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Johann Christoph Sturm's Natural Philosophy

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Published in:
Journal of the History of Philosophy

DOI:
[10.1353/hph.2020.0049](https://doi.org/10.1353/hph.2020.0049)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2020

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Sangiaco, A. (2020). Johann Christoph Sturm's Natural Philosophy: Passive Forms, Occasionalism, and Scientific Explanations. *Journal of the History of Philosophy*, 58(3), 493-520.
<https://doi.org/10.1353/hph.2020.0049>

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Journal of the History of Philosophy, Volume 58, Number 3, July 2020, pp.
493-520 (Article)

Published by Johns Hopkins University Press

DOI: <https://doi.org/10.1353/hph.2020.0049>

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Johann Christoph Sturm's Natural Philosophy: Passive Forms, Occasionalism, and Scientific Explanations

ANDREA SANGIACOMO

ABSTRACT This paper presents the first systematic investigation into Johann Christoph Sturm's natural philosophy and his account of causation and scientific explanations. While Sturm maintains that God is the only true cause of natural effects, he also claims that the specificity of natural effects must be empirically investigated by inquiring into natural forms. Forms, however, do not have any active role in the causal process that brings the phenomenon about, but they only account for its specific features. To articulate this view, Sturm engages with a number of crucial topics discussed by seventeenth-century authors, such as the rejection of scholastic substantial forms and the occasionalist claim that only God is the true efficacious cause of natural effects. Sturm's account departs significantly from other currently available early modern positions and offers a still largely overlooked perspective to investigate the seventeenth-century debate on causation.

KEYWORDS Sturm, Leibniz, occasionalism, substantial forms, causation, scientific explanation, natural philosophy

We have lingered in the chambers of the sea
By sea-girls wreathed with seaweed red and brown
Till human voices wake us, and we drown.
T. S. Eliot, *The Love-Song of J. Alfred Prufrock*

I. SCIENCE WITHOUT FORMS?

In the third *intermède* of *Le Malade Imaginaire* (1673), Molière imagines a sort of medical convention in which “the wisest experts and professors of Medicine” examine whether a bachelor candidate can be deemed to enter the medical profession. As the first question in this examination, the “Chief physician” asks,

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“What is the cause and reason [*causam et rationem*] why opium induces sleep?” The candidate answers without the least hesitation: “Because it contains a sleeping virtue [*virtus dormitiva*], whose nature is to put the senses to sleep.” The answer is followed by a jubilant reaction by the choir: “Good, good, good, he answers well, he is worthy of entering in our wise gild.”¹

The scene is intended to be a hilarious parody of the medical science at Molière’s time. By 1673, Descartes, Boyle, and Hobbes, among many other early modern natural philosophers, had already mounted a sustained attack on scholastic natural philosophy, in which causal powers are rooted in substantial forms, which are in turn the principle in virtue of which individuals have and exercise causally active efficient powers.² Molière’s *virtus dormitiva* is the iconic representation of the way in which scholastics aimed at explaining phenomena (i.e. provide the *causa et ratione* of them) by attributing specific causal powers and virtues to substances themselves. Early modern opponents of scholastic philosophy instead offered scientific explanations based on mechanical principles such as matter and motion.³

Although the connection between substantial forms and causation was under extreme pressure during the early modern period, the notion of form plays a broader role in scholastic accounts. In the wake of Aristotle’s own account of forms, substantial forms make matter into a particular being. Given the problems raised in early modern debates on causation, one may even venture to say that forms should not play any role as efficient causes at all. Although this might sound like a *coup de théâtre* from the perspective of early modern debates, the idea that forms should not be understood in terms of their efficient causal powers is at the core of Johann Christoph Sturm’s (1635–1703) natural philosophy.

In this paper, I offer the first systematic investigation into Sturm’s natural philosophy and how he dealt with the early modern dismissal of substantial forms.⁴ In particular, I draw attention to Sturm’s account of passive forms and how his explanation of natural phenomena no longer relies on any intrinsic and causally efficacious powers in natural beings. Sturm is keen to present God as the ultimate source of causal efficacy in nature; however, he contends that specific natural phenomena depend on the specific mechanical forms of natural beings themselves. Since God’s power is always equally present and at work in every natural phenomenon, it does not contribute to obtaining specific explanations of specific phenomena. Passive forms (although inefficacious from a causal point of view) are sufficient to explain the nature and the particular features of the phenomena themselves.

One can summarize Sturm’s position by stating that he divorces the notion of ‘cause’ (*causa*) from the notion of ‘explanation’ (*ratio*). Sturm dismisses the crucial scholastic tenet according to which a cause is explanatory because it explains how

¹Quotes are from Molière, *Le malade imaginaire*, 128–30; translations are mine.

²See, e.g. Robert Pasnau, *Metaphysical Themes*, 549–73.

³See, e.g. Helen Hattab, *Descartes on Forms and Mechanisms*; and Daniel Garber, “Remarks.”

⁴In this paper, I focus on Sturm’s masterpiece, *Physica Electiva*. The first volume was published in 1697 by Sturm himself, while the second was published posthumously by Christian Wolff in 1722. All translations are mine.

a certain agent gives being and produces an alteration in a certain patient.⁵ The principle (God) that accounts for the production of a certain phenomenon (its *causa*) no longer directly accounts for the specificity of the phenomenon itself; while the principle (the passive form) that explains that phenomenon (its *ratio*) no longer accounts for the power that is necessary to efficaciously bring the phenomenon about.

The relationship between the notions of *causa* and *ratio* undergoes a significant development during the early modern period. Vincent Carraud and Jean-Christoph Bardout drew attention to the reshaping of this relationship during the seventeenth century.⁶ According to Carraud's narrative, late scholastics such as Suárez presented efficient causation as the only real model to account for phenomena. Descartes builds on this model by reducing all causation to efficient causation and by notably dismissing final causes from natural philosophy. However, Descartes faces the problem that by explaining everything, efficient causality itself remains unexplained.⁷ Malebranche radicalizes this point by conceiving of occasional causes as explanatory principles that do not have any causally efficient power. God is the only efficacious cause, whose power nonetheless cannot be intelligibly understood.⁸ In this way, Malebranche divorces the notion of *causa* from that of *ratio*. Carraud's reconstruction ends with Leibniz, who reconnects *causa* and *ratio* in his principle of sufficient reason and understands the order of reasons in terms of final causation.⁹ The conclusion of Carraud's narrative is that post-Cartesian thinkers progressively dismissed the centrality that efficient causation acquired in the first half of the seventeenth century and reintroduced final causation. Overall, Carraud presents the development of the early modern debate on causation as a progressive dismissal and overcoming of the late scholastic framework.

Carraud's narrative can be challenged on a number of different points.¹⁰ Nonetheless, it remains relevant for at least two reasons. From a methodological point of view, it is representative of the still widespread tendency in today's scholarship to build broader narratives by connecting major figures in the western canon in a dialectical linear chain, in which each node reacts to the previous and resolves to the next. From a philosophical and historical point of view, Carraud

⁵See, e.g. Suárez, *DM* 12.2.4: "a cause is a principle per se inflowing being to something else (*causa esse principium per se influens esse in aliud*).\" References to *Metaphysical Disputations* (*DM*) are by the number of the relevant disputation, section, and paragraph. Unless otherwise noted, translations are my own. Concerning Suárez's account of efficient causation, see Stefan Schmid, "Efficient Causality"; Jacob Tuttle, "Suárez's Non-Reductive Theory of Efficient Causation."

⁶See Carraud, *Causa sive ratio*; and Bardout, "Le modèle occasionaliste" and "Cause and Reason."

⁷Michael Della Rocca, "Causation without Intelligibility," offers a different assessment of Descartes's position by arguing that Descartes would not consider the cause as a principle of intelligibility. In this way, Della Rocca presents Descartes as anticipating Hume's view.

⁸This point is further developed by Bardout, "Le modèle occasionaliste" and "Cause and Reason," who discusses it in relation to both Malebranche and Berkeley.

⁹Stefano Di Bella, "Causa Sive Ratio," offers an alternative reading of Leibniz's position, in which he does not completely conflate the notions of *causa* and *ratio*.

