part plan for the reformation of the Sciences, but not yet in a position to make the final ascent to Metaphysics or a Metaphysical Method<sup>25</sup>.

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<sup>23</sup> Compare '*Empiricam et Rationalem*', *Preface to IM*, OFB XI pp. 20–21.

<sup>24</sup> NO I 95. *Foedus* is rare in Bacon. He uses *foedus* to describe the 'League of Mind and Body' (*Foedere Animi et Corporis*) in *De Aug.* IV 2, and again in the fable of the 'Ant, Spider and Bee' (NO I 95). The 'more sacred union' (*sanctiore foedere*) of the experimental and rational required for a true Inductive method is mirrored in the 'League of Mind and Body' (the body perceives, senses and experiments, whereas the mind orders and digests), producing a logic that has 'not so far been achieved'.

<sup>25</sup> OFB XI, xxi. *Abecedarium* (1622) *qua* Preliminary to Part IV.



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