On Living Mirrors and Mites: Leibniz’s Encounter with Pascal on Infinity and Living Things circa 1696.[[1]](#endnote-1)

1. Introduction

Throughout his life, Leibniz had a keen interest in Pascal’s work. The evidence collected over the past century by scholars such as Baruzi[[2]](#endnote-2), Grua, Mesnard,[[3]](#endnote-3) and recently presented by Frédéric de Buzon and Maria Rosa Antognazza, clearlyshows that, from early in his career, Leibniz was very well informed about Pascal’s work.[[4]](#endnote-4) For example, we know that Leibniz had already bought a copy of Pascal’s *Pensées* by 1671 (just a year after its publication).[[5]](#endnote-5) In a letter to Graevious of 1671, he speaks of *Pensées* as a “small book of gold” (*libellum aureolum*) which “by the profoundness of its thought and the elegance of explication compares with any of the greatest men” (A 2.1 193). Before his arrival in Paris in 1672, and certainly during his stay there until 1676, Leibniz was in contact with the Jansenist circle (including Arnauld, Nicole, Saint Amour, Roannez, and Gilberte Pascal) and was also associated with a group loyal to Pascal (“les pascalins”, as Mesnard calles them). In 1673, Leibniz conducted a study of Pascal’s *Letters to A. Detonvile.* Pascal’s mathematical work, referred to Leibniz by Huygens, was one of the most important sources for his mathematical studies in 1673-76, leading to his early development of the calculus.[[6]](#endnote-6)

In the beginning of 1673, Leibniz was busy developing a calculating machine expressly designed to supersede Pascal’s own calculating machine in performing automatic multiplication, division, and extraction of square and cube roots, in addition to summation and subtraction.[[7]](#endnote-7) In 1675, Leibniz received Pascal’s unedited manuscripts from E. Périer (A 1, 253), which he studied with Tschirnhaus, and then recommended for publication in 1676.[[8]](#endnote-8) This marks the last two years of Leibniz’s stay in Paris (1675-76) as a particularly intense period in Leibniz’s reception of Pascal’s work (which was, of course, only one among his many interests during these years).[[9]](#endnote-9)

 Pascal’s work continued to play a subtle and complex role in Leibniz’s thought. Among other things, Pascal certainly was, for Leibniz, a source of inspiration, as well as a source both for comparison and of a certain degree of competition. While Leibniz was clearly impressed with Pascal’s mathematical and experimental work,[[10]](#endnote-10) his reaction to his philosophical work and methodological remarks were much more nuanced and critical.[[11]](#endnote-11) The present paper focuses on a specific text – a comment Leibniz makes on fragment 22 of Pascal’s *Pensées* in the Port-Royal edition, 1670*,* thenentitled *Connaissance générale de l’homme.* However brief, this comment is of great interest – both philosophical and historical.[[12]](#endnote-12)

Leibniz’s comment was published by Gaston Grua under the title *Double infinité chez Pascal et Monade*.[[13]](#endnote-13) In this text, Leibniz refers to Pascal’s notion of the infinitely large and infinitely small and to the way Pascal uses infinity to describe living beings through the example of a mite (*ciron*). In his comment, Leibniz argues that Pascal did not go far enough in employing infinity, and, in contrast to Pascal’s mite, he employs a completely different image – that of a living mirror (*miroir vivant*) – as an illustration of a living being. The present paper compares these evocative images and draws some conclusions concerning the similarities and differences between Leibniz’s and Pascal’s employment of infinity in capturing some essential features of living beings through their respective use of the images.

Although not yet published in English (in print), this text has been the object of studies and commentaries in German and especially in French (more details in the next section). It has recently been revisited, reedited, and published by Frédéric de Buzon, with an appendix presenting a new reconstruction of the text.[[14]](#endnote-14) We know, for the following reasons, that Leibniz composed the text sometime around 1696: the reference to his “system of pre-established harmony, which has just recently appeared on the scene” dates the text to shortly after the *New System* (1695), and the text contains the word ‘monad’, which appears in Leibniz’s writings in this period, as well as the expression “a living mirror” (*miroir vivant*). While the figure of a mirror appears in earlier texts, such as the *Discourse on Metaphysics* as well as in Leibniz’s Paris Notes, the term *miroir vivant* appears only later—in this note, in his correspondence with Sophie (1696), in his correspondence with de Volder, as well as in texts such as the *Monadology* (§ 56) and the *Principles of Nature and Grace* (§ 3), among others.[[15]](#endnote-15) I am unaware of earlier occurrences of the expression.

The composition of this text circa 1696, however, presents something of a puzzle: if Leibniz knew Pascal’s *Pensées* well from 1671, why did he compose this reaction to Pascal only 25 years later? Is there anything in Leibniz’s development that could account for *this* text at this time, given that he had been commenting on Pascal’s work throughout his career? More specifically, what prompts him to see Pascal’s remarks on infinity as the entry point (*une* *entrée*) into his philosophical system at this point of time?[[16]](#endnote-16) I will address this question towards the end of the article.

Even if this text is very short, it is extremely rich and interesting. One commentator has gone so far as to say that Leibniz’s encounter with Pascal gave him the occasion to succinctly summarize the whole of his own philosophy.[[17]](#endnote-17) Even if this is overstated, there is some truth to the remark. The text is indeed one of the most succinct, condensed – and I would say beautiful – expressions of Leibniz’s philosophy at the time that his monadological phase begins to take shape.[[18]](#endnote-18)

In any event, the text certainly merits more attention than it has received in the English-speaking world.[[19]](#endnote-19) Indeed, part of my motivation here is to draw attention to this text, as well as to provide a new English translation of its first version. Another part of my motivation is to highlight and articulate some of the neglected philosophical significance of the text. I focus on Leibniz’s usage of infinity, in contrast to Pascal’s, and especially his attempt to capture the nature of living things – a topic that has received little attention in any of the previous commentaries on the text. I certainly do not wish to suggest that this is the exclusive significance of the text; but it is an important topic that has received very little attention. In particular, I attempt to bring out the contrast between the two central images – that of Pascal’s mite (*ciron*), which is a standard illustration of a minute animal in the pre-microscope era, and that of Leibniz’s living mirror (*miroir vivant*) – to capture the way infinity figures in their respective depictions of living beings.[[20]](#endnote-20) In light of the current interest in the life sciences of the early modern period in general, and Leibniz’s views in particular, revisiting the text from this particular angle seems timely.[[21]](#endnote-21)

In sections 2-5, I present the text and the major differences between Pascal’s and Leibniz’s uses of infinity in describing the nature of living things. In section 6, I offer an account of the content of the text and its appearance around 1696 by looking at the role Leibniz’s view of infinity plays in his definition of living beings in the *New System of Nature*. In section 7, I argue that, in spite of superficial similarities, Leibniz’s use of infinity to define living beings stands in stark contrast to Pascal’s use of infinity. Whereas Pascal uses infinity to emphasize divisibility and disparity, alongside our inability to comprehend the infinite world surrounding us, Leibniz uses infinity to emphasize the intrinsic unity that each living being must have, the inherent harmony among all living beings, and our sense of belonging to an infinite world precisely because we, as imitations of an *absolutely* infinite being, are infinite too (though to a lesser degree).

2. The Text

As already noted, sometime around 1696, Leibniz was busy copying fragment 22 of the so-called Port-Royal edition of Pascal’s *Pensées.* Once he was done with what looks like a hasty (and imprecise) transcription,Leibniz turned to compose a comment. His comment begins with a dramatic and curious statement:

“Ce que Mons. Pascal dit de la double infinité, qui nous environne en augmentant et en diminuant, lorsque dans ses Pensées (n. 22) il parle de la connaissance générale de l’homme, n’est qu’une entrée dans mon système” (version 2 (folio 213 r-v) in De Buzon p. 554).

What M. Pascal says of the double infinity, which surrounds us while increasing and decreasing, when in his *Pensées* (n. 22) he speaks of the general knowledge of man, is but an entry point into my system.

Leibniz proceeds to write a single page comment. The importance of this text was already noted by Gerhardt in 1891[[22]](#endnote-22) and then by Baruzi in 1907;[[23]](#endnote-23) it was reedited by Grua in 1948 under the charming title “*Double infinité chez Pascal et Monade*,” which facilitated further commentaries by Guitton[[24]](#endnote-24), Costable[[25]](#endnote-25), Serres[[26]](#endnote-26), Naërt[[27]](#endnote-27), McKenna[[28]](#endnote-28), and Carraud[[29]](#endnote-29), among others. While there are a fair number of commentaries on this text in French, to the best of my knowledge there is none in English. Even in French, there is very little in the existing literature on the implications of Leibniz’s comment for his view of living things. With the recent commentary by Frédéric de Buzon, this too is beginning to change. [[30]](#endnote-30) In 2010, de Buzon published a commentary in which he notes the significance of Leibniz’s notion of natural machine vis-à-vis Pascal, as well as providing a new edition that presents two different versions of the text in meticulous detail. The first version is a marginal comment added to a transcription of the passage from the *Pensées*, with the note, “*Was am Rande von mir addiert, habe ich besser auf ein ander Papier geschrieben*.” The second version is an expansion of the marginal note, now on a separate piece of paper. While de Buzon emphasizes the similarity between Leibniz’s notion of a natural machine and Pascal’s view, I argue that there are significant differences in their views, which are also expressed in the images they use.

De Buzon’s publication is the immediate occasion for the present article, as well as the source for the text translated into English here. Since the text is dense and difficult to translate, I first cite it in French (in De Buzon’s version) and then offer a translation. The first version of Leibniz’s response to Pascal reads as follows:

Jusqu’ici M. Pascal. <Was am Rande von mir addiert, habe ich besser auf ein ander Papier geschrieben.> Ce qu’il vient de dire de la double infinité n’est qu’une entrée dans mon système. Que n’aurait-il pas dit, avec cette force d’éloquence qu’il possédait, s’il y était venu plus avant, s’il avait su que toute la matière est organique, et que la moindre portion contient, par l’infinité actuelle de ses parties, d’une infinité de façons, un miroir vivant exprimant tout l’univers infini, de sorte qu’on y pourrait lire (si on avait la vue assez perçante aussi bien que l’esprit) non seulement le présent étendu à l’infini, mais encor le passé, et tout l’avenir [infini pour chaque moment] infiniment infini, puisqu’il est infini par chaque moment, et qu’il y a une infinité de moments dans chaque partie du temps, et plus d’infinité qu’on ne saurait dire dans toute l’éternité future. Mais l’harmonie préétablie passe encore tout cela et donne cette même infinité universelle dans chaque [presque néant] <premier presque néant (qui est en même temps le dernier presque tout et le seul pourtant qui mérite d’être appelé une substance après Dieu) > c’est- à-dire dans chaque point réel, qui fait une Monade, dont moi j’en suis une, et ne périra non plus que Dieu et l’univers, qu’il doit toujours représenter, étant [un Dieu] [comme Dieu] en même temps moins qu’un Dieu et plus qu’un univers de matière : un comme-Dieu diminutif, et un comme-univers éminemment, et comme prototype, les mondes intelligibles étant en ectype les sources du monde sensible dans les idées de Dieu.