¹⁰Kara Richardson, "Formal Causality," and Sydney Penner, "Final Causality," stress the importance of formal and final causation in Suárez, against the idea that he would have privileged efficient causation. Valteri Viljanen, *Spinoza's Geometry of Power*, and Karolina Hübner, "On the Significance of Formal Causes," defend the role of formal causation in Spinoza's metaphysics; Alison Simmons, "Sensible Ends," and Tad Schmaltz, "Descartes's Critique" discuss the role that final causation still plays in Descartes.

shows that Leibniz's effort to identify *causa* and *ratio* was not at all an obvious move. It was up for discussion among early modern and late scholastics whether, and to what extent, causes are the same as explanations and vice versa.

My discussion engages with both these points. From a methodological point of view, I show how taking into account so-far-minor figures, like Sturm, significantly undermines the idea that the history of philosophy and science progresses in a dialectical linear way. From a philosophical and historical point of view, Sturm reveals a so far neglected but worth exploring solution to the way in which the relationship between *causa* and *ratio* can be conceived.

Today, Sturm is an obscure figure, who is usually mentioned (if ever) as the polemical target of Leibniz's essay *De Ipsa Natura* (1698).¹¹ In this context, Sturm features as an advocate of Malebranchian occasionalism (i.e. the view that only God is the real cause of natural phenomena, while all natural beings are deprived of causal powers and operate only as occasional causes for God's intervention). It is only in this role that Sturm receives a fugacious mention in Carraud's narrative as well.¹² However, this evaluation overlooks the breadth of Sturm's position.¹³ I contend that there are at least three main reasons to seriously investigate Sturm's account in its own right and in greater detail.¹⁴

First, Sturm's natural philosophy provides new materials to rethink the early modern reshaping of the notions of *causa* and *ratio* beyond the way that more familiar canonical figures address this topic. Descartes's dismissal of substantial

¹¹In the *De Ipsa Natura*, Leibniz engages with Sturm's article *De Idolo Naturae* (published in 1692), but he also mentions Sturm's *Physica Electiva*. On this exchange, see Roberto Palaia, "Naturbegriff und Kraftbegriff." Ariew and Garber, in their editorial note to Leibniz's *De Ipsa Natura*, quickly liquidate Sturm: "the publication of a pamphlet by Johann Christopher Sturm, a minor figure in the history of physics and a correspondent of Leibniz's, was the occasion for this piece" (AG 155). This phrasing conveys the idea that (a) Sturm is just a minor figure, and (b) Sturm is worth mentioning only insofar as he gave the occasion to Leibniz to articulate his own view. Historians of science are slightly more familiar with Sturm and his effort to disseminate experimental philosophy in Germany. See, e.g. Volker Herrmann and Kai Thomas Platz, *Der Wahrheit*; Hans Gaab, Pierre Leich, and Günter Löfflad, *Johann Christoph Sturm*. Endre Zsoldos, "Starting the Classification," discusses Sturm's classification of stars, while Jens Lemanski, "Logic Diagrams," discusses Sturm's use of diagrams in logic. Lemanski also shows that Leibniz and Sturm both studied logic with Erhard Weigel (1625–1699) in Jena in the early 1660's. For a general introduction to Sturm's life and works, see Andrea Sangiacomo and Christian Henkel, "Johan Christoph Sturm."

¹²See Carraud, *Causa sive ratio*, 444–46.

¹³Josef Bohatec, *Die cartesianische Scholastik*, offers the most extensive discussion so far of the merits of Sturm's philosophical position. Bohatec presents Sturm's project as a form of critical eclecticism in which he attempts to adopt only what he finds most solid and useful in other authors. While Sturm tends to combine Aristotelian and Cartesian principles, he does so (according to Bohatec) because he interprets Aristotle and Cartesians themselves as eclectic thinkers. Bohatec also emphasizes that the scope of Sturm's eclecticism goes beyond Aristotle and Descartes and includes a range of other authors such as Campanus, Cassinus, Malpighi, Montanarus, Lana, Sylvius, Barlatus, Kircher, Loverus, Guericke, Schott, Weigel, Eckard, Reyher, and others (*Die cartesianische Scholastik*, 17). In epistemology, Bohatec presents Sturm as striving for a middle way between the sensualism of the scholastics and the "extreme idealism of 'modern' radical Cartesians" (*Die cartesianische Scholastik*, 86). Bohatec further substantiates this view by devoting special attention to his account of matter (*Die cartesianische Scholastik*, 141–45). I am thankful to Christian Henkel for having drawn my attention to Bohatec's text.

¹⁴By encouraging the reappraisal of Sturm's so-far neglected natural philosophy, I aim to contribute to the debate about the actual inclusiveness of the current western canon in the history of philosophy. See Lisa Shapiro, "Revisiting the Early Modern Philosophical Canon"; and Michael Beancy, "Twenty-five years of the British Journal."

forms in natural philosophy is often presented as an attempt to reject what was one of the pillars of scholastic natural philosophy. Sturm subscribes to the broad guidelines of Descartes's mechanist project in natural philosophy (i.e. to the idea of explaining all phenomena in nature in terms of matter in motion). However, Sturm develops his Cartesian-inspired rethinking of natural philosophy in a peculiar way. On the one hand, Sturm tries to preserve certain core elements of the scholastic account of explanation (namely, the use of the notion of form to account for the specificity of natural phenomena). On the other hand, he attempts to overcome the inextricable difficulties and challenges with which the scholastic view was confronted in early modern debates.

Late scholastics put great effort into trying to glue the notion of substantial form to that of efficient causality, and then use this account as the basis for the explanation of natural phenomena. Sturm labors in the opposite direction. He tries to strip the notion of form from its causal role to show that forms can still play a crucial explanatory function without having to be causally active as efficient causes. From Sturm's point of view, the late seventeenth-century reshaping of the notions of *causa* and *ratio* is not just the consequence of Descartes's revolution in natural philosophy. Rather, it is an extreme attempt to safeguard and rethink a crucial feature of the scholastic framework (i.e. the explanatory role of forms) in order to defend it from its early modern threats.

Second, Sturm's way of establishing and defending an occasionalist metaphysics of causation is worth studying in its own right. In his *De Ipsa Natura*, Leibniz presents Sturm as defending Malebranche's occasionalism (G IV.504–16/AG 155–67). This charge is partially correct insofar as Sturm does claim, like Malebranche, that God is the only active cause operating in nature. However, Leibniz oversimplifies Sturm's position. Sturm's account of passive forms is in fact different from Malebranche's occasionalism for the role that it attributes to finite forms in the explanation of natural phenomena and for the relatively minor role that the notion of the laws of nature plays in Sturm's account. A recent trend in the scholarly debate on occasionalism consists in better appreciating how various early modern authors used different argumentative strategies to defend and disseminate occasionalist views.¹⁵ In this respect, a close examination of Sturm's position can significantly contribute to developing a more nuanced and richer account of the various forms of early modern occasionalism and their philosophical underpinnings.

Third, Sturm's attempt to reconceptualize natural forms provides a new perspective to study how scholastic notions were reshaped and evolved during the early modern period. Leibniz is often presented as the restorer of substantial forms in natural philosophy and metaphysics.¹⁶ One of Leibniz's main reasons for this move stems from the limitations of a purely mechanistic account of natural phenomena. However, Sturm develops an alternative way of safeguarding the scholastic notion of form by simultaneously embracing a full-blown mechanist picture of the natural world. In this respect, Sturm's case illustrates a different

¹⁵See Steven Nadler, *Occasionalism*; Schmaltz, *Early Modern Cartesianisms*, 165–227; and Andrew Platt, "Cordemoy."

¹⁶See, e.g. Christia Mercer, *Origin and Development*, 63–98; and Adrian Nita, *Leibniz's Metaphysics*.

strategy to rethink the legacy of the scholastic framework at a moment in which the tenability of its inherited traditional version was ultimately compromised.

My discussion proceeds as follows. In section 2, I introduce Sturm's account of passive forms. In section 3, I discuss Sturm's occasionalism. In section 4, I conclude that Sturm reengineers the notion of form in such a way to allow it to survive in a philosophical milieu increasingly hostile to its traditional scholastic roots.

2. PASSIVE FORM

In this section, I first introduce Sturm's account of forms as passive modes of matter (2.1). I then present Sturm's argument against the late scholastic conception of substantial forms (2.2). I conclude by discussing Sturm's way of ruling out any intermediary finite source of causal efficacy in nature, which entails (by elimination) that God is in fact the only genuine cause operating in the world (2.3).

