Law and Physics in Leibniz

Hao Dong

*Journal of the History of Philosophy*, 2024, 62(1): 49–73

Abstract: In this paper I argue that there is a structural parallelism between law and physics in Leibniz since his early years, which has significant influence on the formation of his views. I start by examining Leibniz's early physical system and an analogy with juridical laws that he uses to explain the structure of physical laws. Then, I argue that this analogy stems from an envisioned parallelism between law and physics. Finally, I illustrate the significance of this legal-physical parallelism by arguing that it underlies some of Leibniz's mature views. Most importantly, I argue that the parallelism explains the origin of architectonic principles or optimality principles in Leibniz's mature physics.

Keywords: LEIBNIZ, physics, law, architectonic principles

Around 1670, Leibniz comes up with his first system of natural philosophy which consists of two parts, an abstract part where “some elements about the true reasons of motion [*de veris motus rationibus*]” are “demonstrated by geometrical method from the definitions of terms alone,”[[1]](#footnote-1) and a concrete part which uses the hypothesis of an all-pervading, constantly moving ether to explain some of the most prominent natural phenomena.[[2]](#footnote-2) An interesting feature of Leibniz’s writings related to this early physical system is that he often resorts to an analogy between physical laws and juridical laws to illustrate the difference between the abstract laws of motion and the concrete laws of motion. To put it roughly, the abstract laws of motion are like natural laws that hold everywhere, while the concrete laws of motion are like civil laws that hold only within a commonwealth.[[3]](#footnote-3) This peculiarity of Leibniz’s early system is not completely ignored by scholars,[[4]](#footnote-4) but as I shall argue, its importance has been greatly underappreciated. In fact, I will show that there is a parallelism between law and physics that goes deep into Leibniz’s system as a whole and that such parallelism helps us understand how Leibniz comes to have certain views both about law and about physics; most strikingly, it sheds light on the provenance of the architectonic principles that are characteristic of the mature Leibniz’s natural philosophy.

My plan for the paper is as follows. First, I will describe Leibniz’s early physical system and discuss why Leibniz uses the legal analogy to illustrate the relation between its two parts. In short, my interpretation is that the legal analogy serves to bring into light the fact that the abstract laws of motion are necessary propositions that apply universally to any individual body whatsoever, while the concrete laws of motion are contingent and could only apply to systems of bodies that interact in certain ways. Then, I will show that Leibniz does not take this legal analogy merely as an ad hoc device, rather, it stems from a structural parallelism between his legal system and physical system. Leibniz explicitly explains this structural parallelism in a series of letters written retrospectively in 1670-1671, and many of Leibniz’s points made there are further substantiated in his early legal writings. This shows that Leibniz has been convinced of the parallelism between law and physics for a long time and that this intricate relationship between the two has actively shaped Leibniz’s way of thinking about both disciplines. Taking stock from my previous discussions, I will argue that two key components of Leibniz’s mature thought can be traced back to, and understood through, the parallelism between law and physics in Leibniz’s early thought. On the one hand, Leibniz holds that the principles of justice or right are eternal truths on the same level as mathematical and logical truths. As I shall argue—and this is supported by what Leibniz himself says—Leibniz comes to hold such a view precisely because the parallelism between law and physics requires that there be an abstract part of the science of right that only contains necessary propositions demonstrated from definitions. On the other hand, Leibniz’s mature physics makes heavy use of a group of contingent, teleological principles that are sometimes called “architectonic principles” by Leibniz himself, or “optimality principles” in recent scholarship.[[5]](#footnote-5) I argue that these principles have their stem in what Leibniz calls “nomothetics” (*nomothetica*) in his early legal system. Nomothetics is concerned with setting up civil laws that could further the citizens’ good or utility (*salus populi*), and as such it provides the principles for civil laws that should be enacted by the ruler within a commonwealth. Thus, nomothetical principles and the civil laws that follow from them are teleological in that they are for the sake of some good. Given the parallelism between law and physics, it is reasonable to expect there to be certain teleological elements in physics as well, and I argue that they can already be found in Leibniz’s early physical system. Therefore, the explicit emergence of architectonic principles that results from Leibniz’s scientific activities in the late 1670s reflects a much less radical change of Leibniz’s system than usually assumed.

1. Leibniz’s Early Physical System and the Legal Analogy

Leibniz’s serious interest in physics proper is prodded by his reading of Huygens’s rules of motion published in the April 1669 issue of the *Philosophical Transactions of the Royal Society*, which happens in the spa town of Bad Schwalbach in August 1669.[[6]](#footnote-6) Before this, Leibniz’s primary concern was jurisprudence, and at that point he has already published several impressive legal works dealing with both technical issues and with broader, more philosophical issues such as how to construct a system of law.[[7]](#footnote-7) But while being a jurist by profession, Leibniz has kept an eye on the new mechanist philosophy, mostly through reading the works of Thomas Hobbes. In fact, Leibniz has been both fascinated and convinced by most of the Hobbesian doctrines,[[8]](#footnote-8) and around the early 1670s he still thinks that Hobbes’s *De Corpore* and *De Cive* are largely correct.[[9]](#footnote-9) However, as we shall soon see, the Hobbesian theory of motion is in conflict with Huygens’s rules of motion which seem to be confirmed by observations. Thus, one of the main tasks of Leibniz’s early physical system is to reconcile the central doctrines of Hobbesian physics with natural phenomena, including Huygens’s rules of motion (which are explicitly called *phenomena* by Leibniz).[[10]](#footnote-10) Leibniz’s solution is to assign the Hobbesian laws of motion and natural phenomena to different levels: the Hobbesian laws are the most fundamental laws governing the motions of the simplest bodies, while the phenomena are larger-scale patterns that emerge from the minute interactions of simplest bodies set up in a certain way.[[11]](#footnote-11) As we shall see in the next section, this structure of physical laws corresponds quite nicely to the structure of juridical laws already expounded in Leibniz’s earlier jurisprudential works, hence the legal analogy; more interestingly, Leibniz’s conception of the structure of juridical laws seems to be originally modelled upon the structure of Hobbes’s bipartite physical system which he studies around 1663. Thus, while Leibniz initially conceives of his legal system on the model of an ideal physical science, after spending several years working almost exclusively in legal studies (1663-1669, and Leibniz never stops working on his legal system afterwards), he begins to view natural philosophy through the lens of jurisprudence when he embarks on his own physical system. This intricate parallelism between law and physics underlies some of Leibniz’s most peculiar views. But before I begin to unravel this parallelism, in this section I will first briefly summarize Leibniz’s early physical system and how the legal analogy fits into it.

As mentioned above, Leibniz’s early physical system can be seen as a development of Hobbes’s physics to better reconcile it with natural phenomena. Hobbes’s physics is based on his idiosyncratic geometry, which is concerned not with abstract objects but rather bodies in motion.[[12]](#footnote-12) Thus for Hobbes the laws of motion are derived entirely from the geometrical composition of motions, or their beginnings—*conatus*.[[13]](#footnote-13) This elegant picture constitutes an attractive alternative to the Cartesian derivation of the laws of motion based on the immutability of God, which is unconvincing for Leibniz.[[14]](#footnote-14) Thus in trying to come up with his own physical system, Leibniz begins by reconstructing some of the most important propositions in Hobbesian physics.

First, Hobbes holds that all bodily action consists in local motion, and a body at rest has no causal efficacy whatsoever.[[15]](#footnote-15) The young Leibniz is convinced by this point, and offers his own demonstration for it:

All action and passion are exercise of power. Exercise of power is the transition from power to act, or from a non-existent possible thing to an existent thing. All power of body is contained in the essence of body. The essence of body is existence in space. The power (or possibility lacking existence) which is contained in existence in space is the power to exist in another space (equal and similar to the space in which the body exists now). The power to exist in another space is the mutability of space. Mutability of space is mobility. Exercise of mobility is motion. Therefore, all action of body is motion … A body at rest does not act, for a body at rest lacks motion. (A VI.2, 168-169)[[16]](#footnote-16)

This argument resembles some arguments in *De Corpore*,[[17]](#footnote-17) and Leibniz’s main development consists in deriving the action of a body from the definition of its essence, existence in space: since action is a kind of change, thus a thing whose essence is existence in space can only act by modifying its essence, that is, by changing its spatial location. Both the idea of body as what exists in space and the idea of deriving theorems from definitions are Hobbesian, and from these Hobbesian ideas Leibniz has built an argument that at least appears to be more rigorous.