Here is my English translation:

Up until here it is Pascal. What he just said of the double infinity is nothing but an entry point to my system. What wouldn’t he have said with his powerful eloquence if he had advanced further, if he had known that all matter is organic, and that the least portion contains, through the actual infinity of its parts, a living mirror expressing all the infinite universe in an infinity of ways, so that one could read in it (if one had a sufficiently penetrating sight and mind) not only the present extended to infinity but also the past and all the future [infinite at each moment] infinitely infinite, since it is infinite at any moment and there are infinity of moments in any part of time, and more infinity than one could ever say in all of future eternity? But the pre-established harmony goes beyond all that and captures this same universal infinity in each primary almost-nothing (which is at the same time the final almost-everything [*presque tout*] and the only thing which deserves to be called a substance after God), that is, in each real point, which makes a Monad, of which I am one, and will not perish anymore than God or the universe, which it must always represent, being at the same time, less than God and more than the material universe: as a diminutive-God and an eminent universe, and as a prototype, the intelligible worlds being in ectype the sources of the sensible world in God’s ideas.

This is obviously a complex text. It contains several astounding claims. First, Leibniz claims that Pascal does not realize that all matter is organic. This indicates that Leibniz is presupposing his panorganic view that all beings are ultimately composed of living beings.[[31]](#endnote-31) Second, organic matter is actually divided to infinity. This is a familiar theme, which is present in Leibniz’s work since his early writings. Third, and perhaps most remarkable as well as most novel, is the claim that, however small, each portion of matter contains a living mirror that expresses the infinitely large universe. The mirroring Leibniz notes here is due not merely to the actual division of matter to infinity but also to the existence of something living and active in each portion of matter. Fourth, such a living mirror contains “not only the present extended to infinity but also the past and all the future,” which is reminiscent of Leibniz’s doctrine of marks and traces that he ascribes to individual substances in the *Discourse on Metaphysics* (articles 8 and 13) and elsewhere. Fifth, Leibniz’s new system of preestablished harmony goes beyond all that in showing that such a living mirror, however minute and particular, captures universal infinity: in being almost nothing but at the same time almost all, it is the only real point that makes a Monad, which (sixth) deserves to be called the only real substance besides God, and (seventh) of which I am one; (eighth) it is like a diminutive-God, and thus (ninth) it will not perish and (tenth) will always represent God and the universe (in being a living mirror).

 Surely my dissection of this dense text into a list of claims can be contested. What cannot be contested, I think, is that Leibniz brings together here some of his familiar theses with some new ones in a remarkable and dense text. Since this is one of the earliest appearances of the term ‘monad’ as well as the expression ‘living mirror’, it is not obvious how to interpret these notions in this context. It is fairly clear, however, that, in this passage, a living mirror is likened to a substance and that it makes a monad, which is both active and representative; and, that it is exemplified through the I. The I, the Ego, or *Moy*, are recurrent examples of the true unity of substance that Leibniz uses in many other texts, both earlier and later than this one. I believe that this example is significant. It suggests that by ‘living mirror’ (as well as by ‘monad’), Leibniz intends here to refer to a complete and true substance, rather than to some constituent of it. But, what does the qualification of a mirror as *living* add to the figure of a mirror *simpliciter* that Leibniz had already used in earlier texts? The qualification of a mirror as living indicates something important about the way Leibniz sees the mirroring relation and the capacity of each substance, however small, to represent the world.

 In the reading I will develop below, this representation is accounted for both (1) by virtue of replication of internal structure among all living substances (in particular, their common infinite structure); and (2) by virtue of the *active* perception of each natural machine or living substance. The active representation, which I shall ascribe to a natural machine, is grounded in the form or entelechy, which is a principle of perception. One might say that there are two types of mirroring going on: 1) the infinite structure of the machine mirrors the universe, by changing in ways that track changes everywhere in the universe; 2) this mirroring is able to occur because the machine is unified by a form, which itself is a "living mirror" representing the infinite structure of its body and, hence, of the universe as a whole. In this way, Leibniz’s two means of accounting for the mirroring relations are connected to one another.[[32]](#endnote-32)

 Leibniz’s text raises other interesting questions. For example, what is the status of the term ‘monad’ at this period and how does it compare with the later usage of monad in texts such as the *Monadology* and the *Principles of Nature and Grace*? I will touch on this question toward the end of the paper. In the next two sections, I am mainly interested in presenting the following theme. Like Pascal, Leibniz conceives of human beings as placed between two infinities. Yet, unlike Pascal, for Leibniz, human beings (as well as other living beings) are themselves seen as *infinite* creatures; and, as such, they are placed between the absolute infinity of God and infinitely divisible matter. As we shall see, Leibniz’s notion of the infinite is quite different from Pascal’s. Whereas, for Pascal, humans are seen as finite creatures facing and realizing their place between the infinitely vast and the infinitely minute, for Leibniz, humans are placed high up on a scale of a graded hierarchy of infinity and perfection – “the only thing which deserves to be called a substance after God… but at the same time, less than God and more than the material universe: as a diminutive-God and an eminent universe.”

3. Approaching Infinity: Leibniz vs. Pascal

Before further developing this theme, I would like to bring out some of the general differences between Pascal’s and Leibniz’s conceptions of infinity. Pascal’s approach is clearly expressed in the passage to which Leibniz is responding. According to Pascal, the point of philosophical reflection is to make us realize the particularity of the human situation. Philosophical reflection reveals that we occupy a middle position between two infinities: on the one hand, a universe that extends to infinity and, on the other hand, everything made of matter is divisible without end – *ad infinitum*. In his *Pensées,* Pascal urges us to recognize our intermediate position between the infinitely large and the infinitely small, both of which we do not fully understand.As Pascal says, we perceive the infinite but do not understand its nature.[[33]](#endnote-33) According to Pascal, this should lead to a realization of our true condition as finite creatures: creatures with a limited understanding facing the infinitude of the universe as well as the infinite and incomprehensible nature of its Creator. These considerations serve as a reminder of humility in pressing the limited capacities of human reason in contrast to the infinite nature of divine wisdom and power.[[34]](#endnote-34)

 Pascal uses the mathematical (quantitative) sense of infinity to draw an analogy with the infinite wisdom and power of God. As he writes,

A unit added to infinity does not add anything to it; nor does a foot to an infinite measure. The finite annuls itself in the presence of the infinite and becomes pure nothing. So is our spirit in front of God’s; so is our justice in front of divine justice […]. We know that there is an infinite but we don’t know its nature. As we know that it is false that numbers would be finite, so it is true that there is the infinite in number. But we don’t know what it is: it is false that it would be even, it is false that it would be odd, for, in adding a unit, it does not change its nature, it is a number and each number is either even or odd. ... Thus one can know well that there is a God without knowing what it is.[[35]](#endnote-35)

Pascal’s aim in drawing this analogy between arithmetical infinity and the infinity of God is clear. His epistemological point, regarding the unbridgeable gap between the finite and the infinite, serves a theological purpose. The upshot of Pascal’s analogy is to cast the human relation to God as a relation between a finite/limited mind and an infinite/unlimited one – with respect to power and with respect to knowledge and wisdom. At the same time, the relation between our finite mind and God is rather subtle. We know and recognize the infinite but do not understand its nature, just as we must admit infinity of number though we cannot comprehend its nature. For Pascal, the point of contemplating the infinite is precisely to make us realize our finitude and our limited nature in the face of the infinite and incomprehensible nature of God. Thus, according to Pascal, just as we know that there is infinity by sensing it with unambiguous clarity, even if we cannot comprehend it, so we sense (and thus know) that there is a God but at the same time we recognize that we cannot comprehend his nature. As Pascal famously writes, “we know the truth not only through reason but also through the heart (fg. 282-110).” Unlike Leibniz, who demands a proof for both the existence of God, seen as an infinite being, and the impossibility of an infinite number, Pascal demands only a clear and acute perception; that is all one needs and all one can ask for.

 Leibniz’s attitude toward the infinite is very different. Although Leibniz is acutely aware of the paradoxes threatening infinity – and especially its quantitative variants, as clearly evidenced in his early reading of Galileo’s *Dialogues on Two Sciences –* he is not opposed to using infinity in his philosophy.[[36]](#endnote-36) Although Leibniz argues that there is no infinite number, since this is a contradictory notion, infinity nonetheless figures in almost every aspect of his philosophy. According to Leibniz, the actual world is but one of infinitely many possible worlds; possible worlds, in turn, are conceived by God’s infinite intellect;[[37]](#endnote-37) and God himself is seen as an *infinite* and most perfect being. The actual world, too, consists of infinitely many individual substances, each of which involves relations to infinitely many others and “exhibits an infinite series of operations” (Comments on Fardella, AG 102).[[38]](#endnote-38) In an early note, Leibniz writes that every part of the world, regardless of how small, “contains an infinity of creatures” which is itself a kind of “world” (A 6.3 474).[[39]](#endnote-39)

 Leibniz’s confidence in using infinity is related to the success of his early mathematical work on infinite series, the development of the calculus,[[40]](#endnote-40) and his syncategorematic interpretation of the infinitely small.[[41]](#endnote-41) It goes without saying that Leibniz’s method of handling the infinitely small demonstrates that a finite mind is capable of comprehending the infinite in this context. It is worth noting that this attitude goes against the warnings of both Descartes and Pascal of the dangers of going beyond our finite capacities.[[42]](#endnote-42)

 Given this background, it is not surprising that, in his remarks on Pascal, Leibniz does not criticize Pascal for using infinity. Rather, he complains that Pascal has not gone far enough in describing nature as infinite; that he does not recognize how pervasive infinity is in nature, and how central it is for understanding the nature of living things and of reality itself. Hence, Pascal’s reflections, Leibniz says, are but an *entrée* to his system (*n’est qu’une entrée dans mon système*). Thus, according to Leibniz, Pascal is not so much wrong as not sufficiently advanced in his employment and analysis of infinity. As we shall see in section 7, this subtle critique implies some significant differences between Leibniz and Pascal.