2.1. *Forms as Passive Modes of Matter*

Before presenting Sturm's own view, it is worth recalling a few fundamental features of the late scholastic account of causation and substantial forms. In the scholastic framework, causal relationships are conceived of as relationships between substances. When something causes something else, this means that one substance acts upon another substance by producing a change in it. The substance that initiates the process is the agent, while the substance that receives the change is the patient. Agent and patient are ontologically paired by their own natures or substantial forms. The agent is such because it instantiates in actuality a certain substantial form, in virtue of which the agent has the active power to elicit certain accidents in a (suitably disposed) patient. The patient is such because it has a passive power of receiving or actualizing certain forms or accidents in virtue of its own nature or form.

In this framework, actuality has ontological priority over potentiality. For this reason, any causal process needs an agent to initiate it. Nonetheless, the agent could not produce any effect if a suitable patient were not present. Being a patient or having merely passive powers does not mean that the patient does not influence the causal process, but rather that it does not initiate such a process (since the patient rather receives the action from the agent). Patients are not absolutely indifferent to what the causal process brings about, but they truly contribute to the effect only by offering the suitably disposed substratum for the actualization of the agent's effect.

In late scholastic accounts, a fundamental feature of substantial forms is to be causally efficacious as efficient causes. This function, however, had not always received such a strong emphasis in earlier scholastic accounts. Aquinas, for instance, stresses that the crucial function of forms is "to give *esse* to matter" (*forma dat esse materiae*).¹⁷ This definition may be problematic, depending on how one interprets the *esse* given by the form. On the one hand, forms may be taken to be responsible for the existence of a material individual, while on the other hand,

¹⁷The formula is quoted and discussed by Rudi Te Velde, *Participation and Substantiality*, 218–24.

forms may be rather responsible for the actualization in matter of a specific way of being that characterizes a certain individual and distinguishes it from others. These two interpretative options, and the complications they entail, have generated a long controversy that cannot be reconstructed here. Suffice it to say that Aquinas's view remains somehow closer to Aristotle's original account of forms, in which the form of a substance is primarily what defines its specific nature and features. In this account, forms are not immediately defined by having genuine causal efficacy as efficient causes.¹⁸ Rather, forms play an explanatory role insofar as they explain which kind of being is the being under examination, by thus providing the cause for why a certain being is as it is and why it is different from other beings.

Sturm's account builds on this understanding of forms as principles that specify the kind of being that certain entities are. Sturm aims to break the connection between forms and efficient causation. He rephrases in mechanical terms the scholastic account of the patient when he discusses the passive nature of forms, while he considers God alone as the only true agent operating in nature. To articulate his account of passive forms, Sturm has not only to clarify the nature of forms but he must also rule out alternative accounts.

The starting point of Sturm's discussion is the seemingly uncontroversial claim that matter, as such, is completely passive and devoid of any active causal powers. As Sturm argues:

This first matter (that is, the matter common to all natural bodies), is a merely passive substance, which can undergo many effects, but that can produce nothing. . . . Not only is matter essentially a merely passive thing, but moreover, it is also entirely incapable of receiving any activity or active power. (*PE* I.65)

Matter is essentially characterized by impenetrable extension, which can be moved, divided, shaped, and arranged in different fashions.¹⁹ However, matter has a merely passive capacity for being moved, shaped, and arranged in different ways. Matter is incapable of beginning new causal processes or actively directing them toward certain results. Whatever happens to matter is caused by some true agent, which is different from matter itself.

Scholastics would largely agree up to this point, but they would then urge that substantial forms are precisely what informs matter and produces individual substances endowed with active powers.²⁰ However, Sturm holds that forms are nothing but mechanical arrangements of material parts. In this sense, they have nothing substantial, but are better understood as modes of matter:

¹⁸Thomists tend to deny that substantial forms are immediately active as efficient causes, but instead argue that substantial forms act in virtue of their own powers. Suárez rejects this view and argues instead that forms are immediately causally active, not only as formal but also as efficient causes (*DM* 18.2.4–22/F 53–71). This point is further discussed by Richardson, "Formal Causality," 78.

¹⁹See *PE* I.47. From the fact that extension is impenetrable, Sturm derives an argument that rejects the idea of a real vacuum (since a completely void space would be a sort of extension that extended bodies can penetrate) and reduces the notion of void to a mere abstraction (*PE* I.61). Bohatec, *Die cartesianische Scholastik*, 141–45, offers a more extensive discussion of Sturm's account of matter. Sturm attempts to prove that Descartes's conception corresponds to Aristotle's conception *rightly understood*. Bohatec notes that Sturm (unlike Descartes) distinguishes *mathematical* matter (which is infinitely divisible) from *physical* matter (which is not infinitely divisible and which leads to an atomistic view). Bohatec also remarks that Sturm did not seem to have taken Huygens's position into account.

²⁰See, e.g. Suárez, *DM* 18.2.1/F 51–52.

Forms (properly speaking) are not substances or some kind of absolute entity [*entitates quaedam absolutae*] (which have some true and proper subsistence), but only some inert and merely passive modifications [*modificationes*] of matter (which is a substance of the most brute kind) or certain arrangements [*habitudines*], which deserve to be called ‘modes’ [*modorum*] rather than ‘things;’ it is certainly much less possible to ascribe to forms any truly active and operative power than to a real and substantial subject. (PEI.115–16)

In this passage, Sturm contrasts two kinds of beings: substances and modes. Substances are “absolute entities” in the sense that they can be conceived in themselves and their particular being does not depend on that of other things. Modes are the opposite of substances: they are “relative” beings, in the sense that they cannot be conceived in themselves and their being depends on the existence of some substance. Modes are not self-subsisting things, but they rather express how self-subsisting things are configured, shaped, or disposed. Nonetheless, modes have a conceptually distinct and specific nature or essence that makes them (modally) distinct from the substances on which they ontologically depend.²¹

By considering forms as modes, Sturm can rule out two alternative options. Modes can be contrasted with both mere contingent accidents (i.e. accidents that contingently qualify a subject but do not have any ontological reality or being apart from the subject itself), and real accidents (i.e. accidents that can be separated, at least by God, and exist apart from their subjects). According to Sturm, forms cannot exist apart from matter (they are not like real accidents), but they are also something more robust than mere contingent accidents, since different forms have different natures and specify matter in distinctive ways. By considering forms as modes, Sturm can establish an ontology of the material world in which there is fundamentally only one subject (matter), which is nonetheless specified and configured in many different and genuinely distinct ways (by natural forms).²²

Since matter is merely passive, and forms are nothing but modes of matter, forms are merely passive as well. This inference presupposes that the causal role and efficacy of modal entities is derivative on that of their substratum. Modes can be causally active insofar as they are modes of causally active substances. However, since forms are modes of matter and matter is causally passive, forms are causally passive as well. This entails that forms cannot be the cause that begins new causal processes, nor can they cause by themselves the production of effects associated

²¹According to Sturm, this account of forms is consistent with Aristotle’s own account of natural forms. In support of his view, Sturm refers to the Altdorf professor Ernst Soner (1572–1612) and his commentary on Aristotle’s *Metaphysics* (*In Libros XII. Metaphysicos Aristotelis Commentarius*), as a defender of the thesis that material forms, considered in themselves, do not belong to the genus of forms but rather to that of accidents (see PEI.79). According to Sturm, early modern scholastics such as Honoré Fabri and Francesco Lana subscribed to the view that natural forms have only *esse respectivum* (PEI.81).

²²Sturm arguably follows Suárez’s realist account of modes in taking modes as real entities that nonetheless depend on their subjects in order to exist and are not separable from them (DM 7.1.16–17). For a reconstruction of Suárez’s account, see Stephen Menn, “Suárez, Nominalism and Modes”; and Pasnau, *Metaphysical Themes*, 253–58. Pasnau also argues that Descartes’s account of modes can be seen as an appropriation of Suárez’s (*Metaphysical Themes*, 262–66). The major discontinuity between Suárez’s account and Sturm’s is that, according to Suárez, modes are also causally active. This point is already less explicit in Descartes. Sturm grants it only in the sense that modes (i.e. forms) play a causal role as *sine quibus non* conditions for God’s operation, but he denies that they are intrinsically efficacious or active.

with them.²³ From Sturm's point of view, the only way to avoid this conclusion is to maintain that forms are not merely modes of matter, but some kind of substantial entity, and that forms are thus not purely material and are capable of being endowed with independent causal efficacy. This option is ruled out by Sturm's argument against the scholastic account of substantial forms.