Then, Hobbes derives the laws of local motion through geometrical composition.[[18]](#footnote-18) Hobbes’s approach appears more appealing when used on one single body—for example, when one body has uniform motion along the horizontal direction and is uniformly accelerating along the perpendicular direction, the path of the body will be composed from these two motions, thus it will be a parabola. This is the main result of the Fourth Day of Galileo’s *Discorsi*, which has unquestionably influenced Hobbes.[[19]](#footnote-19) However, when we are dealing with the interactions between bodies, how we should derive the laws of motion is less obvious, and it is at this point that Leibniz’s main development of the original Hobbesian theory comes in. Taking up the Hobbesian notion of *conatus* (small actual motion), Leibniz proposes that a body in motion occupies a greater space due to its *conatus*:

*One point of a moving body in the time of its endeavour* [*conatus*]*,* namely in a time smaller than can be given, *is in several* places or *points of spaces*, that is, it will fill a part of space greater than itself, or greater than it fills when it is at rest, or moving more slowly, or endeavouring in only one direction; yet this part of space is still unassignable, or consists in a point … But in general, too, *whatever moves is never in one place while it moves*. (*Theoria Motus Abstracti* [*TMA*], Predemonstrable Foundations 13-14, A VI.2, 265/LC 340-341)

Since the magnitude of space occupied by a body is proportional to its speed, calculation about motion can be reduced to a kind of spatial calculation. To use one of Leibniz’s own examples (see Figure 1):

If two bodies with unequal speeds collide on the same line, the whole will be moved towards the direction of the faster, at the speed of the difference between the original speeds. Because as body A moves into place *c* with speed *ac*, B into *c* with speed *bc*—hence the spaces are proportional to the speeds—they will collide at *c*, and the whole BA will have the *conatus* from *c* to *a* and from *c* to *b* or *d* at the same time, therefore it will go forth and go back at the same time; but it will go forth from *c* towards *d* to a greater extent, because this *conatus* is faster than the *conatus* from *d* towards *c*; therefore, it will go from *c* to *d*, yet at a slower speed insomuch as it has also gone back;[[20]](#footnote-20) therefore, during the time in which A travelled from *a* to *c*, the whole BA will travel to *d*, but *dc* will be equal to *ac* – *bc*, because the whole has gone forth as much as *ac* due to the *conatus* gotten from A, and at the same time gone back as much as *bc*. (A VI.2, 338-339)

Figure 1, from A VI.2, 339

Leibniz thinks that from such combination of *conatus* or spatial calculation “all rules of phoronomy or laws of motion” can be “incontrovertibly demonstrated.”[[21]](#footnote-21) It is remarkable that Leibniz’s conception of the laws of motion as spatial calculation forms a consistent and continuous line of thought all the way from his definition of body as what exists in space.[[22]](#footnote-22) In this sense, although the basic ideas of Leibniz’s early physics are mostly Hobbesian, he has given them a more coherent exposition.[[23]](#footnote-23)

Although the young Leibniz is convinced that the laws of motion based on spatial calculation describe the fundamental reality,[[24]](#footnote-24) an obvious problem with the account above is that it does not line up with our daily observations very well. If we follow this account, then (Figure 1) if body B is at rest, then A would not be slowed down at all, because body B does not occupy any extra space when it is at rest, or *bc* is nothing; furthermore, the magnitude of B (or A, for that matter) does not matter at all because all that is taken into account is the speed of B represented by space *bc*; finally, it cannot happen that A and B rebound after they collide, or (to use today’s terminology) all collisions must be inelastic. If the young Leibniz has not been aware of this problem during most of the 1660s, Huygens’s seven rules of motion, which are transcribed by Leibniz, might be a wake-up call for him. These rules describe what we would now call perfectly elastic collision, which begin with two rules that must have been striking for the young Leibniz:

(1.) If a hard body at rest is hit by an equal hard body in motion, after impact the impelling body will be at rest, and the speed that was in the impelling body will have been acquired by the body originally at rest. (2.) But if the first of the two equal bodies is also moved, and is borne in the same straight line, after contact the two of them will be moved with the speeds exchanged. (A VI.2, 157)[[25]](#footnote-25)

Then Huygens also describes what we would now call the conservation of momentum and of kinetic energy, in which the magnitude or mass of the bodies plays a role.[[26]](#footnote-26) Leibniz, however, remains unconvinced, and still holds onto the ideas that he got from Hobbes.[[27]](#footnote-27) But now he needs to explain, if Huygens’s rules are strictly speaking false, why do they appear to hold and be confirmed by observations?

Leibniz’s solution is to introduce a contingent hypothesis about the makeup of the physical world that conforms to the Hobbesian abstract laws of motion on the most fundamental, invisible level, while appearing to conform to Huygens’s rules—and produce other natural phenomena—on the larger-scale, perceptible level. Leibniz summarizes the hypothesis as follows:

*Problem 11:* *To bring about mutual repercussion*. This will happen if both bodies are carried by a discontiguous liquid (by Theorem 21) so subtle, such that most of the liquid in one would proceed through the pores[[28]](#footnote-28) of another, undisturbed by the collision. Then, they would transfer their impetus to the opposing body, and thus not only repercussion, but also the exchange of directions and speeds will also occur. Such subtility is … generally speaking in ether according to my hypotheses, and sensible bodies are carried by the motion of ether rather than their own motions. (*TMA*, Special Problem 11, A VI.2, 271)

Repercussion, or the rebounding of bodies after they collide, is described by Huygens in the first two rules of motion cited above and here Leibniz is trying to reconcile this phenomenon with the abstract laws of motion. Looking back at Figure 1, the solution is roughly the following: macroscopic bodies like A and B are not entirely homogeneous, but have pores through which a very subtle matter, ether, could flow; furthermore, the ether is not continuous or contiguous, and there are interstitial vacua here and there;[[29]](#footnote-29) thus, when A hits upon B, A will first be hit by the first thin layer of ether at the surface of B, and be slowed down (if the ether is slower than A) or halted (if they move at the same speed) or reversed (if the ether moves faster than A), and this process will be repeated when the subsequent layers of ether hit upon A (remember magnitude does not matter here), until A moves at the same speed and direction with the ether underlying B;[[30]](#footnote-30) and since the same will happen to B, the speeds and directions of A and B are exchanged, and repercussion is brought about on the macroscopic level. Such discontiguous, constantly moving ether can be configured in different ways to derive different concrete rules of motion, as well as to explain the phenomena of gravity, elasticity, and magneticism, which is the main task of *Hypothesis Physica Nova* [*HPN*].[[31]](#footnote-31)

*HPN* is written slightly later than its complementary treatise, *TMA*,[[32]](#footnote-32) which is understandable since the latter contains the abstract laws of motion which constitute the foundations of the hypothesis of ether. But Leibniz also recognizes that *HPN* has a unique status which distinguishes it from *TMA*. The legal analogy, I think, is used by Leibniz to illustrate this difference between the two:

In the free or natural state [*statu libero seu naturali*], however large a thing can be easily moved by however small a thing; in the present systematic state [*statu praesenti systematico*], and as I put it, civil [*civili*] state, things can only be moved by things that are proportional to them according to the senses. (*HPN*, §14, A VI.2, 227)

Based on my description of Leibniz’s early physics, the “free or natural state” would be the state in which bodies follow the abstract laws of motion (“however large a thing can be easily moved by however small a thing”), and the “civil state” would be the state in which the concrete laws of motion such as Huygens’s rules also hold due to a “systematic” makeup of the world such as the one described in the hypothesis of ether. Correspondingly, the Hobbesian abstract laws of motion would be like natural laws which hold in the state of nature, while the concrete laws of motion would be like civil laws that hold within civil states. But why does Leibniz find this analogy appropriate?

The first step towards answering this question would be to notice that the concrete laws of motion deal with many more bodies than the abstract laws do, and they treat these bodies as systems and describe the properties of these systems rather than the properties of individual bodies themselves. In a later piece on the optical laws of reflection and refraction (which are concrete laws rather than abstract laws for Leibniz), Leibniz expresses this thought with a distinction between “public” motion and “private” motion:

One should know that there are two kinds of motions in the world, pure or private motions on the one hand, public motions or the motions affected by the system on the other. Bodies exercise private motions if they are thought to move in a vacuum or medium at rest,[[33]](#footnote-33) [and they exercise] public and variously concrete motions when the medium produces their motion by not obstructing and even moving or carrying … Bodies moving by pure or private motion do not resume their impetus once it is diminished, even if the impediment is removed; but those bodies that are carried by an external impetus [*alieno impetu*] and above all by the system regain their forces as soon as they are freed, because the system itself does not ignore the occasion of restituting itself. (A VI.2, 314)

Considered individually and by themselves, bodies exercise “private” motion which follows the abstract laws of motion. According to the abstract laws of motion, as we have seen, all interactions between bodies reduce to geometrical composition of speeds, and individual bodies have no means to restore their speeds. But if—Leibniz here is building on his hypothesis of ether—the entire medium consists of countless discrete corpuscles that are quickly moving in different ways, then it would be possible for bodies moving in this medium to appear to behave like ordinary bodies that we observe, for instance they would rebound when hit upon each other, and larger bodies would be harder to move, etc. These observable behaviors of bodies do not directly follow from the nature of individual bodies but depend on the structure of the entire “system” which includes all the corpuscles that make up the medium. Thus these patterns of motion that regularly obtain on a macroscopic level are “public” since they are predicated on the whole system of bodies arranged in a certain way, and we could talk about the “laws of the public motion” (A VI.2, 315) insofar as they are such macroscopic patterns of motion that obtain within certain systems of bodies.

On this picture, the concrete laws of public motion are analogous to civil laws because both are concerned with complex systems, namely systems of bodies on the one hand and commonwealths on the other. More importantly, they both describe certain facts that only hold within these systems in virtue of certain features of the systems. Hence just like civil laws are contingent upon, for instance, the will of the lawgiver within a certain political community, the concrete laws of motion are contingent upon the specific makeup of the system of bodies. And should the makeup of the system of bodies be different, the concrete laws of motions would also turn out to be different. Just as Leibniz says in his first letter to Oldenburg, Huygens’s rules of motion (which are concrete laws of motion) are “not primary, not absolute, not pure, but by accident, and hold because of a certain terraquaerial state of the globe … yet in a medium at rest or moving in another way, everything will become different” (A II.1, 95). So—take Figure 1 again—if A and B are not carried by a discontiguous, constantly moving ether, or if the makeup of the ether is different (if there are fewer interstitial vacua, say), they would not rebound as prescribed in Huygens’s first two rules.

In this way, a certain complex system of bodies would look like a bona fide commonwealth with its internal structure and laws whose jurisdiction is limited within the system. Furthermore, if we take into account that it is God who has created the physical world, then it would be through God’s will in creating the world with its specific structure and initial conditions that the concrete laws of motion come into effect, and the concrete laws of motion would also be analogous to civil laws in that they are contingent upon the will of the sovereign.[[34]](#footnote-34) By contrast, the abstract laws of motion are not restricted within any particular system of bodies and they are necessary propositions whose validity cannot be affected even by God. In this sense they are analogous to natural laws that hold even in the state of nature where there is no sovereign and consequently no civil laws.