4. Pascal’s Mite and Leibniz’s Living Mirror

Leibniz’s general reproach in this text seems fairly clear: while Pascal did much to ascribe infinity to nature, he did not go far enough. However, since Pascal fully embraces the infinity of nature, the reasons behind Leibniz’s reproach are not so clear; they require further specification. Here is what Leibniz says in the second version of the text:

What would he have not said, with that powerful eloquence he possessed, if he had gone further, if he had known that all matter is organic throughout, and that however small a portion one takes contains, representatively, by virtue of the actual diminution to infinity that it encompasses, the actual increase to infinity that is in the universe outside that portion – that is to say, that each little portion contains, in an infinity of ways, a living mirror expressing the entire, infinite universe…?[[43]](#endnote-43)

Leibniz argues that, however small, each part of matter is organic and makes up a “living mirror” that expresses the whole universe. Leibniz’s use of this image (a living mirror) is new and curious. While Leibniz refers to the notion of a mirror earlier in his career, to the best of my knowledge, this is the first time that the notion of *living* mirror shows up in his writings.[[44]](#endnote-44) Leibniz’s use of this image draws on Pascal’s reference to both the infinitely small and the infinitely large but alters it, so that each portion of matter, however small, is organic and *represents* the infinitely large universe around it by virtue of being a living mirror of it. This in turn implies that any such potion of matter is considered as a living thing, not an aggregate and not just matter (which is always further divisible). In this way, a living mirror, which may be smaller than any given size, expresses a universe that may be larger than any assigned magnitude, so that the infinitely small represents the infinitely large.[[45]](#endnote-45)

It is important to stress that such a mirror is an active, living being – *c’est un miroir* vivant, he writes –, so that the mirroring is not just the replication of structure but also the inner activity (of perception), rather than the mere passive reflection of an ordinary mirror. According to Leibniz, the ontological bedrock of the real world consists of organic things. As he writes: “all organic bodies are animate, and all bodies are either organic or collections of organic bodies (A 6.4 1798/LOC 277).” As we know from later texts, from this period the Leibnizian universe becomes populated by infinitely many living beings for which he will adopt the term ‘monad’. In light of his view that nature consists of living beings and that an essential feature of living beings is that, however small, their inner nature represents (while being a part of) the infinitely large universe, Leibniz’s response to Pascal seems not only more specific but also to signal a radical break from Pascal’s aims of using infinity, as well as from his interpretation of the infinitely small and the infinitely large.

To examine this more closely, let us compare Pascal’s depiction of a mite with Leibniz’s depiction of a living being as a living mirror. Here is what Pascal says:

What is a man in the infinite? Who can comprehend it? But to show him another prodigy equally astonishing, let him examine the most delicate things he knows. Let a mite be given him, with its minute body and parts incomparably more minute, limbs with their joints, veins in the limbs, blood in the veins, humours in the blood, drops in the humours, vapours in the drops. Dividing these last things again, let him exhaust his powers and his conceptions, and let the last object at which he can arrive be now that of our discourse. Perhaps he will think that here is the smallest point in nature. I will let him see therein a new abyss. I will paint for him not only the visible universe, but also everything he is capable of conceiving of nature's immensity in the womb of this imperceptible atom. Let him see therein an infinity of worlds, each of which has its firmament, its planets, its earth, in the same proportion as in the visible world; in this earth of animals, and ultimately of mites, in which he will find again all that the first had, finding still in these others the same thing without end and without cessation. Let him lose himself in wonders as amazing in their minuteness as [are] the others in their vastness.[[46]](#endnote-46)

Pascal’s imagery here is quite astonishing. In fact, it seems rather similar to Leibniz’s early view that the infinitely small implies new *abimes* in the form of worlds within worlds to infinity.[[47]](#endnote-47) But there is an important difference: in Leibniz’s notion of the living mirror, the infinitely vast world is represented by virtue of both the nested structure that develops to infinity and its active perception. For Leibniz, there is an inherent, structural connection between the infinitely small and the infinitely large in the very constitution of the world. The two infinities are not disparate, as in Pascal, but rather are intrinsically connected, in the sense that they map onto one another. This is accentuated by Leibniz’s insistence that these mirrors are living mirrors. In this way, each minute constituent of the world expresses all the rest through isomorphic relations, and perception of those relations, which are at the heart of his system of pre-established harmony.[[48]](#endnote-48) Leibniz’s notion of the living mirror is thus consistent with the famous homomorphism Leibniz sees between each constituent of the world and the world as a whole. “*C’est tout comme ici, partout et toujours,*” as he sometimes expresses this idea.[[49]](#endnote-49) The inner structure of each monad resembles the structure of any other, so that active perception of its own structure mirrors that of the world.

5. The Wonders of Infinity and their Theological Undertones: Desperation vs. Celebration

As we have just seen, there is a sharp difference in the use of infinity between Pascal and Leibniz. For one thing, there is a strategic difference in what they use infinity for. The claim of Pascal’s reflection on the infinite is that awareness of its paradoxical nature would reveal our true nature as finite, cognitively and rationally limited beings, and thus incapable of comprehending the infinity of nature surrounding us. In particular, Pascal’s aim in his description of a mite is to astound, even to shock, his readers. Obviously, Pascal’s ultimate goal here is not a cool and scientific description of the living world.[[50]](#endnote-50) Rather, he urges his readers to lose themselves (*qu’il se regarde comme égaré*) in the marvels of infinity, which are astonishing in both their vastness and their minuteness. But these marvels are meant to bring out the inherent frustration and disproportion of human intelligence as it finds itself caught in between them, “incapable of understating the infinity which surrounds us”.[[51]](#endnote-51)

 While Leibniz is obviously impressed with the wonders of infinity, he rejects Pascal’s call to lose ourselves in its wonders. Whereas in Pascal the human mind loses itself in despair between the infinitely large and the infinitely small, nothing is more foreign to Leibniz’s spirit – either being lost or being in despair. Instead, while it is well known that optimism is one of Leibniz’s trademarks, the celebration of the infinite is one aspect of his optimistic spirit that has not been sufficiently appreciated.[[52]](#endnote-52) In contrast to Pascal’s awe and desperation in face of the infinite,[[53]](#endnote-53) in Leibniz we find marvel and *celebration* of the infinite. As we noted above, infinity figures in almost every aspect of Leibniz’s philosophy. This is very vivid in our text: “through the actual infinity of parts,” Leibniz writes, “the least portion contains a living mirror expressing all the infinite universe in an infinity of ways, so that... not only the present extends to infinity but also the past and all the future [infinite at each moments] infinitely infinite […].” For Leibniz, contemplation of the infinite provides no reason for despair; rather, Leibniz turns Pascal’s despairing attitude into a celebration of infinity. While Pascal attempts to make our rational aspirations more humble, Leibniz is ever optimistic about the capacity of human reason to further extend itself, in general, and with respect to the notion of infinity, in particular.

 As with Pascal, Leibniz’s attitude has some theological motivation. In fact, both thinkers believe that the contemplation of the infinite will lead us to God.[[54]](#endnote-54) But it will do so in very different ways. For Leibniz, celebrating infinity is strongly related to his conviction that infinity is an essential aspect of nature, in general, and our nature, in particular. Therefore, studying infinity constitutes a way to appreciate and admire the glory of God as its creator. Rather than despair in the labyrinthine and awesome nature of infinity and our disproportion to it, Leibniz maintains that we should study and appreciate infinity as a constitutive and positive aspect of nature, including our own. More precisely, infinity is a constitutive aspect of the way created things are made in the image of God. To put it differently, for Leibniz, infinity is part of the likeness between God and his creatures, so that the infinite in nature is a manifestation of that of its creator. Thus, Leibniz’s extensive use of infinity in describing the natural world derives not only from his mathematical work but also from his theological and metaphysical commitments. Leibniz’s mathematical work taught him how to treat the quantitative infinite in a rational manner, but he certainly also uses it to further his theological commitments.

 Some of Leibniz’s theological commitments can be illustrated by what Lea Schweiz has recently called “a sacramental view of nature.” According to this view, “the whole of the created order [can be seen] as exhibiting one of the key principles of Lutheran sacramental theology, namely, the finite is capable of the infinite (*finitum capax infiniti*).”[[55]](#endnote-55) The finite, created world is made in the image of God and, for this reason, it is seen as capable of presenting and manifesting the infinite essence and perfection of God. This theological commitment was certainly controversial. In Malebranche, for example, we find a diametrically opposed view.[[56]](#endnote-56) This commitment goes some way towards explaining why Leibniz complains that Pascal, despite being one of the few to have made so much of the notion of infinity, did not go far enough. It would also explain why Leibniz finds Pascal’s description of the infinitely large and the infinitely small to be on the right track, but to ultimately remain no more than the entry point to his new system of pre-established harmony.

 Leibniz’s ascription of infinity to the created world through the principle that the finite is capable of (perceiving/manifesting/expressing) the infinite raises, however, a serious problem. The relation between God and his creatures is commonly understood at the time as a categorical divide between an infinite entity and finite entities. If Leibniz regards creatures as infinite as well, how would he account for the difference between creatures and the Creator? In fact, Leibniz’s comment on Pascal provides us with an important clue. Most early modern philosophers – for example, Pascal, Descartes, and Spinoza – endorse this dichotomy. The gist of Leibniz’s approach is to cast the difference between creatures and the Creator not in terms of a categorical divide, but rather in terms of degrees. Leibniz’s description of a living mirror in our text as “being at the same time, less than God and more than the material universe: as a diminutive-God… ” implies this notion of degrees. Traditionally, the categorical distinction between finite and infinite was seen as capturing the distinction between God and individual things. In sharp contrast to this tradition, our text suggests that Leibniz draws the distinction in terms of degrees: the absolute infinity of God is set above the infinity of creatures, which are set above the infinite divisibility of matter and the infinity of mathematical things. This is consistent with Leibniz’s earlier distinction between three degrees of infinity that apply to three degrees of being (found in his annotations on Spinoza’s letter on the infinite, in 1676).[[57]](#endnote-57) At the same time, this distinction has to cohere with Leibniz’s position regarding the status of infinite magnitudes, viz., his rejection of infinitely large (number, line, shape, speed) and infinitesimal magnitudes.