2.2. *Sturm's Argument against Scholastic Substantial Forms*

If forms are modes of matter, and if matter is passive, Sturm's conclusion about the passivity of forms seems to follow smoothly. However, a scholastic opponent might wonder why one should accept that forms are modes of matter and not something ontologically more robust, of the kind that a substantial form would be. Sturm's strategy to reject this scholastic suggestion consists in building a trilemma, in which the scholastic view is forced to converge toward Sturm's own position. Substantial forms are either (i) purely material beings, (ii) purely spiritual beings distinct from matter, or (iii) a kind of being that is in between purely material and purely immaterial substances.

The first option leads directly to Sturm's own view. If substantial forms are purely material beings, they cannot be substances in themselves because the form of a material body cannot be another separate material body, given that forms operate in virtue of their intimate union with the matter of the substance of which they are the form. Thus, if substantial forms are purely material, then they have to be conceived as modes of matter.

The second option is relevant because late scholastic authors such as Suárez tended to use the human rational soul as the prototype for our understanding of other natural substantial forms (e.g. *DM* 15.1.6/KR 20). However, the example of human rational souls is difficult to generalize. According to Sturm:

The entire nature of a form generally and essentially consists of a relation [*in relatione consistat*], because each form is the form of the thing that it informs, and each thing that is informed is informed by its form or through its form. And once the notion of form is taken in this sense, it is certain that the rational soul of the human being is not its form in the full and adequate sense of the term. . . . In fact, even if the rational soul is posited, then the human being is not posited and it does not exist as well, although when a human being is posited and exists, then it is necessary that also the rational soul is posited and exists. (*PE* I.94)

Sturm's conclusion is that the rational soul has to be conceived of as a substance in its own right, since it can exist independently from the existence of the actual human being. In this respect, the notion of substantial form applied to the human rational soul should be taken to mean just 'substance' (i.e. a self-standing

²³Sturm explicitly quotes Boyle's *Origin of Forms and Qualities* in support of his claim that forms are modes of matter and consist of mechanical arrangements of corpuscles (*PE* I.87–88). See, e.g. Robert Boyle, *The Works of Robert Boyle*, 5:324. This view can be traced back to Bacon (*Novum Organum*, I I.1–10). However, recent scholarship acknowledges that Boyle introduced a number of active principles and maintained the idea that finite mechanical forms are causally active (at least to some extent). See, e.g. Antonio Clericuzio, "Gassendi, Charleton and Boyle"; Peter Anstey, "Boyle on seminal principles"; and Sangiacomo, *L'essenza del Corpo*, 327–69. A similar orientation can also lead to an eliminativist approach to forms in natural philosophy. See, e.g. the case of Kenelm Digby discussed by Han Thomas Adriaenssen and Sander de Boer, "Between Atoms and Forms."

independent being). This entails that the rational soul is not the form of the body, but simply a different, independent substance that is united with the body itself. Hence (pace Suárez), the case of the human rational soul cannot be used as a model to conceptualize substantial forms in other (non-human) natural beings.

This argument leads to the third option of the trilemma. Sturm acknowledges that several scholastic authors were unwilling to consider the substantial forms of inanimate beings and non-human animals to be of the same kind as the human rational soul (*PE* I.78). At the same time, however, they were also unwilling to consider these substantial forms as purely material. For this reason, Sturm comments that scholastics “invented (without examples and without reason) some middle between the genus of bodily substances and that of spiritual substances” (*PE* I.78).

In order to defend this third option, a scholastic may insist that a substantial form, properly speaking, is not a complete substance but a part of an individual substance that, together with matter, constitutes the individual.²⁴ However, this reply does not escape Sturm’s trilemma. If a substantial form is a part of an individual substance, which is also material, then it should be spelled out whether this part is itself a substantial part that can exist and be conceived in itself or if it is an accident or a mode of the material substratum. If the substantial form is a part in the sense of being nothing but a mode or accident of matter itself, then the scholastic is back to Sturm’s first option. If the substantial form is a part that is in itself a genuine substance in its own right, then the scholastic is faced with the second option just discussed. If, finally, the scholastic wants to maintain that the form is neither a mode of matter, nor a self-standing spiritual substance, then she has to posit that the substantial form is somehow neither fully material nor fully spiritual. In reply to this move, Sturm will show that this alleged “middle genus” does not allow the scholastic to avoid the conclusion that forms, rightly understood, must belong to the category of relatives and not to that of substances, and since they are forms of matter, they must be material as well.

Sturm’s argument against this third option of the trilemma runs as follows. If one defines (as scholastics usually do) a substantial form in terms of the role that the form plays in explaining and accounting for the nature of composite beings, then what is called a ‘substantial form’ cannot belong to the ontological category of a substance, but only to the category of relatives or relational things. As mentioned in the above quote, Sturm stresses that “the entire nature of a form generally and essentially consists of a relation” (*PE* I.94). He then continues:

It will be allowed simply to deny that, in general, indiscriminately all substantial forms (especially those that constitute the substance or essence of their composite and the difference from other things), are said to be substances, namely, absolute entities that exist per se [*entitates absolutas ac per se subsistentes*]. On the contrary, one will acknowledge that all forms are material, and they are evidently various modes or accidents [*modos aut accidentia*] of matter. These modes (whether on their own or in combination, now many, now few) make it the case that a certain peculiar operation is executed or that the function distinct and proper to this or that composite is

²⁴This position can be supported, for instance, by relying on Suárez’s own definition of substantial form as “an incomplete substance” (*DM* I.5.5./KR 77).

performed. In this way, they distinguish the various genera and species of bodies. (PE I.96)

Against the third option of the trilemma, Sturm maintains that forms cannot be conceived of or exist independently from the being that they inform. Natural forms cannot be understood as a kind of substance or being intermediate between material and spiritual substances, because forms are not substances in the first place. Since natural forms are relational beings they cannot be substances, and thus the very idea of a substantial form is a chimera, a category mistake. Against the second option of the trilemma, Sturm argues that forms that scholastic authors improperly called 'substantial forms' cannot be understood on the basis of the model provided by the human rational soul either. The rational soul is just a spiritual, separate, and independent substance in its own right, and not a form. The only viable option left is thus the one defended by Sturm himself.

Remarkably, Sturm stresses that this understanding of forms as nothing but what specifies the particular being of natural entities lies at the root of the scholastic account itself. As he writes:

By the name 'form,' some understand that in virtue of whose existence the informed being also exists and it is prepared to absolve its ordinary functions and attend to its own complete faculties; or, in the common adages current in the schools, taken simply and understood without special restrictions: *the form gives being to the thing* [Forma dat esse rei]; *the form gives the operation; posited the form the informed being is also posited, and vice versa posited the informed being the form is also necessarily posited* etc. (PE I.94)

Sturm accepts the scholastic understanding of forms as the principle that specifies and accounts for the particular features of different natural beings. By relying on this agreement, however, Sturm is going to break any connection between this account of forms and the scholastic way of grounding efficient causal powers in forms themselves. The natural forms that scholastics improperly called 'substantial forms' must be understood as modes of material substances. Since matter is causally passive, and since forms inherit the causal passivity of their substratum, forms are thus causally passive as well.