To summarize, the legal analogy serves to contrast the necessity of the abstract laws of motion with the contingency of the concrete laws of motion, and by doing so, it also brings out the fact that while the abstract laws of motion have the status of eternal truths, the concrete laws of motion allow for, or even require, a willful and purposeful design.

2. The Structural Parallelism between Law and Physics

So far, I have been approaching the legal analogy based on Leibniz’s early physical system. In this section, I will show that this analogy is rooted in the idea of a structural parallelism between law and physics which has guided Leibniz’s early jurisprudential works. This parallelism is initially conceived when Leibniz wants to build a reformed legal system on the model of Hobbes’s bipartite natural philosophy, with natural laws demonstrated from definitions just like the abstract laws of motion and civil laws based on contingent facts and experiences like the concrete laws of motion, thus the legal analogy is a natural expression of this long-held idea. Furthermore, the fact that in the legal analogy Leibniz resorts to the structure of juridical laws to illustrate the structure of physical laws shows that, after extensive work in jurisprudence, he comes to view the former as the model on which the latter is based.[[35]](#footnote-35) As I will later explain in Section 3.2, this change of perspective introduces a providential and teleological element into Leibniz’s physical system whose structure turns out to be more complicated than the original Hobbesian one.

In a series of letters written during 1670-1671, Leibniz explains some of the underlying motivations for his earlier jurisprudential works.[[36]](#footnote-36) The clearest explanation is perhaps contained in a long letter sent to Jean Chapelain in early 1670:

Ever since I applied my mind to Jurisprudence—yet I, who was at that time fresh from a more solid philosophy [*a solidiore philosophia recens*] which admits nothing except experiments and demonstrations, that is, senses and fundaments of reason … thought that I should not start without some preparation [*viatico*] from other sciences—I have begun to inquire into this science [*scientia*] of the just and the unjust. And I was all the more impatient as it seemed to me that it was more worth the effort to give the rule for the motions of the soul than to those of the body.[[37]](#footnote-37) And when I saw that… what are experiments in the knowledge of nature become laws [*leges*] in this matter [namely jurisprudence], because both of them are concerned with sense, fact and history, and that what are abstract *arithmetic, geometric, and phoronomic* demonstrations *about magnitude or number of parts, figure, and motion* which depend on definitions alone and which are certain without the support of sense in the former [namely knowledge of nature], become in this matter [jurisprudence] the indefeasible rules and ratiocinations of natural law [*juris naturalis*] and equitableness … I realized that I must do some work so that, through the conjunction of the two, there could exist a system of art that would suffice for solving all questions whatsoever, whether already proposed or not. (A II.1, 83-84)

This passage, if we put it into the context of Leibniz’s early legal writings, is quite biographical. Leibniz first recounts that he used to think—and there is no reason to assume that he ever relinquishes this view—that jurisprudence must receive help from other disciplines, and this is the view that he vehemently defends in the preface of his very first published legal work, *Specimen Questionum Philosophicarum ex Jure Collectarum* (1664), and strives to argue throughout the entire work by offering instances of legal questions that could receive support from, or be solved by, logical, mathematical, physical, and metaphysical considerations.[[38]](#footnote-38) And at the end of the cited passage Leibniz expresses his aspiration for coming up with a new legal system which presumably integrates the merits of other disciplines and could thereby resolve all legal cases, which aspiration has already appeared in his doctoral thesis, *Disputatio Inauguralis de Casibus Perplexis in Jure* (1666).[[39]](#footnote-39) There is need for a new legal system because, as Leibniz complains both in the letter to Chaplain and *Disputatio Inauguralis*, the current one is so defective that it provides no definite answer to most cases, and consequently one has to resort to the discretion of judges which can often be arbitrary and even subservient to personal goals.[[40]](#footnote-40)

Leibniz thinks that the defect of the current legal system is due to its lack of a proper method. The method of the traditional jurists, as Leibniz sees it, mainly consists in a compilation of specific articles organized roughly by their subjects, which conceals their order and interconnections.[[41]](#footnote-41) By contrast, Leibniz sees great merits in the structure of natural philosophy, or “knowledge of nature,” which is neatly divided into two parts, an abstract part and an empirical part: the former contains demonstrations of universal principles from definitions, while the latter supplies concrete facts. Presumably it is this structure that makes natural philosophy “more solid” because one can easily discern and master its rational foundations which can be then used to derive facts from each other, and in this way the whole system can be reduced to a few definitions and key facts. Leibniz’s aspiration consists therefore in transposing the structure of natural philosophy to jurisprudence and thereby reform the latter.

There are strong reasons suggesting that the “more solid” natural philosophy that Leibniz has in mind is Hobbes’s natural philosophy. First, not only does the abstract part depend on “definitions alone,” it also categorizes “arithmetic, geometric” demonstrations together with “phoronomic demonstrations” about motion, and both of these features are characteristically Hobbesian; second, the distinction between the abstract part of natural philosophy based on *a priori* reasoning from definitions and the empirical part based on *a posteriori* reasoning from sensible phenomena is likely taken from Hobbes.[[42]](#footnote-42) In fact, Leibniz has left us a note about this written in 1663, which matches Leibniz’s biographical account in 1670 in terms of both chronology and content:

Metaphysics, namely first philosophy, is the System of Theorems; a Theorem is a true proposition even if nothing exists, that is, it is only a hypothetical proposition, or resolvable into hypothetical propositions. First philosophy is defined in this manner by Honoratus Fabri, whose *Science of Universal Reasons* is published by Mosnerius, and Hobbes, who divided his work on body into two parts, first philosophy which is abstracted from existence, and physics, namely the causes of things existing in the world. Metaphysics is the work of pure reason, and it flows from definitions, while sense provides the bases of physics. (A VI.1, 22, note 2)

Although Fabri is mentioned first in this note, Hobbes is clearly the focus here, and it is to Hobbes that Leibniz attributes the idea of a bipartite natural philosophy. Leibniz’s description of Hobbes’s bipartite natural philosophy agrees marvelously with his description of the “more solid philosophy,” showing that Hobbes is most likely the referent.

Therefore, long before Leibniz begins to develop his own quasi-Hobbesian physical system in *TMA* and *HPN*, he has been impressed by the structure of the Hobbesian system and been trying to transpose this structure to traditional jurisprudence, which seems to Leibniz to have lacked a proper order for too long.[[43]](#footnote-43) This structure is most visible in the bipartite jurisprudential treatise *Elements of Natural Law* (*Elementa Juris Naturalis*, 1669-1671) and *Element of Civil Law* (*Elementa Juris Civilis*, 1667).[[44]](#footnote-44) In the former Leibniz first tries to come up with a satisfactory definition of justice in a series of drafts, and in the last three drafts Leibniz realizes the intimate relation between justice and love (*amor*/*caritas*) and defines justice as love of the good man (*vir bonus*).[[45]](#footnote-45) It is noteworthy that this is basically Leibniz’s mature definition of justice as “love of the wise [*caritas sapientis*].”[[46]](#footnote-46) Based on this definition, and other auxiliary definitions, Leibniz also attempts to draw various theorems about natural justice or natural law.[[47]](#footnote-47) *Elements of Civil Law*, on the other hand, is a summary of the most prominent positive laws in the Roman law system and contains many contingent prescriptions such as at what age one should acquire legal personhood.[[48]](#footnote-48) These two *Elements* constitute for Leibniz a perfect legal system modelled upon the structure of an ideal physics:

Therefore I am mainly working on three things: Two Elements, one of Roman Law embraced by several charts that are manifest to the eye [*oculariter*], and whoever learns them can solve all cases solely by drawing consequences from them; another Elements of natural Law demonstrated in a short book, with the help of which one can draw consequences from the Elements of the Roman Law. Third, the Rearranged Corpus itself of Roman Law [*Corpus ipsum Iuris Romani Reconcinnatum*], that is all laws, subjected to each other, with their own words and in the most natural order, demonstrated from these Elements in a continuous progression; to these laws are joined not only an Index of all laws, but also an Index of the paragraphs of Roman Law, so that there would no longer appear to be any paragraph which is not organized and which is not demonstrated from *the hypotheses of positive [law] and the axioms of natural law*. (A II.1, 88-89; emphasis added)

The parallelism between Leibniz’s early legal system and his early physical system is clearly expressed in this passage. Just like the abstract laws of motion are necessary propositions demonstrated from definitions, the propositions of natural law are also “axioms” demonstrable from definitions;[[49]](#footnote-49) furthermore, analogous to contingent physical hypotheses such as the hypothesis of ether, articles in civil or positive law are also “hypotheses.” From the conjunction of the axioms of natural law and the hypotheses of civil law, all laws can be derived and explained, just like from the abstract laws of motion and the hypothesis of ether all natural phenomena can be explained. Admittedly the analogy cannot be perfect, because while all natural phenomena must agree with the abstract laws of motion, there might be positive laws that violate natural law. Furthermore, as we shall see in 3.2, civil law is also explained by certain contingent and teleological principles contained in the nomothetic science, whose counterpart in physics is entirely absent from Hobbes’s physics while underdeveloped in Leibniz’s early physics. But besides these differences, it is clear that the envisioned parallelism between law and physics provides the framework for Leibniz’s legal reform.

Given how much Leibniz’s early legal work has been shaped by the parallelism between law and physics, we can now see that the legal analogy in Leibniz’s early physics is by no means a chance occurrence, but rather a natural expression of a much broader and deeply held vision. In the next section we will see how this vision’s influence on Leibniz can be felt in some of his most interesting and controversial views.

3. Eternal Truths and Architectonic Principles

In this section I will explore how the envisioned parallelism between law and physics in Leibniz’s early years genuinely shapes his views in both disciplines. In particular, as a political philosopher, Leibniz thinks that natural justice is independent of anyone’s will and “belongs to the necessary and eternal truths about the nature of things”;[[50]](#footnote-50) as a natural philosopher, Leibniz thinks that the laws of nature are contingent and depend upon “the free choice of wisdom in relation to final causes.”[[51]](#footnote-51) In what follows, I will argue that both of these views have their roots in the parallelism between law and physics.