 As we have seen, Leibniz’s comment on Pascal provides some insights into Leibniz’s attitude towards infinity in general, and into its application in the context of living beings in particular. The text points to the contrasts between the ways in which Leibniz and Pascal conceive of the relation between the finite and the infinite. It suggests that Leibniz understands the gap between the finite and the infinite not as a categorical distinction, as it was traditionally understood, but as one of degree. Thus, for Leibniz, every created thing is seen as infinite, to some degree.[[58]](#endnote-58)

6. Why *This* response to Pascal at *This* time (circa 1696)? Leibniz’s Definition of Living Beings in terms of the Infinite Complexity of Natural Machines

Now let’s return to the question raised at the beginning of this paper; how do we account for the fact that *this* particular reaction to Pascal comes only at this stage of Leibniz’s career (circa 1696)? As we saw in the first section, Leibniz was familiar with Pascal’s work and commented on it from very early in his career. However, Leibniz drafts this comment on Pascal shortly after his *New System of Nature* of 1695. What could account for this particular response to Pascal’s piece on the double infinity at this point? Certain changes that took place in Leibniz’s views might make sense of it. My interest here is not so much in the causes that prompted Leibniz to compose the text, which, for all we know, may be accidental, but for the reasons that could account for the content of his response.

 Attending to the development of Leibniz’s definition of living beings, and his use of infinity as part of this definition in particular, throw some light on this question. The full story of Leibniz’s development on this question would require a paper of its own. It is also not an uncontroversial story.[[59]](#endnote-59) But, there are some striking and noteworthy facts that stand out in this connection: the notion of a natural machine with its nested structure to infinity comes to the foreground as Leibniz’s prime model of living beings only after 1695. This has been argued for in several articles; to my mind, it is made especially clear by Michel Fichant’s “Leibniz et les machines de la nature”.[[60]](#endnote-60)

 In the *New System of Nature* (1695), Leibniz no longer uses infinity merely to describe nature as worlds within worlds to infinity, as he has done previously; instead, infinity now becomes one of the defining features of living beings. In the *New System* *of Nature*, Leibniz draws the distinction between living and non-living things in terms of the subtle difference between natural and artificial machines. He articulates his position against Descartes’s reductionist view that living things are nothing but subtle machines, akin to artificial ones but only more subtle and complex. Leibniz argues that the difference is not merely one of degree. Rather, there is a difference in kind between human-made machines and the natural machines of divine creation. The difference Leibniz notes, however, seems rather subtle: natural machines differ from artificial machines in being machines to the least of their parts, so that they are machines within machines *ad infinitum*. As he writes,

I believe that this [Descartes’] conception (in which the difference between natural machines and ours is merely one of degree) does not give us a sufficiently just and worthy idea of nature, and that my system alone allows us to understand the true and immense distance between the least production and mechanisms of divine wisdom and the greatest masterpieces that derive from the craft of a limited mind; this difference is not simply a difference of degree, but a difference in kind. We must then know that the machines of nature have a truly infinite number of organs, and are so well supplied and so resistant to all accidents that it is not possible to destroy them. A natural machine still remains a machine in its least parts, and moreover, it always remains the same machine that it has been, being merely transformed through the different enfolding it undergoes, sometimes extended, sometimes compressed and concentrated as it were, where it is thought to have perished (*New System of Nature*, AG 142). [[61]](#endnote-61)

By virtue of being a divine creation rather than a result of human production, a natural machine is both infinite (thus bearing the mark of its creator) as well as a single, indestructible entity, which remains one and the same as long as it acts.[[62]](#endnote-62) Unlike an artificial machine, a natural machine cannot be composed or decomposed; its variation and change of states do not destroy its unity as it is “merely transformed through the different enfolding it undergoes”. It is *created* as one functional unit, however complex its internal states may be. As a consequence, it remains the same as long as it lives – which is forever, unless annihilated by God. Hence, a natural machine always preserves a certain degree of life or primitive activity. In his recent book, Richard Arthur writes:

what makes a natural machine ‘the *same* machine in its least parts’ for Leibniz is its possession of a substantial form or monad. It does not have to have the same parts from one instant to another, so long as the parts it does have contribute to its own functions and end. For this it needs to be the source of its own actions, and also to have a law or “program” for the development and unfolding of these actions. Each of these two aspects of Leibnizian forms is crucial.[[63]](#endnote-63)

As Arthur adds: “it is the internal law governing the unfolding of the states of a substance that accounts for it having a genuine unity, as opposed to the accidental unity of an artificial machine.”[[64]](#endnote-64) What gives a natural machine – a machine with an infinitely complex structure – its unity is an internal law of production. This internal law functions as a program for self-organization and self-regulation, so that each Leibnizian substance is also causally self-sufficient. According to Leibniz, a living being is infinite both in the sense of being ever active and in its nested structure, *ad infinitum*.[[65]](#endnote-65) The infinity and unity of living beings is intrinsically related, of course, to the fact (noted above) that they are “divine machines,” created by an infinite creator.[[66]](#endnote-66)

 It is arguable that Leibniz’s view of a natural machine (as briefly presented above) is very similar to Pascal’s description of a mite, such that each of its parts is further divisible to infinity. Frédéric de Buzon has noted this similarity. He writes:

That the parts of living beings are also living beings, and this to infinity, is exactly Leibniz’s conception of natural machines, whose difference from artificial machines is only that they are ‘machines to the least of their parts’ (my translation).[[67]](#endnote-67)

De Buzon is right in pointing to the notion of a natural machine as the most pertinent novelty in the background of Leibniz’s comment on Pascal. He is also right to observe a similarity in the appeal to infinity by both. At the same time, there is a very significant dissimilarity in the role infinity plays in Leibniz’s and Pascal’s respective views of living beings. Whereas for Pascal the infinitely small derives from the divisibility of matter, for Leibniz, the infinity of a natural machine is related instead to the intrinsic unity and indestructibility of substances. According to Leibniz, the distinctive feature of a natural machine (in distinction from an artificial machine) is that it is *not* infinitely divisible. In fact, it is not divisible at all. Rather, I would argue that the infinite structure of a natural machine, produced by an internal law of generation, is what makes it an indivisible and indestructible unity. The unity and indestructibility of a natural machine is due to its internal law of development – in informing the change of its states to infinity, the law functions as a unifying principle as well. While the series of states change *ad infinitum*, the law remains one and the same. The law thus makes it infinite and one thing.[[68]](#endnote-68) In addition, infinity is also what marks a natural machine a divine machine, that is, a machine that cannot be composed or decomposed by humans but must be created or annihilated as a natural unity by God.

 As we have seen, Leibniz begins to articulate this conception of a natural machine in the *New System* of 1695. Thus, we are now in a better position to see why *this* particular response to Pascal was not likely to come up earlier in Leibniz’s career, despite his long familiarity with Pascal’s work. Given this background, it need not surprise us that Leibniz would respond by claiming that Pascal did not see the full significance of infinity as a defining feature of living beings shortly after coming to define living beings through the nested structure *ad infinitum* of natural machines.

 One might wonder at this point what exactly the relation between the notion of a natural machine and that of a living mirror is. The term “mirror” does not appear in the *New System of Nature*. Leibniz, however, comes rather close to implicating it in a several passages in which he discusses the representative nature of the soul:

This is what makes every substance represent the whole universe exactly and in its own way, from a certain point of view [....] And since this nature that pertains to the soul is representative of the universe in a very exact manner (though more or less distinctly), the series of representations produced by the soul will correspond naturally to the series of changes in the universe itself [....] Since every mind is like a world apart, self-sufficient, independent of any other creature, containing infinity, and expressing the universe, it is as durable, subsistent, and absolute as the universe of creatures itself  (AG 143-5).

The definition of a natural machine as a machine in the least of its parts implies a view of a living being with an infinitely complex structure of machines within machines to infinity. I called this feature a nested structure that develops *ad infinitum*. Against this background, depicting a living being as a living mirror brings out a new feature in Leibniz’s view: the inner perception of its proper structure (of the infinitely small, in Pascal’s terms) allows a representation of the infinitely large, by virtue of the isomorphic relation between the inner structure of each living being and that of all others. Hence, the role of active mirroring derives from inner perception that would represent the external world. Perhaps this is why the figure of a mirror that already appears in the discourse on metaphysics (art. 9) now becomes a *living* one, so that it comes to exemplify the very nature of a living being. It is worth observing that the notion of mirror and living mirror also come up in other texts circa 1696. To show this, let us take a closer look at Leibniz’s letter to Sophie, written on November 4th, 1696.[[69]](#endnote-69)

 In this letter, we find Leibniz expressing many of the points just noted (while using the terms ‘mirror’, ‘living mirror’, and ‘machine of nature’), and strongly echoing some of the doctrines presented in the *New System*. After noting that some Cartesians have complained that he attempts to reestablish the view that animals are entitled to have souls (*des amés*) and that all bodies involve some vigor and life (*de la vigueur et la vie*), rather than being mere extended mass (in Fichant 2004, 333), he writes these famous lines:

My fundamental meditations turn on two things, namely on unity and on infinity. Souls are unities and bodies are multitudes, but infinite ones, so that the slightest grain of dust contains a world of an infinity of creatures. And microscopes have revealed more than a million living animals in a drop of water. But unities, even though they are indivisible and without parts, nevertheless represent the multitudes, in much the same way as all the lines from the circumference are united in the centre of the circle, which alone faces it from all the sides even though it does not have any size at all. The admirable nature of sentiment consists in this reunion of infinity in unity (*cette réunion de l’infini dans l’unité*), which also makes each soul like a world apart, representing the larger world in its way and according to its point of view, and that consequently each soul, once it begins to exist, must be as durable as the world itself, of which it is a perpetual mirror. These mirrors are likewise universal, and each soul exactly expresses the universe in its entirety… (Lloyd Strickland translation, *The Shorter Leibniz Texts,* 79)

I need not stress, I believe, the striking similarity between this text and Leibniz’s comment on Pascal. A bit later in the text Leibniz notes that the *secte Machinale* has gone too far in reducing animals to machines, thus downgrading the majesty of nature. He then argues that once we would have a better grasp of the infinite, we would have an altogether different idea of Nature, in seeing its majesty rather than in seeing it as reduced to mere machines, or, as nothing more than a workman’s shop (*la boutique d’un ouvrier)*, as the otherwise clever author of the *Entretiens sur la pluralité des mondes* (Fontenelle) believes. Leibniz then continues:

The Machines of nature are infinitely above ours. For besides the fact that they have sensation, each contains an infinity of organs, and what is even more marvelous,[[70]](#endnote-70) it is for that reason that every animal is resistant to all accidents and can never be destroyed, but only changed and strengthened by death, as a snake sheds its old skin (80-81).[[71]](#endnote-71)

The term living mirror comes up at the very end of the letter:

And it is in this that consists the advantage of minds (*esprits*) for which the sovereign Intelligence has made everything else, so as to make itself known and loved, multiplying itself so to speak in all these living mirrors that represent it (*The Shorter Leibniz Texts*, 81).