2.3. *Ruling out Finite Causal Efficacy*

If matter and forms are passive, Sturm must offer an alternative account for the origin of causal activity in nature. Sturm concludes that God himself is the only real causal agent:

In the same way in which the matter of all bodies (both natural and artificial) has only a simple and general aptitude for motion or mobility, so too all the forms of matter have only a specific mobility, that is, an aptitude for such and such motion. It is thus necessary to suppose the existence of some truly active principle that, on the one hand, is able to actualize everywhere the mobility of matter; and thus vindicate that, on the other hand, all the effects that follow from this mobility and that flow from a body into another (which have been unduly ascribed until now to the bodies themselves) follow from that efficacy only, as the true and unique efficacious and ruling principle. And this is particularly true if one considers that both the origin of all forms and their various production and conservation depend on nothing else than on this unique efficacious power. (PE I.117–118)

Sturm concludes that God is the only true agent operating in nature, while natural bodies are merely passive. In order to secure this conclusion, however, Sturm rules out two rival options for explaining natural phenomena: (1) a manifold of finite spiritual principles (granted that they are understood as completely immaterial substances, rather than as scholastic-like substantial forms) rule natural phenomena; and (2) a unified spiritual principle or world soul rule natural phenomena.²⁵

Sturm's strategy for ruling out these options consists of both metaphysical and empirical arguments. Sturm's metaphysical argument aims to demonstrate that it is impossible for any finite being (either corporeal or spiritual) to be the cause of motion (which in turn underpins all natural phenomena). The argument runs as follows (*PE* I.161). Sturm takes as already proved that matter does not exist by itself (*PE* I.66), but must be created by an immaterial being, namely, by an infinitely powerful spiritual substance. The existence of matter endures for an infinite amount of moments of time, both in the past and in the future. Motion is nothing but a mode of matter, and its existence too, thus, extends for an infinite manifold of different moments of time. This point presupposes that time, like space, is infinitely divisible, and thus even a motion that endures only for a finite duration can be in fact conceived as traversing an infinite amount of moments of time that are comprised within that duration.²⁶ Since existing or doing something for infinitely many moments of time entails infinitely more being than existing or doing something for only one moment, it follows that only an infinitely powerful cause can bring about motion (and matter). On the basis of this consideration, Sturm concludes:

The efficient or (if you prefer) exigent [*exigentem*] cause of local motion is God's will, which is absolutely free and infinitely powerful. Local motion cannot be produced by a power smaller than that . . . nor can any body, since it is completely devoid of will, or any finite mind, since its will and efficacy is equally finite (nay, as it will be shown later, experience shows that is incredibly powerless), move anything or produce motion in any body, nor could it thus be capable of receiving any faculty for motion. (*PE* I.161–62)

In Sturm's argument, the infinite disproportion between finite and infinite powers plays the pivotal role in demonstrating that only God can be the real and sole cause of motion in nature. Since only an infinite power can produce existence and motion (because of their extension over an infinite manifold of moments of time), only God can be their real cause.

Nonetheless, a defender of the scholastic approach might still object that God could concur with the operations of finite beings, namely, by supporting them into existence and simultaneously granting them some limited (although real)

²⁵Cambridge Platonists may be an example. See, e.g. David Cuning "Systematic Divergences"; and Jasper Reid, *The Metaphysics of Henry More*, 313–48.

²⁶In Cartesian physics it is controversial to establish whether time is continuous and infinitely divisible or composed of atomic parts (see J. E. K. Secada, "Descartes on Time," and Garber, *Descartes's Metaphysical Physics*, 266–73; both argue that Descartes was not committed to a definitive view on this issue). Spinoza, however, in his commentary on Descartes's *Principles*, explicitly argues in favor of the infinite divisibility of time and rejects the idea that time is made of temporal atoms. On this point, see Sangiacomo, *L'essenza del Corpo*, 246–48.

causal powers. Sturm's reply consists in showing that God does not have anything with which to concur (*PE* I.167). Sturm has already shown that material beings, qua material, are deprived of active powers. Since forms are nothing but modes of matter, they are as passive as matter. The only doubt that might remain concerns the possibility of spiritual active substances, which might still offer a limited domain in which the traditional scholastic account of God's concurrence could remain a viable solution. However, Sturm contends that finite minds are unable to actively produce motion in bodies. Several considerations that Sturm adds to his discussion support this latter point.

From an empirical point of view, the most direct evidence for admitting finite, immaterial active principles in nature comes from living beings, which seem to be capable of moving themselves (*PE* I.170). Sturm replies to this point by arguing that the alleged immaterial principle that is supposed to explain animal motions has never been fully clarified. What Aristotelians call 'sensitive animal soul' has been accounted for by seventeenth-century authors in terms of animal spirits in completely mechanical terms (*PE* I.232–33). Moreover, if one accepts that animal spirits are material, then obviously they cannot be the cause of motion by themselves, since no material body can be such a cause (as already proved).

Sturm's treatment of the case of the human rational soul further supports this point. Sturm grants that the human rational soul can cause immanent effects within itself, such as volitions and desires (*PE* I.172). However, he denies that the soul can directly cause changes in the human body because it lacks the relevant knowledge of the human anatomy that would be required for the mind to actually and effectively direct the body and the animal spirits. As Sturm states, the human mind is "completely ignorant of how, what for, and in what ways this happens" (*PE* I.173).²⁷ If the human rational soul does not know how to move the human body (and thus cannot cause its motion), it seems plausible to infer a fortiori that any inferior and less perfect soul would be even less capable of accounting for natural phenomena.²⁸ In this discussion, Sturm explicitly endorses Cordemoy and Malebranche's arguments in support of the causal inefficacy of the human mind in producing effects on the human body (*PE* I.136–38, 173).

Sturm also dismisses the idea that God directs everything in nature by means of intermediary immaterial agents that act as God's vicars but that are nonetheless deprived of proper cognition and intelligence (*PE* I.182). According to Sturm, this hypothesis is implausible. The hypothesis aims to prevent God from operating in every occurrence of natural effects and thus being directly involved with the operations of brute things. However, Sturm points out that it is hard to understand how an immaterial being devoid of cognition could ever succeed in governing and directing material functions and processes according to God's laws (*PE* I.182). By postulating the operation of immaterial but unintelligent beings, the hypothesis

²⁷"Quomodo fiant, et quorsum, quibusve viis fiant penitus ignara."

²⁸One may find it problematic to accept that knowledge is required for proper causation. However, this knowledge condition was taken extremely seriously in the early modern context. Emanuela Scribano, "Quod nescis," reconstructs how the knowledge condition is rooted in the Galenic tradition; Scribano, "Connaissance et causalité," shows its widespread acceptance in the sixteenth-century medical tradition. For the role of this argument in Malebranche, see Sangiacomo, "Malebranche's Arguments."

(defended by Cambridge Platonists²⁹) seems in fact redundant and unhelpful to genuinely account for natural phenomena and their regularity.

Forms are merely passive modes of matter. Substantial forms do not exist. Immaterial beings are causally inefficacious on bodies. Sturm thus arrives by elimination at the conclusion that God and only God is the true genuine cause operating in nature. This leads Sturm to embrace an occasionalist metaphysics of causation.

3. STURM'S OCCASIONALISM

According to Sturm, God is the “requiring cause” (*causam exigentem* [PE I.161]) of natural phenomena. This means that when God *wants* something to happen then the effect obtains. However, Sturm also maintains that God's will does not operate in nature through its “absolute power” (*potentia absoluta*) but rather by following what Sturm calls “respective or hypothetical power”:

Here I established that God acts and operates in the whole of nature, not on the basis of his absolute power [*absolutam potentiam*] (which obtains whatever he wants without hindrances and in the most perfect way), but on the basis of a respective and hypothetical power [*potentiam respectivam et hypotheticam*], whose exercise God himself has (in the freest way) subordinated to certain conditions of matter or of the human mind. (PE I.178)

God did not establish to elicit effects absolutely by his mere act of free will. Rather, God freely subordinated his own actions to the obtainment of certain specific conditions, namely, certain states of natural beings or of human minds. Sturm does not extensively use the Malebranchian terminology of occasional causes, but he does equate occasional causes with *sine quibus non* causes.³⁰ A *sine qua non* cause is a (counterfactually) necessary condition for the production of a certain effect,³¹ although the *sine qua non* cause does not truly contribute to the production of that effect in virtue of any intrinsic active power.³² Sturm's account of God's hypothetical power entails that all natural forms are *sine quibus non* conditions for the production of natural effects, in the sense that God (freely) established to bring about certain effects as consequences of certain modifications (i.e. forms) of matter. Since (what Malebranche calls) ‘occasional causes’ can be understood in terms of *sine qua non* causation, and since Sturm maintains that all natural forms work as *sine quibus non* causes of natural effects, it seems safe to conclude that Sturm supports a version of occasionalism. However, Sturm does not reach his occasionalist conclusion by building on the same argumentative strategy used by other Cartesian occasionalists (Malebranche included).

²⁹See Cunning, “Systematic Divergences”; and Reid, *The Metaphysics of Henry More*, 313–48.

³⁰PE I.117: “causae sine qua non, ut Scholae loquuntur, vel occasionalis nomen mereri.”

³¹In this context, I use the terms ‘cause’ and ‘condition’ interchangeably.