*3.1 Justice as Eternal Truth*

The connection between Leibniz’s mature view on natural justice and the legal-physical parallelism can be seen immediately from the beginning lines of the *Meditation on the Common Notion of Justice* (1703), which is perhaps the most detailed exposition of Leibniz’s ideas about natural law produced in his mature career:[[52]](#footnote-52)

It is agreed that whatever God wills is good and just. But there remains the question whether it is good and just because God wills it or whether God wills it because it is good and just: in other words, whether justice and goodness are arbitrary or whether they belong to the necessary and eternal truths about the nature of things, *as do numbers and proportions*. (*Political Writings*, 45; emphasis added)

A few paragraphs later, in order to bolster his claim that the rules of natural justice are eternal and apply even to God, Leibniz again invokes the correspondence between natural justice and mathematics:

This [view that God follows different rules of justice] is also somewhat as if someone wanted to maintain that our science, for example of numbers, which is called arithmetic, does not agree with that of God or of the angels, or perhaps that all truth is arbitrary and depends on whim. (*Political Writings*, 49)

Then Leibniz goes on to demonstrate the arithmetic truth that (n+1)2-n2=2n+1 with a diagram, thereby showing the difference between “necessary and eternal truths which must be the same everywhere, and that which is contingent and changeable or arbitrary,” and immediately adds, “the same is true of justice” (ibid.).

Leibniz’s argument here—if it can be called an argument at all—seems to be at best a heuristic device. But if we take into account the parallelism between law and physics, then it becomes much more understandable why Leibniz would use the analogy with arithmetic truths to support his view about justice. The point is essentially the same as the one expressed in Leibniz’s letter to Chapelain: since natural philosophy or physics is “more solid” than traditional jurisprudence, thus jurisprudence should aspire to imitate the structure of physics; and since an ideal physics has an *a priori* part which only contains necessary mathematical propositions, therefore jurisprudence should also have an analogous part where the necessary truths about justice are demonstrated from definitions alone. Perhaps Leibniz’s point is even stronger, that is, *any* discipline that can be properly called science must have an *a priori* part. I suspect this is indeed Leibniz’s view, as can be seen from Leibniz’s attempt to come up with an *a priori* argument for the measure of *vis viva* and an *a priori* part of his dynamics.[[53]](#footnote-53)

Therefore, Leibniz’s radical claim that natural justice belongs to eternal truths is not only based on his well-known distinction between right and fact,[[54]](#footnote-54) but also based on the internal, structural requirement of jurisprudence as “the science of right.” In fact, if we take a closer look at the Chapelain letter, Leibniz’s distinction between right and fact seems to be borne out exactly from the distinction between the *a priori* abstract part and the *a posteriori* concrete part of an ideal jurisprudence, as the latter is concerned with “sense, *fact*, and history,” while the former “the indefeasible rules and ratiocinations of *natural law* [=natural right, *juris naturalis*].” Similarly, in a draft to his 1686 July 14th letter to Arnauld, Leibniz uses “truth of right” (*verité de droit*) and “truth of fact” (*verité de fait*) to refer to necessary truth and contingent truth respectively.[[55]](#footnote-55) Hence, it is very possible that Leibniz’s distinction between right and fact in the ends reduces to the distinction between the *a priori* and the *a posteriori*. In this sense Leibniz can be seen as a precursor of Kant insofar as both recognize the need for an *a priori* moral science, although the contents of their respective *a priori* moral sciences cannot be more different.[[56]](#footnote-56)

*3.2 Nomothetics and Architectonics*

In 3.1 I have argued that, on the abstract level of the legal-physical parallelism, it is physics that exerts its influence on law, leading Leibniz to posit an abstract part of jurisprudence. Now as I will proceed to show, on the concrete level it is law, more specifically the science of civil law, that shapes Leibniz’s way of thinking about nature.

Starting from the late 1670s, Leibniz famously holds that all laws of nature are contingent and thus depend on the free choice of God acting to bring about the greatest perfection in the world. In a work now dated to 1678-1679, Leibniz expresses the view that the laws of motion “are finally resolved into metaphysical reasons and that these metaphysical reasons arise from the divine will or wisdom” (A VI.4, 2008/L 288-289); three decades later, in *Theodicy* Leibniz argues that since the laws of motion cannot be demonstrated geometrically, they are only of “a moral necessity, which comes from the free choice of wisdom in relation to final causes” (§349, H 334). Here Leibniz’s inference from the contingency of the laws of motion to the conclusion that these laws depend on a providential God acting for a purpose relies on the important fact that these laws are “resolved into metaphysical reasons.” These metaphysical reasons, as Leibniz explains in *Tentamen Anagogicum*, are “the most sublime principles of order and perfection, which indicate that the universe is the effect of a universal intelligent power”; later in this essay, Leibniz dubs these principles “architectonic principles.”[[57]](#footnote-57) Since for Leibniz the violation of architectonic principles does not imply contradiction but rather imperfection, the fact that all laws of nature can be derived from architectonic principles means that there is a supreme architect of the universe who creates the universe in accordance with the most perfect design.

The importance of architectonic principles for Leibniz cannot be overstated because, first of all, without them the laws of nature would be based on a kind of brute contingency, and it would be much less plausible to infer from the brute contingency of the laws of nature to the existence of a providential God. Furthermore, it is through architectonic principles that Leibniz justifies his natural teleology and reconciles efficient-causal explanation with final-causal explanation of natural phenomena.[[58]](#footnote-58) The main thought behind such reconciliation is that “all corporeal phenomena can be derived from efficient and mechanical causes, but we understand that these very mechanical laws as a whole are derived from higher reasons” (AG 126), and the “higher reasons” obviously refer to the architectonic principles showing that the mechanical laws are put into effect in order to realize the best possible world. Finally, architectonic principles pervade Leibniz’s more specific physical doctrines, as can be seen from a quick overview of them.

Three of the most often mentioned architectonic principles are the principle of equipollence or the equality of cause and effect, the principle or law of continuity, and as recently brought into light by McDonough, the principle of the easiest or the most determined path. The principle of equipollence is the foundation of Leibnizian dynamics, while the principle of continuity is often used to refute Descartes’ laws of motion, the most direct target of Leibnizian dynamics; the principle of the most determined path grounds Leibniz’s derivation of the laws of reflection and refraction, which are also meant to supersede those of Descartes in the *Dioptrics*.[[59]](#footnote-59) Hence many of Leibniz’s most important scientific innovations are connected with his use of architectonic principles. Finally, although Leibniz does not explicitly call it such, the principle of sufficient reason seems to be the most fundamental architectonic principle since he thinks that other architectonic principles can be demonstrated from it.[[60]](#footnote-60)

Given the importance of architectonic principles, one would naturally want to know how Leibniz comes to hold his mature views about them. One traditional account is that Leibniz first thinks that the principle of equipollence is a necessary truth, and after he fails to demonstrate it from definitions, he starts to think that it is contingent and depends on divine wisdom.[[61]](#footnote-61) McDonough contests that this account is not satisfactory either historically or conceptually: historically, the transition from Leibniz’s repeated attempts to demonstrate the principle of equipollence to his recognition of its contingency seems too abrupt and unexplained; conceptually, the principle of equipollence does not seem to be a paradigmatic case of contingency and divine wisdom. By contrast, he argues, a group of optical works written around 1677 that rely on the principle of the easiest path, which is a prima facie contingent principle that shows a certain degree of perfection, could better explain Leibniz’s sudden conversion to his mature views one or two years later.[[62]](#footnote-62)

Now, although McDonough’s new account brings into light the relevance of Leibniz’s optical works, one might worry whether his account fares significantly better than the traditional one. Historically speaking, the optical works (especially the 1677 piece) to which McDonough draws attention do not explicitly say that the principle of the easiest path is contingent, hence it is possible that at the beginning Leibniz assumes it to be necessary just like the principle of equipollence; on the other hand, if Leibniz already recognizes the contingency of the principle of the easiest path in 1677, then it becomes somewhat puzzling that Leibniz still insists on demonstrating the principle of equipollence at the same time[[63]](#footnote-63)—why would he think that these two principles are different with respect to their modal status? Hence a more plausible story is still that Leibniz suddenly recognizes the contingency of *both* principles in the late 1670s. Conceptually speaking, although the principle of the easiest path *seems* to be more contingent and providential than the principle of equipollence, one could question whether the difference between the two is all that significant for Leibniz. After all, even on McDonough’s account it does not take very long (judging from textual evidence, a few months at the shortest and no more than two years) for Leibniz to recognize the contingency and providential nature of the principle of equipollence after his application of the principle of the easiest path in optics, thus it is still more plausible that Leibniz does not think that the two principles are different in their modal status from the beginning.

Of course, Leibniz’s works in optics could well be an extra impetus to his sudden transition in the late 1670s, but this extra impetus does not significantly alleviate the historical and conceptual worries pointed out by McDonough. These worries are common, I think, to any bottom-up account that explains Leibniz’s transition by his engagement with some particular physical principle, because it seems somehow insufficient that the apparent contingency and providential nature of one or two principles should suddenly lead Leibniz to fundamentally revise his views about the workings of nature. Although I am not denying the possibility of a bottom-up account, I do think a better one could be offered.

The account that I will offer is in a sense a top-down one which shows that the conceptual space for architectonic principles is already created by Leibniz’s early jurisprudence, so that any particular architectonic principle that Leibniz later discovers only gradually substantiates this preexisting conceptual space rather than creates it *ex nihilo*. Indeed, as we shall see, given the legal-physical parallelism, the possibility of architectonic principles is already implied in Leibniz’s early physics. In this way, both the historical and the conceptual worries are alleviated because, on the one hand, these works are composed from the late 1660s to the early 1670s, and on the other hand, if contingency and providence have always been a part of Leibniz’s natural philosophy from the beginning, then it becomes more understandable that Leibniz would recognize them in particular principles.