7. Divisibility and Disparity in Pascal vs. Unity and Harmony in Leibniz

As we have seen, at this stage of Leibniz’s thought, the infinity of natural machines is not a principle indicating division, as in Pascal; rather, it is a principle of unity. This also explains why the term ‘monad’ is evoked in this context. And I say this without implying any commitment to the later connotations of the term in Leibniz’s later writings. [[72]](#endnote-72) As I have argued elsewhere, the unity of a natural machine with its structure of machines nested one within the other to infinity derives from its inner source of activity – its entelechy, which is in turn informed by its internal law of development. Its internal law of development may also account for the infinity of a natural machine.[[73]](#endnote-73)

 Furthermore, Leibniz’s usage of infinity in his comment on Pascal does not only signal unity as opposed to divisibility but also harmony and connectedness as opposed to the disparity and disproportion emphasized by Pascal. The notion of a living mirror not only encapsulates the infinitely small but also allows a *representation of* the infinitely large by virtue of inner perception.[[74]](#endnote-74) As Leibniz writes to de Volder, a living mirror is a “concentrated world,” whose inner structure expresses the structure of the universe. Further, a living mirror expresses the world through active perception whose role is to reveal the diversity of each such individual through its active principle. This, I believe, is why the notion of a living mirror is connected to that of entelechy, that is, the source of action (perception) in a substance is also what accounts for the mirroring:

Entelechies must necessarily differ, that is, they must not be entirely similar to each other. Indeed, they must be sources (*principia*) of diversity, for different ones express the universe differently, each from its own way of viewing things; it is their duty to be so many living mirrors of things, that is, so many concentrated worlds (Leibniz to de Volder, June 1703, AG 177).[[75]](#endnote-75)

Leibniz’s use of infinity through the notion of a living mirror suggests that each individual being, no matter how minute, forms an integral part of a well-connected and harmonious system. Whereas Pascal exploits the infinite division of the organic world to stress our alienation and incomprehension of the world surrounding us, in Leibniz, infinity serves to stress a sense of connectedness among individual substances, a sense of harmony and, for that reason, one might even say, a sense of belonging.[[76]](#endnote-76) Indeed, for Leibniz, infinity need not make the world strange and incomprehensible to us. Rather, being made in the image of God, we are infinite as well, and should feel at home in a world in which every aspect bears the mark of an infinite creator.[[77]](#endnote-77)

8. Conclusion

Unlike most thinkers of the period (including Descartes, Malebranche, and Pascal), Leibniz ascribes infinity to created beings as one of their essential features. He rejects the sharp dichotomy between an infinite creator and finite creatures, as well as the epistemological imperative (explicit in both Descartes and Pascal) that, as finite minds, we cannot, and thus should not even attempt to, grasp the infinite. By contrast, Leibniz argues that the infinite need not be dreaded but should rather be investigated, so that the glory of God and its expression in the created world becomes more apparent and comprehensible. Thus, for him, created substances are imitations of their creator *in this respect* (infinity). The kind of infinity related to being is not quantitative, so that creatures do not possess an infinitesimal *magnitude*.[[78]](#endnote-78) It is rather infinity related to a program of action that lasts for as long as creatures act. As Leibniz writes in the second version of his note on Pascal,

...all these wonders are surpassed by the envelopment of what is (infinitely) above all greatnesses in what is (infinitely) below all smallnesses; that is to say, our pre-established harmony, which has only recently appeared on the scene, and which yields even more than (entirely) universal infinity, concentrated in the more than infinitely small and absolutely singular, by placing, virtually, the whole series of the universe in each real point which makes a Monad (or substantial unity), of which I am one; that is, in each substance truly one, unique, primitive subject of life and action, always endowed with perception and appetition, always containing in what it is the tendency to what it will be,to represent everything else which will be.[[79]](#endnote-79)

Leibniz goes on to say that this substantial unity, which is a primitive subject of life, or a “living mirror,” is like a “diminutive God.” It is like God in that it is a living, active being that will never cease to act and perceive. But, unlike God, it is a particular and thus limited expression of God, and its perceptions are often indistinct and confused.

 Leibniz’s response to Pascal thus clearly brings out the close and interesting relation he sees between infinity and living beings. On the face of it, Leibniz does not dispute Pascal’s description of living beings as infinite; he argues that Pascal did not go far enough in ascribing infinity to living beings. But, as we look closer into this text and its implications, Leibniz’s turns out to be an altogether different sense and use of infinity. Had Pascal comprehended the true nature of the organic world, Leibniz thinks, he would see that infinity cuts deeper into the nature of things – that it is the mark of living beings, which constitutes the fundamental ontology of the universe. Furthermore, each living being mirrors the whole universe by virtue of being infinite itself, and it thus constitutes a living representation of the universe. Leibniz’s notion of a living mirror illustrates his view that each living being, whose inner structure develops to infinity, *actively* represents the infinitely large world. At the same time, it constitutes a principle of unity that stands above the infinite divisibility of matter. While the wonders of infinity invoke awe and astonishment, they also deserve admiration and contemplation and, I would go so far as to say, celebration. Thus, according to Leibniz, contemplating and studying the infinite will yield a sense of comprehension and belonging, rather than Pascal’s sense of fear, alienation, and despair.

References

Antognazza, Maria Rosa, *Leibniz: An Intellectual Biography* (Cambridge University Press, 2009).

Aristotle, ‘Generation of Animals’ in Jonathan Barnes (ed.), A. Platt (trans.), *The Complete Works of Aristotle*, vol. I (Princeton, N.J.: Princeton University Press, 1984).

Arthur, Richard T. W, *Leibniz* (Cambridge: Polity Press, 2014).

Baruzi, Jean, *Leibniz et l’organisation religieuse de la terre* (Paris: Félix Alcan, 1907).

———, *Leibniz* (Paris: Bloud, 1909).

De Buzon, Frédéric, ‘Que Lire Dans Les Deux Infinis? Remarques Sur Une Lecture Leibnizienne,’ *Les Études Philosophiques,* 4 (2010), 535-548.

———, ‘Double Infinité Chez Pascal Et Monade. Essai de Reconstitution Des Deux États Du Texte,’ *Les Études Philosophiques,* 4 (2010), 549–56.

Duchesneau François, *Les modèles du vivant de Descartes à Leibniz* (Paris: J. Vrin, 1998)*.*

———, *Leibniz, le vivant et l'organisme* (Paris: J. Vrin, 2010).

Fichant, M. (ed.), *G.W. Leibniz, Discours de métaphysique suivi de Monadologie et autres textes* (Paris: Gallimard, 2004).

———, ‘Leibniz et les machines de la nature,’ *Studia leibnitiana,* 35 (2003), 1-28.

———, ‘L’invention métaphysique,’ an introduction to G.W. Leibniz *Discours de métaphysique suivi de Monadologie et autres textes* (Gallimard, 2003).

Garber, Daniel, *Leibniz - Body, Substance, Monad* (Oxford and New York: Oxford University Press, 2009).

Gerhardt, Carl Immanuel, ‘Leibniz und Pascal,’ in *Sitzungsberichte der Königlichen Akademie der Wissenschaften zu Berlin*, Band 2 (Berlin: Verlag der Königlichen Akademie der Wissenschaften, 1891).

Goldenbaum, Ursula, ‘Leibniz as a Lutheran,’ in Allison Courdert, Richard H. Popkin, and Gordon M. Weiner (eds.), *Leibniz, Mysticism, and Religion* (Dordrecht, NL: Kluwer, 1998), 169–92.

Grua, Gaston, *G. W. Leibniz: Textes Inédits D’après Les Manuscrits de La Bibliothèque Provinciale de Hanovre* (Paris: PUF, 1948).

Laerke, Mogens, *Les Lumières de Leibniz. Controverses avec Huet, Bayle, Regis, et More* (Paris: Classiques Garnier 2015).

Leibniz, Gottfried Wilhelm, *Samtliche Schriften und Briefe*, Deutsche Akademie der Wissenschaften zu Berlin (ed.) (Darmstadt, 1923 ff., Leipzig, 1938 ff., Berlin, 1950 ff.)

———, *Die Mathematischen Schriften von G. W. Leibniz*, Gerhardt, Carl Immanuel (ed.) (Berlin: Winter, 1860).

———, *Die Philosophischen Schriften von G. W. Leibniz*, Gerhardt, Carl Immanuel (ed.) 7 vols. (Berlin: Weidmann, 1875).

———, *Philosophical Essays*, Roger Ariew and Daniel Garber (eds.), 1st edition (Indianapolis: Hackett Publishing Company, 1989).

———, *De Summa Rerum: Metaphysical Paper, 1675–1676,* George H. R. Parkinson (ed.) (New Haven, CT: Yale University Press, 1992).

———, *The Labyrinth of the Continuum: Writings on the Continuum Problem, 1672-1686,* Richard T. W. Arthur (ed.) (New Haven: Yale University Press, 2002). [LOC]

———, ‘Leibniz: Double Infinity in Pascal and Monad,’ Lloyd Strickland (trans.), *Leibniz-Translations.com*, n.d., http://www.leibniz-translations.com/pascal.htm.

———, *Leibniz. The Shorter Leibniz Texts*, Lloyd Strickland (trans.) (London: Continuum, 2006).

———, *The Leibniz-Des Bosses Correspondence,* Brandon Look and Donald Rutherford (trans.) (New Haven: Yale University Press, 2007).

Marras, Christina, ‘Mirrors that mirror each other,’ in Herbest Breger, Jürgen Herbest, and Sven Erdner (eds.), *The Collection of Papers from the VIII Internationaler Leibniz-Kongress* (Hannover: 2006), 556-64.