³²In scholastic debates, *sine quibus non* causes work as what Malebranche calls ‘occasional causes.’ Concerning Gabriel Biel's account, for instance, see Dominik Perler and Ulrich Rudolph, *Occasionalism*, 189–201. Concerning the use of *sine qua non* causation as a model to understand early modern occasional causation, see Sangiacomo, “*Sine Qua Non* Causation.”

3.1. *Sturm's Strategy to Establish Occasionalism*

The authors usually associated with early modern occasionalism are Arnold Geulincx, Louis de la Forge, Géraud de Cordemoy, and Nicolas Malebranche.³³ Each of these authors uses rather distinct strategies to support somewhat different versions of occasionalism. Remarkably, Sturm does not seem to significantly rely on any of these arguments to support his own view.

According to La Forge, a key argument for supporting occasionalism (in the domain of body-body causation) is the claim that bodies cannot transfer motion from one to another. La Forge does not seem willing to endorse a form of full-blown occasionalism that would extend to minds as well. Unlike La Forge, Sturm does not exploit the non-transfer argument, and he accepts full-blown occasionalism.³⁴

Cordemoy's way to establish occasionalism builds on the idea that the force of motion cannot be intrinsic to bodies themselves but must come from a spiritual substance. Cordemoy demonstrates that finite minds do not have the power to move the body, and thus concludes that only an infinite and omnipotent spiritual substance (i.e. God) can be the real cause of motions in nature (Cordemoy, *Six Discourses*, 93–101). The discussion of the communication of motion among bodies takes a central place in Cordemoy's argument. Like La Forge, Cordemoy eagerly shows that bodies may seem to communicate motion, but they actually cannot. Cordemoy advances several arguments against the possibility for bodies to communicate motion (*Six Discourses*, 95–97). By ruling out the communication of motion, and by arguing that finite minds do not have proper causal efficacy on bodies, Cordemoy concludes that only the infinite agent (i.e. God) that originally created motion is still conserving and redistributing it in nature. Sturm mentions Cordemoy several times.³⁵ As already pointed out, Sturm explicitly endorses Cordemoy's arguments about the causal inefficacy of finite minds when it comes to mind-body causation (*PE* I.173). However, Sturm's overall discussion of his occasionalist metaphysics of causation does not rely on any in-depth discussion of the issue of the communication of motion among bodies, which is at the core of Cordemoy's argumentation.

Geulincx bases his occasionalism on the principle that only if an agent knows how to produce an effect, then that agent can be the cause of that effect. Malebranche echoes the same argument in the *Search after Truth* (OC II.315/LO 449–50). Sturm briefly mentions this argument in his discussion of the causal inefficacy of minds (*PE* I.173). However, in Sturm's discussion, Geulincx's argument plays only a peripheral role in ruling out the possibility that finite

³³See, e.g. Bardout, "Occasionalism"; Nadler, *Occasionalism*; and Schmaltz, *Early Modern Cartesianisms*, 165–227.

³⁴Sturm makes a passing reference to the non-transfer argument in *PE* I.141. However, this reference is a quote taken from Jean-Baptiste Du Hamel (1624–1706) and not attributed to La Forge. Sturm does not explicitly discuss La Forge's view in his treatment of occasionalism (*PE* I.122–96).

³⁵In the first volume of the *PE* (*Liber Primus, Pars Generalis, Sectio Prima*), Sturm discusses Cordemoy in several places concerning (i) atomism (*PE* I.36 and 85), (ii) Cordemoy's arguments for occasionalism (*PE* I.136–37 and 173), (iii) Cordemoy's claim that all changes in nature have to be accounted for in terms of motion (*PE* I.151), and (iv) the fact that the talk about 'real causes' may be maintained in the usual way of speaking (*PE* I.165). Concerning La Forge's use of the non-transfer argument, see Sangiacomo, "Louis de La Forge."

minds can be the cause of bodily motions. Moreover, Sturm never refers directly to Geulincx himself. Arguably, he was acquainted with Geulincx's argument via Malebranche's use of it.

Malebranche exploits two further arguments to support his occasionalist conclusion, namely, the 'no necessary connection' argument and the 'conservation is but constant creation' argument. I do not have the space here to present the details of how these two arguments work and how they are related to each other.³⁶ It is noteworthy that Sturm's strategy does not rely on either of them. In his presentation of Malebranche's position, Sturm summarizes Malebranche's argument as they are presented in the *Search after Truth* and in the fifteenth *Elucidation*. Sturm explicitly mentions Malebranche's 'no necessary connection' argument (PE I.138); however, Sturm does not exploit this argument any further in the development of his own position.

Concerning Malebranche's 'conservation is but constant creation' argument, Sturm refers to God's creative act and to the need of appealing to an infinite power in order to account for the diachronic existence of matter and motion (PE I.161). However, Sturm's argument does not build on the idea that conservation in existence is nothing but constant creation, which is the pivotal point of Malebranche's own argument. Rather, Sturm insists on the fact that only an infinitely powerful spiritual substance can have the force of creating and sustaining matter into existence in an infinite number of instants of time. The key to Sturm's argument seems to be the infinite moments of time in which matter exists require an infinitely powerful cause to sustain matter's existence.³⁷

By comparing Sturm's position with that of other Cartesian occasionalists, Sturm's occasionalism appears as a consequence of his discussion of the nature of material forms and their passivity. The passivity of matter is a widely spread trope in seventeenth-century natural philosophy.³⁸ All the Cartesian occasionalists I mentioned subscribe to it. However, subscribing to the passivity of matter does not commit one to embracing occasionalism. God may have decided, for instance, to endow matter with active powers, he may have created all sorts of active principles, or he may have allowed finite non-material substances to act on matter. This is why all Cartesian occasionalists have to rule out that (i) bodies have any force of communicating motion among themselves (and thus mechanically act on each other with real causal efficiency, even if they are not intrinsically endowed with motion); and that (ii) there may be intermediary principles that mediate between natural beings and God's direct intervention in nature.

Sturm's account of passive forms addresses both these points. As I argued in the previous section, Sturm insists on the fact that since matter cannot exist by itself but must be created by God, matter is completely devoid of any causal efficacy or power (PE I.66). Moreover, since matter is passive and forms are modes of matter, forms are passive as well. Sturm thus holds a strict dualism between the complete

³⁶On this point, see Sangiacomo, "Malebranche's Arguments."

³⁷Malebranche exploits the 'conservation is but continuous creation' argument especially in his *Christian and Metaphysical Meditations* (1683) and in the *Dialogues on Metaphysics and Religion* (1688). However, Sturm does not mention either of these works in his discussion of Malebranche's view.

³⁸John W. Yolton, *Thinking Matter*, 90–106.

passivity of matter and forms, on the one hand, and the full activity and agency of God's immaterial substance, on the other hand (*PEI* 67). Since Sturm's account of passive forms also entails (as I argued in section 2) that there are no finite immaterial beings that may also be causally efficacious in affecting bodies, only God is left as the sole genuine cause of all natural phenomena.

In this way, Sturm remarkably brings to the extreme (occasionalist) consequences the widespread and almost trivial claim about the passivity of matter, on which both occasionalist and non-occasionalist agree. It is on this shared ground that Sturm advances his own eclectic version of occasionalism, without essentially relying on the more specific and sometimes idiosyncratic arguments used by other Cartesian occasionalists.

3.2. *Forms versus the Laws of Nature*

Sturm not only builds his case for occasionalism by taking a rather different strategy than that defended by other Cartesian occasionalists, but his version of occasionalism looks also distinctively different from Malebranche's when it comes to the role that the laws of nature play in Sturm's natural philosophy. To illustrate this point, I shall introduce one of the objections that Leibniz addresses to Sturm in his *De Ipsa Natura*. I argue that, while the objection may work against Malebranche, Sturm's own account is actually immune from it.

Leibniz's criticism runs as follows:

[Sturm] grants . . . that the motions now existing happen *by virtue of the eternal law* God once set up, a law he then calls a volition and command. He also grants that there is no need for a new divine command, a new volition, not to speak of a new effort [*conatus*], or for any other labors. . . . But yet, it certainly seems to me that this explanation is insufficient. For, I ask, has that volition or command, or, if you prefer, divine law that was once laid down, bestowed a mere extrinsic denomination, as it were, on things? Or, on the other hand, has it conferred some kind of enduring impression produced in the thing itself, that is, . . . has it conferred an inherent law [*lex insita*] . . . from which both actions and passions follow? The first seems to be the doctrine of the inventors of the system of occasional causes, principally that of that very acute Malebranche, while the latter is the received view, and, as I judge, the one that contains the most truth. For, since that past command does not now exist, it cannot now bring anything about unless it left behind some subsistent effect at the time, an effect which even now endures and is now at work. (G IV.506–07/AG 158)

Leibniz had his own interpretation of how Malebranche's account of the laws of nature works. According to Leibniz, Malebranche held the view that God has to constantly intervene in nature and the laws of nature do not actually leave any trace upon the nature of finite creatures. Despite being subject of some controversy among both early modern and today's readers,³⁹ Leibniz's interpretation captures an important point of Malebranche's account, namely, the ontological, causal, and explanatory priority that the laws of nature have over the nature of finite things.