From my previous description of Leibniz’s early jurisprudence it might seem that the study of civil law consists mostly in gathering facts, but at several places Leibniz says that there is a reason (*ratio*) behind every specific civil law, and thus there is also a science concerned with the reasons of civil law, which Leibniz calls “nomothetics” (*nomothetica*), literally the law-setting science:

Thus, there are two principles for deciding [legal cases]: the law of nature [*jus naturae*] and similar positive law [*lex similis*]; and whenever the legislator has been silent, one can argue from one material to another only when the reason [*ratio*] is similar, and the reason of positive law depends on that part of politics which is called nomothetics. It thus appears that the two eyes of a jurisconsult in office are the *Science of Natural Law* and the *Nomothetic Science*. (*Nova Methodus*, II.70, A VI.1, 341-342, published 1667)

Another eye of a jurisconsult in deciding cases is *Nomothetics*, whose principle is the utility of the republic … *Salus populi*, the supreme law of the republic, consists in the good of the citizens as matter, and in the conservation of the regime as form … The good of the regime consists in public law and such a form of other positive laws that change is prevented; the good of the citizens consists in *eudaimonia* [happiness] and *autarkeia* [self-sufficiency], or the goods of the soul and of fortune. (*Nova Methodus*, II.76[77], A VI.1, 345)

Nomothetics, as the science of civil or positive law, is both contingent and teleological: contingent because it does not seek to *a priori* demonstrate civil law from necessary definitions (which would be impossible), but to determine whether some civil law is in accordance with its reason, *salus populi*, which is doubly contingent because it is contingent that civil law should further the *salus populi* (that is, it is non-contradictory that civil law does not further the *salus populi*), and it is also contingent that a specific civil law furthers the *salus* *populi* in a specific commonwealth; teleological, because some good, *salus populi*, is the goal of nomothetics. The recognition of a nomothetics dealing with the *ratio* of civil law contrasts Leibniz from legal voluntarists like Hobbes, for whom nothing grounds civil laws but the bare will of the sovereign, be it a human sovereign or God,[[64]](#footnote-64) and there is in the end no *ratio* behind any law-giving decision of the sovereign.

Three years after the publication of *Nova Methodus*, in his first letter to Hermann Conring Leibniz again brings up nomothetics and further explains its structure:

It is one question to find out what should be said with regard to right [*de jure*], another question to decide how the positive laws should be set [*condendae Leges*]. The former belongs to judicial prudence [*prudentiae dicasticae*], the latter nomothetics. Then judicial prudence itself has two parts, science and experience, namely the science of natural law and the experience of positive law, since positive law belongs to fact rather than right … Again, just as the law of nature has positive law corresponding to it, the nomothetic science has the corresponding knowledge [*notitiam*] of the republic as it is found in reality, which is a purely empirical matter. (January 1670, A II.1, 45)

Immediately following the passage, Leibniz illustrates the relations between judicial prudence and nomothetics, science and experience with the diagram:



Figure 2, from letter to Conring, Jan. 1670, A II.1, 46

In this diagram, *prudentia*, the whole system of jurisprudence, is divided into two levels, that of science and that of experience (*peritia*). On the level of science there are the science of natural law (*ethica*) and the nomothetic science (*politica*), and on the level of experience there are experiences about private law and public law, both of which belong to “civil law or [*seu*] positive law.” This diagram also makes it clear that civil law or positive law as a whole is subordinated to the two sciences, while the two sciences are independent from each other.

This text, together with the texts from *Nova Methodus*, show that the structure of Leibniz’s legal system is a bit more nuanced that it is described in Section 2. Previously it seems as if that system consists only of the science of natural law and the experiences or facts about civil law, but now we see that there is also a nomothetic science which contains the guiding principles of civil law such as “civil law should further *salus populi*,” “the regime of a republic should be stable,” “citizens should be happy and self-sufficient,” etc. More interestingly, this nomothetic science which is of a higher status than mere experience does not seem to be demonstrable from definitions like the axioms of natural law. This is because first, Leibniz never actually attempts to demonstrate any nomothetic principles from definitions; second, the distinction between such *a priori* demonstrated nomothetic principles and natural law would become very obscure; and finally, it simply seems untenable that the negation of nomothetic principles implies logical contradiction. Hence the nomothetic principles occupy a middle ground between natural law and civil law: on the one hand, the nomothetic principles are not *a priori* demonstrable, on the other hand, they are not empirical knowledge gotten from observation and induction.

This intermediate status of the nomothetic science and nomothetic principles resembles that of the architectonic principles, as both are contingent principles that are more general than any empirical induction. Plus, nomothetic principles are teleological principles, and even paradigmatically so, as they aim to realize the greatest good of the commonwealth and reveal the good intention of the sovereign. Now, if we put into picture the legal-physical parallelism which Leibniz takes very seriously (as I have argued), then it appears that it is not at all surprising that within physics there is a place for contingent, teleological principles intermediate between *a priori* mathematical truths and empirical generalizations. Hence Leibniz’s sudden transition in the late 1670s is not due to the discovery of a whole new category of principles, but rather due to the realization that certain physical principles, such as the principles of equipollence and of the easiest path, should belong to the same category as nomothetic principles. This better explains the seeming abruptness of Leibniz’s transition.

A justified worry for the account offered so far is that, if the nomothetical science, the legal counterpart of architectonic principles, is already there since Leibniz’s early days, and Leibniz always recognizes the legal-physical parallelism, why does his early physical system look so different from his mature system? My answer, in short, is that these two systems are really not that different. In particular, contingency and divine providence do play a role in Leibniz’s early physical system, albeit in a less principled way.

Recall that, first of all, the concrete laws of motion are contingent laws that depend on the specific makeup of a physical system. Furthermore, according to Leibniz, God has created the world with its physical makeup exactly in order to bring about order and perfection. Take, for example, the optical laws which Leibniz already thinks are contingent laws in his early system:

It is accepted by all that the angles of incidence and of reflection are equal, and both phoronomical and optical experiments support this conclusion. The very compendious and beautiful appearance of this theorem is appealing, which affects even the greatest men, and convinced them that this proposition can be demonstrated universally from the abstract nature of motion. I myself also believed in this, until through serious and strict inquisition I noticed that all those efforts are child’s play. I have examined the demonstrations of Digby, Descartes, and Hobbes (but how great they are) and recognized that the charm of their opinion is greater than the rigor of their demonstration.[[65]](#footnote-65) But meanwhile it could not be denied that this proposition is well supported by the senses, and thus should be numbered among observations rather than theorems. Therefore, the reason of its constancy should be sought at least from the hypothesis of concrete motion, or the present economy of things, if not from the theory of abstract motion. *It is useful to the world that the matter be arranged in this way, because if this law of reflection does not hold, then there would not be vision and hearing … By the admirable skill [artificio] or beneficence [beneficio] that is necessary for life, all sensible bodies, according to our hypothesis, are elastic by the circulation of ether, therefore all sensible bodies reflect or refract.* (*HPN*, §22, A VI.2, 228-229, italics added)

God’s freedom, wisdom, and benevolence consist exactly in arranging the world with a such a material structure (“the circulation of ether”) that the useful concrete laws such as the law of reflection could hold on a macroscopic level. In Leibniz’s words:

And here one should admire the achievement of a geometricizing God in the economy of things. Because although it is impossible by the nature of things that some body be entirely lucent, transparent, fluid, heavy, soft, stretchable, flexible, hard, hot, etc.; that some motion be exactly continuous, uniform, uniformly accelerated or decelerated, rectilinear, circular, reflected, refracted, permuted; that the effect of magnet, light, and sound arrive at whatever assignable point, etc., nonetheless it happens with the greatest exactness for the senses that all these things, even if they are not truly so, appear to hold for the senses; and insofar as they are relevant for our use, it is just as if they are truly so. And thus, by the incredible beneficence of God, optics, music, statics, elastics … and whatever pertaining to the sciences mixed from physics and mathematics can be developed even to the envy of the pure sciences, as these theorems do not fail for the senses (unless by accident). This cannot be brought about except by an inimitable skill, through minute motions and structures that generate those qualities underlying every sensible point and directed towards every sensible direction. (*HPN*, §59, A VI.2, 255)

Already in Leibniz’s early physical system the concrete laws of nature are contingent and providential, and God, as the sovereign of the physical world, is the most perfect lawgiver insofar as every civil law of his commonwealth conduces to its order and perfection. In this sense God is guided by nomothetics in creating the world and implementing its contingent laws of nature. It is noteworthy that in these texts divine providence seems to be assumed from the outset rather than inferred via an argument from design; indeed, even if one could claim that there is a very primitive version of the argument from design (“this cannot be brought about except by an inimitable skill […]”), this argument looks very different from Leibniz’s mature argument that relies on the intermediate step involving architectonic principles. Hence Leibniz’s belief in divine providence and natural teleology does not originate with his engagement with architectonic principles in the late 1670s, rather, it is already there when he begins to construct his early physical system with the eyes of a jurist.