McKenna, Antony, *De Pascal à Voltaire. Le rôle des Pensées de Pascal dans l’histoire des idées entre 1670 et 1734*, 2 vols. (Oxford: The Voltaire Foundation, 1990)*.*

Mesnard, Jean, ‘Leibniz et les papiers de Pascal,’ in *Leibniz à Paris,* vol. I (Wiesbaden: F. Steiner 1978), 45-58.

Nachtomy, Ohad, ‘Leibniz on Nested Individuals,’ *British Journal for the History of Philosophy* (2007).

———, ‘Leibniz on Artificial and Natural Machines’ in Justin E. H. Smith and Ohad Nachtomy (eds.), *Machines of Nature and Corporeal Substances in Leibniz*, (Springer, The New Synthese Historical Library, 2011).

Nachtomy, Ohad, and Justin E. H. Smith, *The Life Sciences in Early Modern Philosophy* (New York, NY: Oxford University Press, 2014).

Naërt, Émilienne, *Leibniz et la querelle du pur amour* (Paris: Vrin, 1959).

———, ‘Double infinité chez Pascal et Monade,’ *Studia Leibnitiana*, 17:1 (1985), 44-51.

Pascal, Blaise, ‘Pensèes,’ in Louis Lafuma (ed.), *Œuvres Complètes* (Paris: Éditions du Seuil, 1963).

Riley, Patrick, *Leibniz' universal jurisprudence: Justice as the charity of the wise* (Cambridge, Massachusetts: Harvard University Press, 1996).

Schweitz, Lea F. ‘On the Continuity of Nature and the Uniqueness of Human Life in G. W. Leibniz,’ in Ohad Nachtomy and Justin E. H. Smith (eds.), *The Life Sciences in Early Modern Philosophy* (New York, NY: Oxford University Press, 2014).

Serres, Michel, *Le système de Leibniz et ses modèles mathématiques* (Paris*:* PUF 1968).

Smith, Justin E. H. and Nachtomy, Ohad (eds.), *Machines of Nature and Corporeal Substances in Leibniz* (Springer, The New Synthese Historical Library, 2010).

Smith, Justin E. H., *Divine Machines: Leibniz and the Sciences of Life* (Princeton University Press, 2011).