³⁹See, e.g. Malebranche's *Treatise on Nature and Grace* (OC v.28), *Meditations* (OC x.48–55), and *Dialogues* (OC xii–xiii.164). The details of Malebranche's account are a matter of some scholarly controversy. Cf. Nadler, "Occasionalism and the General Will"; Schmaltz, "From Causes to Laws"; and Nicolas Jolley, *Causality and Mind*, 92–104.

According to Malebranche, the laws of nature (understood as God's volitions) account for the reason why certain occasional causes are connected with certain effects. Finite creatures are connected with the production of certain effects only in virtue of God's laws. This connection is entirely dependent on God's volition and completely independent from the actual nature of the creatures. Consider, for instance, Malebranche's controversy with Fontenelle.⁴⁰ Fontenelle objects to Malebranche that if bodies are extended, then the properties of extension (such as impenetrability) should play some role in accounting for natural phenomena, and thus natural causes must be somehow more robust than merely occasional causes. In replying to Fontenelle, Malebranche fiercely maintains that extension can have any role in physical effects *only* in virtue of God's own laws (OC xii–xiii.163–64). This entails that whatever properties natural beings may have, they do not entail any direct causal efficacy, nor do they play any direct role in accounting for natural phenomena. Whether, and to what extent, any of these properties become relevant for explaining natural phenomena depends entirely on God's establishment of certain laws of nature. In this respect, Leibniz is right to maintain that Malebranche's account of laws is such that the laws of nature do not leave any trace in the nature of things themselves, in the sense that they will never become "inherent laws."

However, pace Leibniz's attempt to conflate Sturm's position with that of Malebranche, the difference between Sturm and Malebranche's accounts is twofold. First, the laws of nature play a relatively limited role in Sturm's natural philosophy and in his explanation of particular phenomena. Second, this marginalization of the role of the laws of nature is germane with Sturm's defense of a more robust explanatory role of natural passive forms.

Sturm enunciates only two very general laws, one concerning the communication of motion and the other concerning the mind-body union (*PE* I.858–59). With regard to the law of motion, Sturm writes:

Only God's will is the supremely efficacious power which is truly active, which moves without being moved, and most properly speaking moves one body through another, and moves this whole corporeal world and its parts one through the other. In this way, all the natural effects that happen in all things, and even in the more remote corner of the universe, are brought about only by the immediacy of God's power. These effects are produced namely on the basis of this absolutely universal law, revealed once and for all (not by God himself, but deduced from a careful observation and comparison of phenomena themselves): *that, whenever a part of matter (or a body) transfer the impetus received by the Supreme Mover in another part of matter (or body), this second part (or body) too begins to move, and surely more or less in proportion to the impetus and magnitude of the impacting body, in such a way that the motion that is lost by the impacting body is received by the body in which it impacts.* This law amounts to say that the same quantity of motion in the whole of the universe is constantly conserved, although distributed in different ways in different times. (*PE* I.164)

This law of conservation of motion is not supposed to explain what specific features different specific bodies can have, nor does Sturm ever suggest (pace Malebranche) that the variety of finite things could follow from a consideration of this (or any

⁴⁰For a detailed reconstruction of this controversy, see Schmaltz, "Occasionalism and Mechanism."

other) law alone. Rather, the law of the conservation of the quantity of motion simply enunciates a general constraint that affects every natural phenomenon (namely, the fact that motion cannot be dissipated during impacts but must be always conserved in the whole of the universe).⁴¹ Notably, Sturm also mentions that this law is not deduced a priori from purely metaphysical considerations (such as in the case of Descartes's deduction of conservation from the nature of God's immutability), but rather only a posteriori on the basis of empirical observations.⁴² As an empirical regularity derived from experience, Sturm's conservation law does not have the same strong metaphysical connotations of Malebranche's laws of nature (which are grounded in a consideration of God's attributes of simplicity and wisdom), nor does it play any significant role in the explanation of particular phenomena.

In his objection, Leibniz is unsatisfied with this account, and asks, "has that volition or command, or, if you prefer, divine law that was once laid down, bestowed a mere extrinsic denomination, as it were, on things?" (G IV.506–07/AG 158). To this question, Sturm's considered reply is twofold. If one considers God's *absolute* power, then the answer is 'yes,' since God (in virtue of his absolute power) is not bound by anything and, in principle, he could change his volitions (and thus the laws of nature) at any moment. This entails that from the point of view of God's absolute power, the laws of nature and the causal connections observed among creatures remain contingent and extrinsic with respect to the nature of creatures. However, natural philosophy is not concerned with God's absolute power, but rather with the ordinary course of nature (i.e. with God's *potentia ordinata*). As I discussed at the beginning of section 3, Sturm maintains that "God acts and operates in the whole of nature, not on the basis of his absolute power . . . but on the basis of a respective and hypothetical power, whose exercise God himself has (in the freest way) subordinated to certain conditions of matter or of the human mind" (PE I.178). This means that Sturm would grant to Leibniz that God's laws (insofar as they are considered from the point of view of God's *potentia ordinata*) do leave a trace in the nature of finite creatures. This trace is the fact that the specific mechanical arrangement of parts of a certain passive natural form is the *sine qua non* condition for the production of certain specific effects.

In his objection, Leibniz contrasts Malebranche's position with "the received view, and, as I judge, the one that contains the most truth" (G IV.506–07/AG 158). Arguably, this "received view" is the scholastic account of substantial forms, which Leibniz revives and reworks in his own way. I will argue in the next section that Leibniz's approach to substantial forms fundamentally diverges from Sturm's concerning the issue of the activity of forms. However, for the sake of discussing the issue of the laws of nature, Leibniz's objection does not seem to capture Sturm's actual position. Sturm can, in fact, consistently maintain that (1) God does not have to constantly renew his laws or volitions in order to keep the course of nature

⁴¹Leibniz objects to Sturm that in nature it is not the quantity of motion that is conserved, but the quantity of the active force. See *De Ipsa Natura*, AG 157.

⁴²Concerning Descartes's account of the laws of nature and its scholastic context, see Hattab, "Early Modern Roots." For a comparison between Descartes and Malebranche's accounts of the laws of nature, see Schmaltz, "From Causes to Laws."

on track, and (2) God's volition of establishing certain causal connections does leave a trace in the nature of finite things and, in fact, remains engrained in them in the ordinary course of nature.

If one asks what is the ontological seat of the laws of nature, in Malebranche's account this seat is in God's own volitions. In Sturm's account, instead, the seat of the laws of nature are natural forms themselves, which ground (in virtue of God's own free decision to establish so) the regularity of the ordinary course of nature and the connection between (occasional) causes and their effects. Although Sturm does not extensively rely on general laws, one may say that every causal (occasional) connection between certain forms and certain effects plays the same function as general laws (i.e. establishes a regularity in nature). Moreover, like general laws, every occasional connection ultimately depends on God's volition to establish this connection. In this sense, Sturm's account remains relatively closer to the scholastic account than to Malebranche's, since natural forms fulfil the role of the laws of nature (with the important caveat that, for Sturm, forms are causally passive) without reducing all natural regularities to a few general laws.⁴³

While significantly downplaying the role of the laws of nature, Sturm defends the explanatory role of (passive, mechanical) forms in scientific explanations:

Indeed, after that it has generally been shown that it is the *infinite efficacy of God's will*, and the true and pure action of His power, that does and did everything; since it also appears that such efficacy does not operate in an absolute way but in a conditioned way (namely, as adapted to the various configurations of matter and material things, in such a way that the divine efficacy does not produce everything with an immediacy of suppositum [*immediatione suppositi*] but through various passive means), it is valuable for the research to henceforth enquire into every kind of effect and special cases . . . how does the most powerful mover use the conditions of matter, that is, what are those intermediary or secondary causes [*causae mediae sive secundae*] through which God wanted to produce this or that effect (which he could have also produced by using his absolute power only, without any means). (*PE* I.178–79)

In this quote, Sturm refers to finite forms and natural beings as "secondary causes." However, the discussion provided so far makes clear that he does not want to claim that forms and natural beings are secondary causes in the scholastic sense of being genuinely efficacious causes that concur with God. Rather, they are secondary causes insofar as they provide the specific conditions and kinds of effects that are directly linked with the production of specific phenomena. In other terms, forms are secondary causes in the sense that they provide a specific explanation (*ratio*) for a specific phenomenon, although they do not bring it about (i.e. although they are not the efficient *causa* of it).