One of the main flaws of Leibniz’s early physical system that leads to its rejection, I think, is not that in this system the laws of nature do not reveal a providential design, but rather that the general principles of providential design are not clearly expressed so as to enable one to systematically derive the contingent laws of nature. If there are no such general principles, God would be acting only in an ad hoc manner; and since it is very difficult for us to know the particular wills of God, the contingent laws of nature would be known mostly through empirical observations, and we can never be sure of their universal applicability. This uneasy situation is witnessed by Leibniz’s early attempts to justify the concrete laws of motion, including Huygens’s rules of motion and the optical laws, through the hypothesis of ether. In these attempts no actual derivation is given since what the concrete laws look like would depend on the specific makeup of the underlying ether, yet it seems that we can never be assured that the ether always has a so-and-so structure, and thus what Leibniz is doing is only explaining specific empirical observations without justifying their status as laws of nature.[[66]](#footnote-66) In quite a few later texts, Leibniz explains that it is exactly the failure to systematically derive the concrete laws of motion that led him to add architectonic principles—and substantial form as the metaphysical locus of these principles—to his physical system, and in these texts Leibniz is quite explicit that divine providence is already present in his early system.[[67]](#footnote-67)

Hence Leibniz’s physical system always has a counterpart of nomothetics—which could be called “architectonics”—through which God providentially designs the physical world to bring about order and perfection. The difference between Leibniz’s early and mature physical systems is that in the early system God directly practices architectonics in an ad hoc fashion, while in the mature system there emerge general architectonic principles for God’s design of the physical world; relying on these architectonic principles, we can systematically derive the contingent laws of nature. In this sense it is Leibniz’s mature system that better satisfies the legal-physical parallelism, because—recall Leibniz’s description of nomothetics in his letter to Conring—Leibniz’s early physical system does not yet have the counterpart of a *nomothetic science* that grounds civil law by general nomothetic principles, while this role is fulfilled by architectonic principles in Leibniz’s mature system.

According to the account offered so far, what happens in the late 1670s is perhaps that Leibniz finally realizes, after his unsuccessful demonstrations of the principle of equipollence and his engagement with the principle of the easiest path, that these principles have the same status as nomothetic principles which are neither necessary truths nor empirical observations. One could even say that they are the physical “translations” of nomothetic principles, since just as stability is good and violent change bad for a commonwealth, similarly, the stability of power in causal processes and the determinedness of path in reflection and refraction are good, and sudden changes (in violation of the principle of continuity) are bad for the physical world. Leibniz very quickly turns to embrace architectonic principles because they agree better with his vision that physics and law share the same structure and God governs nature just like a sovereign governs a commonwealth.

Concluding Remarks

In this paper I have explained the legal-physical parallelism in Leibniz and argued for its significance in Leibniz’s philosophy. In general, the formative influence of the parallelism can be described as an interpenetration of law and physics—jurisprudence becomes partly detached from will and power in imitation of abstract physics, while divine will and deliberation feature in concrete physics on the model of a sovereign issuing civil laws.

The intimate connection between law and physics might seem surprising, but I think it is a natural expression of Leibniz’s conception of God as both the creator of the physical world and the supreme lawgiver for the city of God made up of rational minds. In creating the best of all possible worlds, God at once realizes maximal perfection (metaphysical goodness) in nature as well as maximal happiness and virtue (physical and moral goodness) for the rational minds; furthermore, as convincingly shown by Rutherford, these two goals are inherently connected, since “only in a world in which there exists as much perfection and harmony as possible can rational minds attain their greatest possible happiness—a happiness that is derived from their perception of these qualities.”[[68]](#footnote-68) Hence the divine jurisprudence and the divine architecture of nature are about two intertwined subspecies of goodness that are both maximized in the best of all possible worlds. Insofar as human knowledge is derived from divine knowledge, the human jurisprudence and the human knowledge of nature are also connected with each other. This, I believe, is one of the most fundamental visions that underly Leibniz’s philosophy as a whole.[[69]](#footnote-69)

Bibliography

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

Arthur, Richard. *Monads, Composition, and Force*. Oxford: Oxford University Press, 2018.

Baldin, Gregorio. *Hobbes and Galileo*. Dordrecht: Springer, 2020.

Beeley, Philip. *Kontinuität und Mechanismus*. Stuttgart: Franz Steiner, 1996.

Busche, Hubertus. “Einleitung.” In *Frühe Schriften zum Naturrecht*, by Gottfried Wilhelm Leibniz, Edited and translated by Hubertus Busche. Hamburg: Meiner, 2003.

Dong, Hao. “Hobbes’s Model of Refraction and Derivation of the Sine Law.” *Archive for History of Exact Sciences* 75 (2021): 323-348.

Duchesneau, François. *La dynamique de Leibniz*. Paris: Vrin, 1994.

Fichant, Michel. *Science et métaphysique dans Descartes et Leibniz*. Paris: PUF, 1998.

Garber, Daniel. *Leibniz: Body, Substance, Monad*. Oxford: Oxford University Press, 2009.

Goldenbaum, Ursula. “Indivisibilia Vera: How Leibniz Came to Love Mathematics.” In *Infinitesimal Differences: Controversies between Leibniz and His Contemporaries*, edited by Ursula Goldenbaum and Douglas Jesseph, 53–94. Berlin/New York: De Gruyter, 2008.

Hobbes, Thomas. *De Corpore*. Edited by Karl Schuhmann. Paris: Vrin, 1999.

———. *Leviathan*. Edited by Edwin Curley. Indianapolis: Hackett, 1994.

Jesseph, Douglas. “Hobbes on ‘Conatus’: A Study in the Foundations of Hobbesian Philosophy.” *Hobbes Studies* 29 (2016): 66–85.

———. “Hobbes on the Ratios of Motions and Magnitudes.” *Hobbes Studies* 30 (2017): 58–82.

———. “Leibniz on the Foundations of the Calculus: The Question of the Reality of Infinitesimal Magnitudes.” *Perspectives on Science* 6 (1998): 6–40.

———. *Squaring the Circle*. Chicago: University of Chicago Press, 1999.

Johns, Christopher. *The Science of Right in Leibniz’s Moral and Political Philosophy*. London: Bloomsbury, 2013.

Leibniz, Gottfried Wilhelm. *De Corporum Concursu*. Edited by Michel Fichant. Paris: Vrin, 1994.

———. *Dialogi filosofici e scientifici*. Edited by Francesco Piro. Translated by Gianfranco Mormino and Enrico Pasini. Milan: Bompiani, 2007.

———. *Die Philosophische Schriften von Leibniz*. Edited by C. I. Gerhardt. 7 vols. Berlin: Weidmann, 1875.

———. *Frühe Schriften zum Naturrecht*. Edited and translated by Hubertus Busche. Hamburg: Meiner, 2003.

———. *Leibniz: Logico-Philosophical Puzzles in the Law*. Edited by Alberto Artosi, Bernardo Pieri, and Giovanni Sartor. Dordrecht: Springer, 2013.

———. *Leibniz: Political Writings*. Translated by Patrick Riley. Cambridge: Cambridge University Press, 1972.

———. *Leibnizens Mathematische Schriften*. Edited by C. I. Gerhardt. 7 vols. Berlin: A. Asher, 1849.

———. *Philosophical Essays*. Edited and translated by Roger Ariew and Daniel Garber. Indianapolis: Hackett, 1989.

———. *Philosophical Papers and Letters*. Edited by Leroy Loemker. Dordrecht: D. Reidel, 1976.

———. *Sämtliche Schriften und Briefe*. Edited by Deutsche Akademie der Wisseschaften zu Berlin. Berlin: Akademie-Verlag, 1923.

———. *The Labyrinth of the Continuum: Writings on the Continuum Problem*. Edited and translated by Richard Arthur. New Haven: Yale University Press, 2001.

———. *The Leibniz-Arnauld Correspondence*. Edited and translated by Stephen Voss. New Haven: Yale University Press, 2016.

———. *The Leibniz-De Volder Correspondence*. Edited and translated by Paul Lodge. New Haven: Yale University Press, 2013.

———. *Theodicy*. Translated by E. M. Huggard. New Haven: Yale University Press, 1952.

———. “Unicum Opticae, Catoptricae & Dioptricae Principium.” *Acta Eruditorum* (1682): 185–90.

Levey, Samuel. “Leibniz on Mathematics and the Actually Infinite Division of Matter.” *The Philosophical Review* 107 (1998): 49–86.

McDonough, Jeffrey. *A Miracle Creed: The Principle of Optimality in Leibniz’s Physics and Philosophy*. Oxford: Oxford University Press, 2022.

———. “Leibniz on Natural Teleology and the Laws of Optics.” *Philosophy and Phenomenological Research* 78 (2009): 505–44.

———. “Leibniz’s Optics and Contingency in Nature.” *Perspectives on Science* 18 (2010): 432–55.

———. “Optics.” In *The Oxford Handbook of Leibniz*, edited by Maria Rosa Antognazza. Oxford: Oxford University Press, 2018.

Médina, José. “La Lecture Leibnizienne de De Corpore de Hobbes.” In *Leibniz Lectuer Critique de Hobbes*, edited by Éric Marquer and Paul Rateau, 177–204. Montréal: Les Presses de l’Université de Montréal, 2017.

Murray, Gemma, William Harper, and Curtis Wilson. “Huygens, Wren, Wallis, and Newton on Rules of Impact and Reflection.” In *Vanishing Matter and the Laws of Motion*, edited by Dana Jalobeanu and Peter Anstey, 153–91. London: Routledge, 2011.

Pikkert, Owen. “The Modal Status of Leibniz’s Principle of Sufficient Reason.” *Journal of the American Philosophical Association* 7 (2021): 40–58.

Riley, Patrick. *Leibniz’ Universal Jurisprudence*. Cambridge: Harvard University Press, 1996.

Ross, George MacDonald. “Leibniz’s Debt to Hobbes.” In *Leibniz and the English-Speaking World*, edited by Pauline Phemister, 19–33. Dordrecht: Springer, 2007.

Rutherford, Donald. *Leibniz and the Rational Order of Nature*. Cambridge: Cambridge University Press, 1995.

———. Review of Christopher Johns, *The Science of Right in Leibniz’s Moral and Political Philosophy*. *Notre Dame Philosophical Reviews*, 2014.

Tönnies, Ferdinand. “Leibnitz und Hobbes.” *Philosophische Monatshefte* 23 (1887): 557–73.