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2. J. Baruzi, *Leibniz et l’organisation religieuse de la terre* [*l’organisation religieuse*] (Paris: Félix Alcan, 1907); and J. Baruzi, *Leibniz* (Paris: Bloud, 1909). [↑](#endnote-ref-2)
3. J. Mesnard, ‘Leibniz et les papiers de Pascal’ [‘Pascal’], in *Leibniz à Paris*, vol. I (Wiesbaden: F. Steiner, 1978), 45-58. [↑](#endnote-ref-3)
4. F. de Buzon, ‘Que Lire Dans Les Deux Infinis ? Remarques Sur Une Lecture Leibnizienne’ [‘Lecture Leibnizienne’], *Les Études Philosophiques,* 4 (2010), 535-548; M. R. Antognazza, *Leibniz: An Intellectual Biography* [*Intellectual Biography*] (Cambridge University Press, 2009), 537. For more details of Leibniz’s early reception of Pascal, see Mesnard, ‘Pascal,’ 45-58. [↑](#endnote-ref-4)
5. See A I. 1 436 for the receipt of Leibniz’s purchase of Pascal’s work. From here on, I will follow these standard abbreviations: A = Deutsche Akademie der Wissenschaften (ed.), Gottfried Wilhelm Leibniz : Sämtliche Schrifien und Briefe (Berlin: Akademie Verlag, 1923–); AG = R. Ariew and D. Garber (eds. and trans.), Philosophical Essays (Indianapolis: Hackett, 1989); GP = C. I. Gerhardt (ed.), Die philosophischen Schriften von Gottfried Wilhelm Leibniz, 7 vols. (Berlin, 1875-90); LOC = Richard Arthur (ed. and trans.), The Labyrinth of the Continuum: Writings on the Continuum Problem, 1672–1686 (New Haven: Yale University Press, 2001); O = Andre Robinet (ed.), *Malebranche: Œuvres complètes,* 20 vols. (Paris : J. Vrin, 1958-84). [↑](#endnote-ref-5)
6. Antognazza, *Intellectual Biography*, 157–59. [↑](#endnote-ref-6)
7. See A 6.2 332; see also Antognazza, *Intellectual Biography*, 144. [↑](#endnote-ref-7)
8. See Leibniz’s letter to Oldenburg in A 3.1 255-6. See also Antognazza, *Intellectual Biography*, 162; De Buzon, ‘Lecture Leibnizienne’, 537. [↑](#endnote-ref-8)
9. Mesnard even thinks that it was due to his discovery of Pascal that these years (1675-76) were so exceptionally rich for Leibniz. See Mesnard, ‘Pascal’, 58. [↑](#endnote-ref-9)
10. Ibid., 538. [↑](#endnote-ref-10)
11. For example, Leibniz was critical of Pascal’s *Esprit géométrique* and his theory of definition. See, for example, A 6.4 591 and 970; and see, De Buzon, ‘Lecture Leibnizienne,’ 539; and M. Laerke, *Les Lumières de Leibniz. Controverses avec Huet, Bayle, Regis, et More* [*Les Lumières* ], (Paris: Classiques Garnier, 2015), 107-10 for more details. For Leibniz’s attitude regarding the use of mathematics in the service of theology in relation to Pascal, see Baruzi, *l’organisation religieuse*, 222-25. [↑](#endnote-ref-11)
12. I do not pretend to analyze here the complex relations between the two philosophers, or to consider all aspects of Leibniz as a reader of Pascal. For Leibniz’s references to Pascal, see, for example, Leibniz’s letter to Burnett, February 1697, GP III 195; his letter to Seckendorff, 11 June, 1683, A II 1 840. For a more thorough discussion of the way Leibniz read Pascal, see V. Carraud, ‘Leibniz lecteur des *Pensées* de Pascal’ [‘*Pensée*s de Pascal’], *XVIIe siècle* 2, (1986), 107-124; De Buzon, ‘Lecture Leibnizienne’ and Laerke, *Les Lumières.* [↑](#endnote-ref-12)
13. G. Grua, *G. W. Leibniz: Textes Inédits D’après Les Manuscrits de La Bibliothèque Provinciale de Hanovre* (Paris: PUF, 1948), 552–555. [↑](#endnote-ref-13)
14. F. de Buzon, ‘Double Infinité Chez Pascal Et Monade. Essai de Reconstitution Des Deux États Du Texte’ [‘Double Infinité’], *Les Études Philosophiques,* 4 (2010), 549–56. [↑](#endnote-ref-14)
15. See Leibniz’s Letter to De Volder AG 177 and Leibniz to Rémond, February 11 1715, GP III 636. [↑](#endnote-ref-15)
16. See de Buzon, ‘Double Infinité,’ “Ce que Mons. Pascal dit de la double infinité, qui nous environne en augmentant et en diminuant, lorsque dans ses Pensées (n. 22) il parle de la connaissance générale de l’homme, n’est qu’une entrée dans mon système,” 554 De Buzon, ‘Lecture Leibnizienne,’ articulates the question as follows: “ …comment une sorte de résonance philosophique se met en place dans Double infinité et Monade, par laquelle un auteur peut faire entendre une pensée dans la sienne, à titre de commencement ou d’entrée, à un certain moment de son propre développement?,” 536 [↑](#endnote-ref-16)
17. “On voit comment les pages de Pascal sont, pour Leibniz, l'occasion de donner, en un raccourci saisissant, toute sa philosophie.” (E. Naërt, ‘Double infinité chez Pascal et Monade’ [‘Pascal et Monade’], *Studia Leibnitiana,* 17:1 (1985), 51.) [↑](#endnote-ref-17)
18. For two remarkable accounts of Leibniz’s development in this period, see Michel Fichant’s introduction to his edition of G. W. Leibniz, *Discours de métaphysique suivi de Monadologie et autres textes,* (Paris: Gallimard, 2003), 7-147; and D. Garber, *Leibniz - Body, Substance, Monad* (Oxford and New York: Oxford University Press, 2009). [↑](#endnote-ref-18)
19. See Patrick Riley, *Leibniz' universal jurisprudence: justice as the charity of the wise* (Cambridge, Massachusetts: Harvard University Press, 1996), 62-64. This text is translated in Lloyd Strickland’s website of Leibniz’s short texts. See http://www.leibniz-translations.com/pascal.htm [↑](#endnote-ref-19)
20. In copying Pascal’s text, Leibniz makes some alterations and additions. In particular, after: “des cirons dans lesquels il retrouvera ce que les premiers ont donné, trouvant encore dans les autres la même chose,” Leibniz adds between parenthesis: “ou des choses analogues” (second line). This suggests that Leibniz takes the *ciron* more generally as an illustration of living things. This addition by Leibniz has been noted by both Baruzi, *l’organisation religieuse*, 224 and Naert, ‘Pascal et Monade’, 45. [↑](#endnote-ref-20)
21. For Leibniz’s contribution to the life sciences, see F. Duchesneau, *Les modèles du vivant de Descartes à Leibniz* (Paris: J. Vrin, 1998); F. Duchesneau*, Leibniz, le vivant et l'organisme [le vivant]* (Paris: J. Vrin, 2010); J. Smith, *Divine Machines: Leibniz and the Sciences of Life* [*Divine Machines*] (Princeton: Princeton University Press, 2011); J. Smith and O. Nachtomy (eds.), *Machines of Nature and Corporeal Substances in Leibniz [Machines of Nature]* (Dordrecht: Springer, 2010). [↑](#endnote-ref-21)
22. C. I. Gerhardt, ‘Leibniz und Pascal’, in *Sitzungsberichte der Königlichen Akademie der Wissenschaften zu Berlin*, Band 2 (Berlin: Verlag der Königlichen Akademie der Wissenschaften, 1891). [↑](#endnote-ref-22)
23. Baruzi, *l’organisation religieuse*, 224-231. [↑](#endnote-ref-23)
24. J. Guitton, *Pascal et Leibniz* (Paris: Aubier 1951). [↑](#endnote-ref-24)
25. P. Costabel, ‘Notes relatives à l’influence de Pascal sur Leibniz,’ *Revue d’histoire des sciences,* 15: 3-4 (1962), 369-374. [↑](#endnote-ref-25)
26. M. Serres, *Le système de Leibniz et ses modèles mathématiques [Le système de Leibniz]*, vol. II (Paris: PUF, 1968), 719-21*.* [↑](#endnote-ref-26)
27. E. Naërt, ‘Pascal et Monade’, 44-51. [↑](#endnote-ref-27)
28. A. McKenna, *De Pascal à Voltaire. Le rôle des Pensées de Pascal dans l’histoire des idées entre 1670 et 1734*, 2 vols. (Oxford : The Voltaire Foundation, 1990). [↑](#endnote-ref-28)
29. Carraud studies the philosophical relations between Leibniz and Pascal in some detail. See Carraud, ‘*Pensées* de Pascal’ and V. Carraud, *Pascal et la philosophie [la philosophie]* (Paris: PUF, 1992). [↑](#endnote-ref-29)
30. Another commentary that does touch on this question, though indirectly, is Naërt, ‘Pascal et Monade.’ [↑](#endnote-ref-30)
31. The division to infinity of organic bodies and the existence of microscopic animals comes up in a letter Leibniz writes to Malebranche in 1679: “There is even room to fear that there are no elements at all, everything being effectively divided to infinity in organic bodies. For if these microscopic animals are in turn composed of animals or plants or other heterogeneous bodies, and so on to infinity, it is apparent, that there would not be any elements” (A 1. 2 719, translated by Smith, 2010). [↑](#endnote-ref-31)
32. I am grateful to Don Rutherford for helping me to clarify the different kinds of mirroring and the strong relation that mirroring has to the notion of entelechy. [↑](#endnote-ref-32)
33. Fragments 233-418, B. Pascal, ‘Pensèes,’ in L. Lafuma (ed.), *Œuvres Complètes* (Paris: Éditions du Seuil, 1963), 550 ; See also Ibid., 418, “Nous connaissons qu’il y a un infini, et ignorons sa nature.” [↑](#endnote-ref-33)
34. “La dernière démarche de la raison est de reconnaître qu’il y a une infinité de choses qui la surpassent. Elle n’est que faible si elle ne va pas jusque là.” Ibid., 524. [↑](#endnote-ref-34)
35. “L’unité jointe à l’infini ne l’augmente de rien, non plus qu’un pied a une mesure infinie. Le fini s’anéantit en présence de l’infini, et devient un pur néant. Ainsi notre esprit devant Dieu; ainsi notre justice devant la justice divine. [...] Nous connaissons qu’il y a un infini et ignorons sa nature. Comme nous savons qu’il est faux que les nombres soient finis, donc il est vrai qu’il y a un infini en nombre. Mais nous ne savons ce qu’il est : il est faux qu’il soit pair, il est faux qu’il soit impair; car, en ajoutant l’unité, il ne change point de nature; cependant, c’est un nombre et tout nombre est pair ou impair. ... Ainsi on peut bien connaître qu’il y a un Dieu sans savoir ce qu’il est.” Ibid., 550. [↑](#endnote-ref-35)
36. “Among numbers there are infinite roots, infinite squares, infinite cubes. Moreover, there are as many square numbers as there are numbers in the universe. Which is impossible. Hence it follows either that in the infinite the whole is not greater then the part, which is the opinion of Galileo and Gregory of St. Vincent, and which I cannot accept; or that infinity itself is nothing, i.e. that it is not one and not a whole.” (Fall 1672, Notes on Galileo's Two New Sciences; A 6.3.168, LOC 9) [↑](#endnote-ref-36)
37. *Monadology* §53; *Theodicy* § 225. [↑](#endnote-ref-37)
38. “Je suis tellement pour l’infini actuel, qu’au lieu d’admettre que la nature l’abhorre, comme l’on dit vulgairement, je tiens qu’elle l’affecte partout, pour mieux marquer les perfections de son auteur. Ainsi je crois qu’il n’y a aucune partie de la matière qui ne soit, je ne dit pas divisible, mais actuellement divisée, et par conséquent, la moindre particelle doit être considérée comme un monde plein d’une infinité des créatures différentes”  (Letter to Foucher, GP I 416). See also *Monadology* §65: “Every portion of matter is not only divisible to infinity, as the ancients realized, but is actually subdivided without end, every part into smaller parts, each part divided into parts having some motion of their own” (AG 221). Contrast this with Aristotle’s view expressed in his *Generation of Animals*: “But nature flies from the infinite; for the infinite is imperfect, and nature always seeks an end (1.1.715b15).” (Aristotle, ‘Generation of Animals,’ in J. Barnes (ed.), A. Platt (trans.), *The Complete Works of Aristotle*, vol. I (Princeton, N.J.: Princeton University Press, 1984), 3.) As I argue below, there is a sense of infinity in Leibniz that means precisely absolute perfection and completion. But, of course, this is not completion in Aristotle’s teleological sense. [↑](#endnote-ref-38)
39. G. W. Leibniz, *De Summa Rerum: Metaphysical Papers, 1675–1676,* George H. R. Parkinson (ed.) (New Haven, CT: Yale University Press, 1992), 25. [↑](#endnote-ref-39)
40. Ironically, it owes some of its inspiration to Pascal’s mathematical work. See, for instance, Antognazza, *Intellectual Biography,* 157-159. [↑](#endnote-ref-40)
41. For details regarding Leibniz’s approach to the infinitely small and infinitely large see Arthur’s introduction to LOC. [↑](#endnote-ref-41)
42. In fact, Leibniz’s method consists in translating infinite magnitudes into finite ones, just smaller than any assignable. [↑](#endnote-ref-42)
43. Que n’aurait-il pas dit avec cette force d’éloquence qu’il possédait, s’il était venu plus avant, s’il avait su que toute la matière est organique partout, et que sa portion quelque petite qu’on la prenne, contient représentativement, en vertu de la diminution actuelle à l’infini qu’elle enferme, l’augmentation actuelle à l’infini qui est hors d’elle dans l’univers, c’est-à-dire que chaque petite portion contient d’une infinité de façons un miroir vivant exprimant tout l’univers infini…  (De Buzon, ‘Double Infinité,’ 554). [↑](#endnote-ref-43)
44. For a survey and some analysis of Leibniz’s use of mirrors, see C. Marras, ‘Mirrors that mirror each other,’ in Herbest Breger, Jürgen Herbest, and Sven Erdner (eds.), *The Collection of Papers from the VIII Internationaler Leibniz-Kongress* (Hannover: 2006), 556-64. [↑](#endnote-ref-44)
45. With much insight but without any explication Baruzi, *l’organisation religieuse* remarked: “Ainsi se transforme le ‘ciron’ de Pascal,” 227. I hope my comments make the nature of this transformation more explicit. [↑](#endnote-ref-45)
46. The passages continues thus: “For who will not be astounded at the fact that our body, which a little while ago was imperceptible in the universe, itself imperceptible in the bosom of the whole, is now a colossus, a world, or rather a whole, in respect of the final smallness which we cannot reach? He who regards himself in this light will be afraid of himself, and observing himself suspended in the mass given him by nature between those two abysses of the Infinite and Nothing, of which he is equally removed, will tremble at the sight of these marvels; and I think that, as his curiosity changes into admiration, he will be more disposed to contemplate them in silence than to examine them with presumption.” Pascal, ‘Pensèes,’ 199. For the English cited here, see ‘Leibniz: Double Infinity in Pascal and Monad,’ L. Lloyd Strickland, *Leibniz-Translations.com*, n.d., <http://www.leibniz-translations.com/pascal.htm>. [↑](#endnote-ref-46)
47. As early as his Theory of Concrete Motion (1670-71), Leibniz articulates the doctrine (mentioned by Pascal as well) that, in every bit of matter, there are worlds within worlds, and that this goes on to infinity. In this context, the doctrine appears as a consequence of the infinite divisibility of the continuum. Leibniz writes: “any atom will be of infinite species, like a sort of world, and there will be worlds within worlds to infinity (A 6.2 N40; LOC 338-39).” A similar view appears several years later in Leibniz’s notes from Paris (1676), where he writes that every part of the world, regardless of how small, “contains an infinity of creatures” which is itself a kind of “world (A 6.3 474).” Similarly, in the dialogue Pacidius to Philalethes, Leibniz says: “in any grain of sand whatever there is not just a world, but an infinity of worlds” (A 6.3 555; LOC 211). [↑](#endnote-ref-47)
48. In order to avoid any misunderstandings, it is perhaps worth emphasizing that Leibniz’s view does not imply the existence of an infinitely small beings, which Leibniz flatly denies. For Leibniz, infinitesimals are not entities but useful fictions. Rather, for any finite living being, no matter how small, there is a smaller one. This is what the actual infinity involves, according to Leibniz. [↑](#endnote-ref-48)
49. In our text this point is expressed quite explicitly as follows: “*chaque petite portion contient d’une infinité de façons un miroir vivant exprimant tout l’univers infini qui existe avec elle ; en sorte qu’un assez grand esprit, armé d’une vue assez perçante, pourrait voir ici tout ce qui est partout*” (De Buzon, ‘Double Infinité,’ 554). See also Leibniz’s letter to Sophie Charlotte of May 8th, 1704, G III 343–348. For this reason, “God sees in each portion of the universe the whole things ... He is infinitely more discerning than Pythogoras, who judged the height of Hercules by the size of his footprint” (*Theodicy* § 341). [↑](#endnote-ref-49)
50. For an elaboration of Pascal’s attitude, stressing the consideration of human beings rather than the contemplation of nature, see Carraud, *la philosophie*, 403-34 (sections 30-31). Carrauld also adds the following perceptive remark: “*Le regard pascalien est regard sur l’autre aveugle, regard sans être regardé, sans réciprocité, sans miroir,*”  Carraud, *la philosophie*, 397. He notes that the notion of a mirror, so typical of the renaissance, does not appear even once in the Pensées. It is all the more striking therefore that Leibniz is contrasting the notion of living mirror to that of Pascal’s mite. [↑](#endnote-ref-50)
51. “*Car enfin qu’est‑ce que l’homme dans la nature ? Un néant à l’égard de l’infini, un tout à l’égard du néant, un milieu entre rien et tout, infiniment éloigné de comprendre les extrêmes. La fin des choses et leurs principes sont pour lui invinciblement cachés dans un secret impénétrable, également incapable de voir le néant d’où il est tiré et l’infini où il est englouti.”* Pascal, ‘Pensèes,’ 199, p. 526; see also: http://www.penseesdepascal.fr/Transition/Transition4-moderne.php [↑](#endnote-ref-51)
52. This is especially the case when contrasted with the notorious aspect of his optimism that was made infamous by Voltaire in *Candid*. On the contrast between Leibniz’s optimistic attitude with Pascal’s pessimistic one, though in a different context, see Naërt, ‘Pascal et Monade,’ 167, and yet in another context, see Laerke’s recent penetrating remark:

“La situation du géomètre leibnizien se rapproche beaucoup de celle de l’« homme, dans l’infini » dont parle Pascal, et qui se trouve « suspendu dans la masse que la nature lui a donnée entre ces deux abîmes de l’infini et du néant, dont il est également éloigné » (Lafuma 199). Toutefois, et contrairement à la vision plutôt austère de Pascal, pour Leibniz, cette suspension dans l’infini n’a rien d’épistémologiquement tragique : Pascal exige trop de la science démonstrative” (*Les Lumières*, 172). [↑](#endnote-ref-52)
53. “Que fera(‑t‑)il donc sinon d’apercevoir quelque apparence du milieu des choses dans un désespoir éternel de connaître ni leur principe ni leur fin.” Pascal, ‘Pensèes,’ 526. [↑](#endnote-ref-53)
54. “Ces extrémités se touchent et se réunissent a force de s’être éloignées et se retrouvent en Dieu, et en Dieu seulement.” Pascal, ‘Pensèes,’ 199, p. 527. [↑](#endnote-ref-54)
55. As Schweitz writes: “Lutheran sacramental theology affirms that finite matter in the forms of bread, wine, and water is a means of grace and a vehicle for the divine. Said another way, the sacraments are instances when the ‘finite is capable of the infinite.’ The material elements of the sacraments are means of real and transformative encounters with the divine because they are capable of the infinite in, with, and under the finite.” See L. Schweitz, ‘On the Continuity of Nature and the Uniqueness of Human Life in G. W. Leibniz,’ in *The Life Sciences in Early Modern Philosophy* (New York, NY: Oxford University Press, 2014), 214. For further information on Leibniz’s Lutheran heritage, see U. Goldenbaum, ‘Leibniz as a Lutheran,’ in A. Coudert, Richard H. Popkin, and Gordon M. Weiner (eds.), *Leibniz, Mysticism, and Religion* (Dordrecht, NL: Kluwer, 1998), 169–92. [↑](#endnote-ref-55)
56. “On ne peut concevoir que quelque chose de créé puisse représenter l’infini ; que l’être sans restriction, l’être immense, l’être universel puisse être aperçu par une idée, c’est a dire, par un être particulier, par un être diffèrent de l’être universel& infini. Mais pour les êtres particuliers, il n’est pas difficile de concevoir qu’ils puissent être représentés par l’être infini qui les renferme dans sa substance très efficace, et par conséquent très intelligible.” (*Recherche de la vérité*, V III, II, VII. 11; OC I. 449). [↑](#endnote-ref-56)
57. “I usually say that there are three degrees of infinity. The lowest is, for the sake of example, like that of the asymptote of the hyperbola; and this I usually call the mere infinite (*tantum infinitum*). It is greater than any assignable, as can also be said of the other degrees. The second is that which is greatest in its own kind (*maximum in suo scilicet genere*), as for example the greatest of all extended things is the whole of space, the greatest of all successives is eternity. The third degree of infinity, and this is the highest degree, is everything (*omnia*), and this kind of infinite is in God, since he is all one; for in him are contained the requisites of existing of all others.” (February 1676, A 6.3 386; LOC 43) [↑](#endnote-ref-57)
58. I have begun to explore this interesting issue (in relation to degrees of perfection and degrees of being) in O. Nachtomy and Justin E. H. Smith, *The Life Sciences in Early Modern Philosophy* (New York, NY: Oxford University Press, 2014) and will develop this in a forthcoming monograph. [↑](#endnote-ref-58)
59. For my version of the story see O. Nachtomy, ‘Leibniz on Artificial and Natural Machines’ in Justin E. H. Smith and Ohad Nachtomy (eds.), *Machines of Nature and Corporeal Substances in Leibniz* [*Corporeal Substances*] (Springer, The New Synthese Historical Library, 2011) and Nachtomy, *Life Sciences*. [↑](#endnote-ref-59)
60. See M. Fichant, ‘Leibniz et les machines de la nature,’ *Studia leibnitiana,* 35 (2003), 1-28; Duchesneau, *le vivant*; Smith and Nachtomy, *Machines of Nature*; Smith, *Divine Machines*; and R. Arthur, *Leibniz* (Cambridge: Polity Press, 2014). [↑](#endnote-ref-60)
61. In a later piece (May, 1702) entitled by the English translators “On Body and Force, Against the Cartesians,” Leibniz writes: “…a natural machine has the great advantage over an artificial machine, that, displaying the mark of an infinite creator, it is made up of an infinity of entangled organs. And thus, a natural machine can never be absolutely destroyed just as it can never absolutely begin, but it only decreases or increases, enfolds or unfolds, always preserving in itself some degree of life [*vitalitas*] or, if you prefer, some degree of primitive activity [*actuositas*]” (May, 1702. AG 253). [↑](#endnote-ref-61)
62. This is clearly articulated later in the Monadology: “Thus each organized body of a living being is a kind of divine machine or natural automaton, which infinitely surpasses all artificial automata. For a machine constructed by man’s art is not a machine in each of its parts. For example, the tooth of a brass wheel has parts or fragments which, for us, are no longer artificial things, and no longer have any marks to indicate the machine for whose use the wheel was intended. But natural machines, that is, living bodies, are still machines in their least parts, to infinity. That is the difference between nature and art, that is, between the divine art and our art.” (Monadology, § 64, AG 221) [↑](#endnote-ref-62)
63. Arthur, *Leibniz*, 73. [↑](#endnote-ref-63)
64. *Ibid*. For some differences between Arthur’s interpretation and mine, see my review of his (2014) book and his reply in *The Leibniz Review* (2014), 123–136. [↑](#endnote-ref-64)
65. In a Letter to Lady Masham from 1704 Leibniz writes:

 “I define an organism or a natural machine, as a machine each of whose parts is a machine, and consequently the subtlety of its artifice extends to infinity, nothing being so small as to be neglected, whereas the parts of our artificial machines are not machines. This is the essential difference between nature and art, which our moderns have not considered sufficiently” (GP III 356). [↑](#endnote-ref-65)
66. See also Leibniz’s Fifth Letter to Clarke (arts. 115, 116, in AG 344-45). [↑](#endnote-ref-66)
67. “Que les parties des êtres vivants soient aussi des êtres vivants, et ce à l’infini, est exactement la conception des machines de la nature, dont la différence avec les machines de l’art est que les premières sont « machines jusques dans leurs moindres parties.” de Buzon, ‘Lecture Leibnizienne,’ 547. See also *Considérations sur les principes de vie et sur les natures plastiques,* GP VI 543 and Nachtomy, *Corporeal Substances.* [↑](#endnote-ref-67)
68. I provide some further arguments in support of these claims are presented in O. Nachtomy, ‘Leibniz on Nested Individuals,’ *British Journal for the History of Philosophy* (2007) and Nachtomy, *Corporeal Substances*. [↑](#endnote-ref-68)
69. A I. 12 90-93. I use Strickland’s English translation of the letter here. [↑](#endnote-ref-69)
70. My translation differs slightly from Strickland’s here. [↑](#endnote-ref-70)
71. “Les Machines de la nature sont infiniment au-dessus des nôtres. Car outre qu’elles ont du sentiment, chacune contient une infinité d’organes ; et ce qui est encore plus merveilleux, c’est par cela que chaque animal est a l’épreuve de tous les accidents et ne saurait être jamais détruit, mais seulement change et resserré par la mort, comme un serpent quitte sa veille peau.” (M. Fichant (ed.), *G.W. Leibniz, Discours de métaphysique suivi de Monadologie et autres textes* (Paris: Gallimard, 2004), 336-37.) [↑](#endnote-ref-71)
72. While the resemblance between Leibniz’s use of living mirrors here and his use of monads is quite striking, we need to be cautious about what Leibniz means by ‘monad’ in this context. Since our text dates from shortly after the publication of the *New System* it comes at the moment when Leibniz is just beginning to use the term ‘monad’ in his philosophy. When first introduced, it is unclear whether ‘monad’ is just another term for a genuine unity, in which case it could apply both to a corporeal substance and to a non-extended soul-like entity. The term ‘monad’ clearly indicates a genuine unity. I also think that the notion of a living mirror provides us with some clues as to how a genuine unity can be made compatible with infinity – that is, its having an infinitely complex structure that resembles that of the world. This line seems to be strongly supported by Leibniz’s remarks on (the union of) infinity and unity in the letter to Sophie cited above. [↑](#endnote-ref-72)
73. See Nachtomy, *Corporeal Substances*. [↑](#endnote-ref-73)
74. For an interesting discussion of related issues, see Serres, *Le système de Leibniz*, 720-22. [↑](#endnote-ref-74)
75. For more on the connection between entelechies and living mirrors, see GP VI. 626. [↑](#endnote-ref-75)
76. “*L’ homme, dans l’infini » se trouve « suspendu dans la masse que la nature lui a donnée entre ces deux abîmes de l’infini et du néant, dont il est également éloigné*.” De Buzon, ‘Double Infinité’, 551-552. Pascal, ‘Pensèes,’ fg. 199. [↑](#endnote-ref-76)
77. At the same time, the kind of infinity Leibniz ascribes to created beings is not the same as the absolute infinity he ascribes to God. It is also not the (quantitative) infinity he employs in mathematics. I develop this point elsewhere (O. Nachtomy and J. E. H. Smith, *Life Sciences*). [↑](#endnote-ref-77)
78. I argue for this in a forthcoming monograph. [↑](#endnote-ref-78)
79. *Mais toutes ces merveilles sont effacées par l’enveloppement de ce qui est <infiniment> au-dessus de toutes les grandeurs dans ce qui est <infiniment> au-dessous de toutes les petitesses ; c’est-à-dire notre harmonie préétablie, qui vient de paraître aux hommes depuis peu, et qui donne cette même plus qu’infinité <tout à fait> universelle, concentrée dans le plus qu’infiniment petit tout à fait singulier, en mettant virtuellement toute la suite de l’univers dans chaque point réel qui fait une Monade <ou unité substantielle> dont moi j’en suis une ; c’est-à-dire dans chaque substance véritablement une, unique, sujet primitif de la vie et action, toujours doué de perception et appétition, toujours renfermant avec ce qu’il est la tendance à ce qu’il sera, pour représenter toute autre chose qui sera*. De Buzon, ‘Lecture Leibnizienne’, 555. [↑](#endnote-ref-79)