1. Leibniz to Oldenburg, July 23rd, 1670, A II.1, 95. Also see *De Rationibus Motus*, A VI.2, 160. I use the following abbreviations for Leibniz’s works in this paper: A = *Gottfried Wilhelm Leibniz: Gesämtliche Werke und Briefe*, ed. German Academy of Sciences; GP = *Philosophische Schriften*, ed. C. I. Gerhardt; GM = *Mathematische Schriften*, ed. C. I. Gerhardt; H = *Theodicy*, trans. E. M. Huggard; L = *Philosophical Papers and Letters*, ed. and trans. Leroy Loemker; AG = *Philosophical Essays*, eds. and trans. Roger Ariew and Daniel Garber; LC = *The Labyrinth of the Continuum*, ed. and trans. Richard Arthur; LDV = *The Leibniz-De Volder Correspondence*, ed. and trans. Paul Lodge. [↑](#footnote-ref-1)
2. See Leibniz’s description of his hypothesis in a series of letters to Oldenburg, A II.1, 104-105, 144-145, 167-168. [↑](#footnote-ref-2)
3. For Leibniz’s references to this analogy, see A VI.2, 160, 161, 225, 227, 314-315, 337. In *Phoranomus* (1689), before he launches a critique of his early system, Leibniz again invokes this analogy (*Dialogi filosofici*, 782). [↑](#footnote-ref-3)
4. Michel Fichant is the scholar who has put much emphasis on this analogy, see *Science et métaphysique*, Chapter 9, and the introduction to his edition of *De Corporum Concursu*, 36-41. Besides, Jeffrey McDonough has also noted Leibniz’s use of the analogy in the optical context (see “Optics”). However, no scholars, as far as I know, have yet explored in detail the parallelism between Leibniz’s early legal system and his early physical system. [↑](#footnote-ref-4)
5. Leibniz employs the expression of “architectonic principles” in, e.g. *Tentamen Anagogicum*, GP VII, 275, 279. For uses of “optimality principles,” see the recent works of McDonough, “Leibniz on Natural Teleology,” “Leibniz’s Optics,” and *A Miracle Creed*. Throughout this paper I will refer to these principles as architectonic principles because this also agrees with Leibniz’s depiction of God as a supreme architect (see *Discourse on Metaphysics*, §§3, 5 and *Monadology*, §§83, 87). [↑](#footnote-ref-5)
6. For an account of the event, see A VI.2, 160 and A II.1, 101. Also see Antognazza, *Leibniz*, 100-113. [↑](#footnote-ref-6)
7. These works include: *Specimen Quaestionum Philosophicarum ex Jure Collectarum* (1664, A VI.1, N.4), *Disputatio Juridica de Conditionibus* (1665, A VI.1, Ns.5, 6), *Disputatio Inauguralis de Casibus Perplexis in Jure* (1666, A VI.1, N.9), *Nova Methodus Discendae Docendaeque Jurisprudentiae* [*Nova Methodus*](1667, A VI.1, N.10), and *Doctrina Conditionum* (a rewritten version of *Disputatio Juridica de Conditionibus*, A VI.1, N.11). The first and third of these have been translated and commented by Artosi et al. in *Leibniz: Logical and Philosophical Puzzles*, and part of *Nova Methodus* is translated into German and commented by Hubertus Busche in *Frühe Schriften*, 26-87. [↑](#footnote-ref-7)
8. Leibniz starts reading Hobbes at least from 1663 (A VI.1, 22, note 2), and influences from Hobbes are conspicuous in Leibniz’s writings throughout the 1660s. To name a few examples, see A VI.1, 25 note 12, 278, 375-376 (theory of signs); A VI.1, 178, 183, 194, 380 (logic); A VI.1, 62 note 61, 207, 342, 457 (ethics and human nature); A VI.1, 432, 244 (political philosophy). Thus it is likely that Leibniz has been continuously engaging with Hobbes’s writings throughout 1660s, and there is no obvious hiatus in this process. This is first pointed out by Ferdinand Tönnies, who argues for the thoroughgoing influence of Hobbes on Leibniz during 1663-1673, e.g. in *De Arte Combinatoria* and letters on natural philosophy (see “Leibnitz und Hobbes”). For other studies on the relationship between Hobbes and Leibniz, especially in natural philosophy, see Ross, “Leibniz’s Debt to Hobbes”; Garber, *Leibniz*, 13-40; Goldenbaum, “Indivisibilia Vera”; Médina, “La lecture lebnizienne de *De Corpore*.” [↑](#footnote-ref-8)
9. See Leibniz’s design for an encyclopedia, A VI.2, 395. [↑](#footnote-ref-9)
10. See A VI.2, 231; A II.1, 95. [↑](#footnote-ref-10)
11. Although in this sense phenomena might seem to be objective patterns, it is important to note that they still depend on the senses because they are inexact and only appear to be such (see, A VI.2, 255, 273). [↑](#footnote-ref-11)
12. *De Corpore*, VI.6, 60-61 (page number is that of Karl Schuhmann’s edition); Douglas Jesseph has fully elaborated this feature of Hobbesian geometry in *Squaring the Circle*, Chapter 3. [↑](#footnote-ref-12)
13. See Jesseph “Hobbes on ‘Conatus’,” “Hobbes on the Ratios of Motions and Magnitudes.” [↑](#footnote-ref-13)
14. See Leibniz to Oldenburg, Oct. 15/25, 1671: “I now come to the laws of motion offered by Descartes. The first one (*Principles of Philosophy*, II.37) is true, but not demonstrated by him; Hobbes is the first one to have demonstrated it” (A II.1, 272). [↑](#footnote-ref-14)
15. *De Corpore*, XV.3, 156-157. [↑](#footnote-ref-15)
16. This is a preliminary work of *Theoria Motus Abstracti*. For a more succinct version see L 115-116. [↑](#footnote-ref-16)
17. E.g. IX.7, 97-98. [↑](#footnote-ref-17)
18. The main results are contained in Chapters 16-24 of *De Corpore*. [↑](#footnote-ref-18)
19. For the relationship between Hobbes and Galileo, see Baldin, *Hobbes and Galileo*. [↑](#footnote-ref-19)
20. Leibniz thinks that *conatus* cannot be destroyed, since they are only the beginnings or ends of motions (A VI.2, 332-333). This argument is also inherited from an argument from *De Corpore*, XV.7, 159. [↑](#footnote-ref-20)
21. A VI.2, 333. There are certain complications, though. In Leibniz’s account in *TMA* there are some *conatus* that cannot be geometrically combined, and thus these cases must be treated separately (A VI.2, 268). But later in *Summa Hypotheseos Physicae Novae*, Leibniz seems to abandon this distinction (compare Leibniz’s treatment of two bodies colliding with equal speed in *TMA*, Predemonstrable Foundation23 and Theorems 7-12, A VI.2, 268-269 with his treatment in A VI.2, 338). [↑](#footnote-ref-21)
22. In this sense the laws of motion in Leibniz’s early physics are derived *a priori*, namely they are derived from primitive definitions *more geometrico*. It might be the case that the mature Leibniz holds a less strict view about what *a priori* demonstrations amount to, so that demonstrations that are based on primitive definitions *and* contingent architectonic principles count as *a priori*. For an interpretation of Leibniz’s dynamics that highlight this latter kind of *a priori* demonstrations, see Duchesneau, *Dynamique*. [↑](#footnote-ref-22)
23. One of the issues on which the young Leibniz departs from Hobbes is whether there are indivisibles. But I won’t get into this question as it is not very relevant for my topic. For discussions of the indivisibles in Leibniz, see Beeley, *Kontinuität*, Chapter 10; Jesseph, “Leibniz on the Foundations of the Calculus”; Levey, “Leibniz on Mathematics”; Arthur, *Monads*, Chapter 1. [↑](#footnote-ref-23)
24. And even the mature Leibniz does not think this picture is inconsistent or impossible. See LDV 74-75. [↑](#footnote-ref-24)
25. This translation is based on Murray et al., “Huygens,” which has a full translation of the whole document. [↑](#footnote-ref-25)
26. Rules 5, 6, A VI.2, 158. [↑](#footnote-ref-26)
27. *De Rationibus Motus*, §§12, 24, A VI.2, 161-163. [↑](#footnote-ref-27)
28. The text reads *polos*, but it is likely a typo of *poros*. [↑](#footnote-ref-28)
29. Leibniz explicitly admits the existence of vacuum in his early system (A VI.2, 223, 270), unlike in his mature dynamics. [↑](#footnote-ref-29)
30. Discontiguity is the key here, since if ether is continuous, then it would be conquered all at once. See Leibniz’s more detailed explanation in A VI.2, 164 (§33), which is inherited from *De Corpore*, XV.8. Cf. Garber, *Leibniz*, 20-21. [↑](#footnote-ref-30)
31. See *HPN*, §§22-23, A VI.2, 228-232 for an account on how the concrete laws of motion are explained. For explanations of other main phenomena, see *HPN*, §§17, 27, 34[*bis*], A VI.2, 227-228, 234-235, 238-239 (Beeley, *Kontinuität*, 157-162, contains a useful summary). [↑](#footnote-ref-31)
32. Leibniz begins working on *TMA* immediately after his reading of Huygens in August 1669, which is testified by *De Rationibus Motus* and other drafts of the treatise that come after it (A VI.2, 165-185). On the other hand, it seems that Leibniz only has a rough idea about *HPN* when he starts to correspond with Oldenburg in July 1670 (A II.1, 95-96), and in all likelihood Leibniz is developing the *HPN* while corresponding with Oldenburg. The two treatises are published together in 1671. [↑](#footnote-ref-32)
33. During this period Leibniz thinks that there is no distinction between bodies at rest and empty space. See Leibniz’s 1671 letter to Arnauld, L 148, and discussion of this view in Garber, *Leibniz*, 23-25. [↑](#footnote-ref-33)
34. Leibniz is famous for distinguishing between *jus* and the will of the powerful in his mature legal writings, but I think there he is talking about natural law rather than civil law. Furthermore, around the 1670s, Leibniz seems to be very much under the influence of Hobbes’s political philosophy and accepts the absoluteness of sovereignty as “demonstrated” by Hobbes (see L 105-106). [↑](#footnote-ref-34)
35. This is called Leibniz’s “juriscentrism” by Busche (“Einleitung,” lvii). [↑](#footnote-ref-35)
36. Besides the letter to Jean Chapelain that I will discuss, other letters of interest include: two Letters to Hermann Conring (A II.1, N.15, N.20), Letter to Graevius (N.18), Letter to van Velthuysen (N.19), and the Letter to Hobbes (L 105-106). [↑](#footnote-ref-36)
37. The same point is made 16 years later in *True Method in Philosophy and Theology* (1686) (see Riley, *Universal Jurisprudence*, 30). [↑](#footnote-ref-37)
38. A VI.1, N.4. A very reliable translation of the text as well as summaries of each question can be found in Artosi et al. ed., *Leibniz: Logical-Philosophical Puzzles*, 2-39. [↑](#footnote-ref-38)
39. §11 (A VI.1, 239-240). In this text Leibniz argues that all cases should be decided according to law, whether natural or civil, and other factors have no bearing on the rightful decision of any case. [↑](#footnote-ref-39)
40. A II.1, 84-85; *Disputatio*, §§9-10 (A VI.1, 238-239). [↑](#footnote-ref-40)
41. *Nova Methodus*, II.8-10 (A VI.1, 296-299); A II.1, 88. [↑](#footnote-ref-41)
42. See *De Corpore*, XXV.1, 267-268. Hobbes is perhaps the only philosopher before Leibniz that makes explicit use of this distinction to construct his philosophical system—*De Corpore* is itself organized in this way, with Parts II and III as the *a priori* part, and Part III as the *a posteriori* part. There might be something like this in Descartes, but he is far from being explicit about it, and he certainly does not intend to derive the laws of motion from definitions. More importantly, Leibniz’s knowledge about Descartes is very limited before 1670—his first close reading of *Principia* happens only in 1675-1676 (A VI.3, 213-217). [↑](#footnote-ref-42)
43. In Leibniz’s own words, the method of an ideal science, either physical or jurisprudential, “differs as much as from that method which the jurist-methodologists have used so far as the Euclidean method differs from the Ramean method, for Ramus connects term to term and word to word by continuous subdivisions and distinctions, while Euclid connects proposition to proposition by continuous demonstrations, and it is just as Hobbes says, the former method is verbal [*verbifica*], while the latter is scientific [*scientifica*]” (A II.1, 88). This again supports my point that Hobbes is the source for Leibniz’s methodology. [↑](#footnote-ref-43)
44. This structure can also be seen in previous treatises like *Nova Methodus* (II.4, A VI.1, 294) and *Dissertatio Inauguralis* (§11, A VI.1, 239-240). [↑](#footnote-ref-44)
45. Draft 4: “Justice will be the habit of loving others [*habitus amandi alios*]” (A VI.1, 465); Draft 5: “Justice is the habit of loving all” (ibid.); Draft 6: “Justice is the habit (or stable state) of a good man [*viri boni*]” (A VI.1, 480), “Love [*caritas*] and justice cannot be separated. After innumerable tentative notions of justice, I finally have been satisfied with this, and found it to be primary, universal, and reciprocal” (A VI.1, 481). [↑](#footnote-ref-45)
46. *Political Writings*, 171. [↑](#footnote-ref-46)
47. These theorems are mostly contained in Draft 5. [↑](#footnote-ref-47)
48. E.g. “[The following do not have legal personhood:] 1. The underaged (that is a male younger than 14 or a female younger than 12) except with respect to the validity of those acts that do not diminish right as well as of those right-diminishing acts to which the authority of the guardian is immediately interposed. 2. One who is younger than 25 with respect to the legal personhood [*personam*] of standing in court without a guardian, and with respect to any donation” (A VI.2, 50-51). [↑](#footnote-ref-48)
49. This is also a distinctive view that Leibniz inherits from Hobbes. Hobbes thinks that since all necessary propositions are based on definitions, then either axioms are themselves definitions or they can be demonstrated from definitions (on the demonstrability of axioms, see *De Corpore*, III.9, 36-37; VIII.25, 93-94; on demonstrations as a series of definitions, see VI.16, 70-71). Leibniz follows Hobbes in denying that axioms cannot be demonstrated (A VI.2, 480), thus for him axioms have no independent role in demonstrations, and demonstrations thereby consists purely in series of definitions (A VI.2, 479 note 1, 486; A VI.3, 462). [↑](#footnote-ref-49)
50. *Meditation on the Common Notion of Justice*, *Political Writings*, 45. [↑](#footnote-ref-50)
51. *Theodicy*,§349, H 334. [↑](#footnote-ref-51)
52. Leibniz seems to have composed the *Meditation* for Queen Sophie-Charlotte. See his letter to Sophie-Charlotte in August 1703, A I.22, 529. [↑](#footnote-ref-52)
53. Leibniz’s demonstration against the conservation of *m|v|* in *Brief Demonstration* is *a posteriori* because it relies on Galileo’s law of free fall, which is contingent; to remedy this defect Leibniz has tried to come up with an *a priori* argument in *Dynamica* (see GM VI, 345-367). [↑](#footnote-ref-53)
54. See *Political Writings*, 47. [↑](#footnote-ref-54)
55. *Leibniz-Arnauld Correspondence* (ed. and trans. Stephen Voss), 80. [↑](#footnote-ref-55)
56. Leibniz holds that in the end justice consists in bringing about the greatest perfection (*Political Writings*, 57-58), and this semi-consequentialist approach is obviously different from that of Kant. Nonetheless Johns, *The Science of Right*, argues that this is not the case and Leibniz is a thoroughgoing Kantian. For an objection (which I take to be decisive), see Rutherford’s review of Johns. [↑](#footnote-ref-56)
57. L 477, 484. [↑](#footnote-ref-57)
58. McDonough, *A Miracle Creed*, Chapter 1 argues convincingly that Leibniz’s natural teleology based on the contingency and providential nature of the laws of nature qualifies as genuine teleology. [↑](#footnote-ref-58)
59. The principle of equipollence is first discussed in the 1676 piece *De Arcanis Motus* (A VIII.2, 133-138), and it is the foundation of Leibniz’s dynamics (see Garber, *Leibniz*, 102-106). The principle of continuity is central for Leibniz’s refutation of the Cartesian laws of motion, see L 351-354, 397-403. The optical principles and their significance are treated in detail by McDonough (see “Leibniz on Natural Teleology”; “Leibniz’s Optics”; “Optics”), but a point that needs to be clarified is that Leibniz clearly intends to supersede the principle of the easiest path elaborated in *Unum Opticae, Catoptricae & Dioptricae Principium* (1682) with the principle of the most determined path in *Tentamen Anagogicum* (ca. 1696). The confusion might have originated from Loemker’s mistranslation of a line in the *Tentamen*, where he translates “et je le monstray un jour par un echantillon, lors que je proposay le principle general d’optique, que le rayon se conduit d’un point à l’autre par le voye qui se trouve la plus aisée […]” (GP VII, 273), where Leibniz uses the past tenses of the verb (*monstray*, *proposay*), with “Some day I shall show this in a special case in which I shall propose […]” (L 479). While in the original text Leibniz is clearly describing his past work in *Unicum Opticae* and it becomes clear a few lines later that he proposes to modify the principle of the easiest path into the principle of the most determined path, in Loemker’s translation it reads as if Leibniz still thinks the principle of the easiest path is not obsolete. [↑](#footnote-ref-59)
60. See the second letter to Clarke, L 677-678. I think it is highly plausible that PSR is a contingent principle in Leibniz’s mature system (for an explicit expression, see the fifth letter to Clarke §126, AG 346; for a recent argument for the contingency of PSR, see Pikkert, “Modal Status”), although in his early thought he seems to take PSR as necessary. [↑](#footnote-ref-60)
61. See Garber, *Leibniz*, Chapter 6. Duchesneau, *Dynamique*, recognizes the contingency of the architectonic principles and argues that they spring from Leibniz’s demand for a systemic explanation of phenomena via the hypothetico-deductive method, but he does not touch on Leibniz’s change of position with regard to their modal status. [↑](#footnote-ref-61)
62. See McDonough, “Leibniz’s Optics”; *A Miracle Creed*, Chapter 3. [↑](#footnote-ref-62)
63. See *De Aequipollentia Causae et Effectus*, A VI.4, 1963-1964, written in 1677-1678. [↑](#footnote-ref-63)
64. If the sovereign is human, then the law are civil laws; if the sovereign is God, then the laws are natural laws. Therefore, although according to Hobbes natural laws are based on natural reason, they, including the natural reason itself, are still grounded in the divine will and omnipotence. See *Leviathan* (ed. Curley), Chapter 31, 235-237. [↑](#footnote-ref-64)
65. For analysis of the demonstration of optics laws in Descartes and Hobbes, see my “Hobbes’s Model.” [↑](#footnote-ref-65)
66. For example, in *HPN* Leibniz explains that Huygens’s rules of motion can be explained without offering any actual quantitative derivation (A VI.2, 230), as it the case with his early attempts to derive the optical laws (A VI.2, 309-322). [↑](#footnote-ref-66)
67. See *Phoranomus*, Dialogue 2, *Dialogi filosofici*, 796-798; AG 124, 249. [↑](#footnote-ref-67)
68. Rutherford, *Order*, 53. The denominations of “metaphysical,” “physical,” and “moral” goodness are also taken from this work. [↑](#footnote-ref-68)
69. I am grateful to Daniel Garber for his comments and encouragements. This paper was presented in a Princeton PhilSoc workshop, and I thank the audience, especially João Carvalho, for their feedback. Also thanks to the helpful comments from the anonymous reviewers and the editor. [↑](#footnote-ref-69)