To illustrate how Sturm's account of explanation works, consider how Sturm treats the case of gravity and arrives at the most plausible hypothesis (in his

⁴³Malebranche accepts a form of preformism, according to which highly complex individuals would be entirely formed since the first moment of creation and would simply grow in size at some point (see *Search* [OC I.80–9; OC II.343–44]; *Dialogues* [OC XII–XIII.250–67]). This view places conceptual pressure on Malebranche's own claim in the *Treatise on Nature and Grace*, according to which laws of nature are the simplest and most fecund. If the most complex bodies do not directly follow from these laws, it seems that the laws of nature are insufficient to account for the most complex phenomena in nature. On Malebranche's preformism, see Jaques Roger, *Les Sciences*; François Duchesneau, *Les modèles*, 231–36; and Andrew Pyle, "Malebranche on Animal Generation."

reconstruction) to explain its cause. At the beginning of the second volume of the *Physica Electiva*, Sturm presents a catalogue of hypotheses that both scholastic and modern seventeenth-century authors have used to explain the cause of gravity, which seems to be a property of all material bodies (*PE* II.42–60). In a nutshell, Sturm endorses a version of the ether theory, according to which gravity would be the effect of the movement of a subtle matter (i.e. a fluid matter composed by the subtlest and agitated corpuscles) whirlpooling around the earth and other celestial bodies (*PE* II.82–84). In a sense, thus, Sturm does locate the cause of gravity within the material world, but this is only with qualification, namely, insofar as one is looking for the mechanism that makes possible the effects and phenomena ascribed to gravity. As Sturm explains:

It is right and necessary to appeal to the active power of God when we investigate the first and simplest principles of the creation of nature. In fact, in these principles there was certainly no use of any bodily means or instrument, but God did everything immediately, both with an immediacy of power . . . and with an immediacy of suppositum [*tum immediatione virtutis . . . tum immediatione suppositum*]. At the same time, however, once nature has been created and organs and substances have been put in place, God still does everything immediately, in the sense that His power is the only active virtue; but no longer with an immediacy with respect to the supposita or the instrumental causes [*suppositorum sive instrumentalium causarum*], which are certainly said to act. However, they are acted upon by God's only true and active power, which uses them as a means of operating, while they remain purely passive. (*PE* II, 70)

The distinction between immediacy of power and immediacy of suppositum is a scholastic distinction used at least since Aquinas to account for the different ways in which God can be considered to act immediately in nature.⁴⁴ The immediacy of power refers to the source of causal power that is immediately linked to the production of the effect, while the immediacy of suppositum refers to the substance that is immediately linked with the production of the effect.

For present purposes, what is relevant is that once it has been accepted that God is the only source of power in nature (namely, that he always has immediacy of power), then the explanation of the cause of any phenomenon will no longer seek to find the seat of the relevant causal power necessary to bring about that phenomenon. In any phenomenon, the relevant causal power needed to bring it about is always God's power. This fundamental metaphysical fact is known a priori before the explanation of any particular phenomenon actually takes place. As a result, the scientific explanation of a particular phenomenon (such as the explanation of the cause of gravity) relies on the actual mechanism that might be considered to be responsible for the observed effects and explains its specificity (although it does not causally produce the phenomenon itself).⁴⁵

4. EXPLANATIONS WITHOUT CAUSAL ACTION

Sturm's account of passive forms breaks with the idea that explanatory principles in natural philosophy must also account for the active powers that bring phenomena

⁴⁴On this point see Sangiacomo, "From Secondary Causes" and "Neither with occasionalism."

⁴⁵Among early modern authors, Pierre-Sylvain Régis defended a similar position concerning the immediacy of both power and suppositum. See Sangiacomo, "From Secondary Causes."

about. In this sense, Sturm dismisses the idea that causal explanations must be based on active powers intrinsic in the natural agents themselves. According to Sturm, all phenomena are brought about by God himself. But God's power being equal, differences among phenomena depend on passive forms, which operate as *sine quibus non* conditions for their production. This means that the *explanandum* in natural phenomena is not the fact that something is brought about, but rather the specific characteristics of what is brought about. God's power explains that something (in general) is brought about, but only passive forms explain what is brought about in particular and how. The *explanandum* in natural phenomena is thus the specificity of the phenomenon at stake, and the *explanans* of this phenomenon are passive forms, which are a matter of empirical investigation.

Forms are nothing but mechanical structures. Sturm often repeats that natural forms can be understood analogously with artificial forms.⁴⁶ A human body and a clock differ only in their degree of complexity and sophistication, but not in the way in which they actually work. Both the human form and the form of the clock are nothing but modes in which a merely passive matter is shaped and arranged in such a way that it will produce certain effects rather than others.

By considering forms as merely passive modes in which matter is structured in different ways, Sturm preserves an important function that the notion of form played in scholastic accounts, namely, that of providing a principle for explaining the different effects and operations that characterize different natural beings. However, Sturm simultaneously erases any strong distinction between the domain of the natural and that of the artificial, namely, by denying that natural beings can be conceived of as having forms or internal active principles that would set them apart from artificial beings. In fact, Sturm presents the whole of nature as an immense and complex clockwork. Sturm grounds this analogy in his principle of scientific explanations: accounting for natural phenomena is nothing but accounting for their different features on the basis of their mechanical structure (as if every natural being were nothing other than a mechanical engine).

Sturm's endorsement of occasionalism provides the metaphysical backdrop for his account of explanations based on passive forms. Sturm can be rightly considered to be an occasionalist, since he agrees with the fundamental occasionalist claim that finite natural beings are deprived of powers, while God is the only agent operating in the natural world. Sturm's occasionalism encompasses both the realm of body-body causation and that of mind-body causation. However, Sturm supports this occasionalist metaphysics of causation in a rather different way than that followed by other Cartesian occasionalists. Sturm's strategy consists in bringing to the extreme (occasionalist) consequences the widespread and almost trivial idea that matter is purely passive. In this way, Sturm builds a case for occasionalism starting from a position that would most likely find transversal support among both late scholastic authors and *novatores*. The upshot of Sturm's discussion is an occasionalist natural philosophy in which passive forms still play a prominent role in accounting for natural phenomena (as they did in the scholastic framework), although they are deprived of any causal power and operate only as *sine quibus non*

⁴⁶See, e.g. PEI.71, 101–4, 106, 108, 110, and 180.

conditions or occasional causes for God's own intervention in nature. In this way, Sturm's occasionalism remains significantly close to the scholastic camp insofar as it takes forms as the principal *explanans* of natural phenomena while reserving a relatively small role (pace Malebranche) for the laws of nature.

The price that Sturm pays for preserving the explanatory role of forms in late seventeenth-century natural philosophy consists in abandoning the talk about active powers in finite natural beings. This is how Sturm attempts to bring (a revised version of) the scholastic notion of form out of the turmoil of the seventeenth century. Sturm's project recreates in a late seventeenth-century context (which was increasingly hostile to the scholastic conceptual apparatus) the conditions of survival for the pivotal notion of form that has been at the core of natural philosophy since Aristotle's own works.

Sturm's project is diametrically opposed to Leibniz's. Consider once more Leibniz's objections to Sturm in his *De Ipsa Natura*. At the core of Leibniz's criticisms is his commitment to the traditional scholastic view that the notions of substance and action are deeply interconnected:

To the extent that I have made the notion of action clear to myself, I believe that the widely received doctrine of philosophy, that *actions pertain to supposita*, follows from that notion and is grounded in it. Furthermore, I believe that we must grasp the fact that this also holds reciprocally, so that not only is it the case that everything that acts is an individual substance [*substantia singularis*], but also that every individual substance acts without interruption, including even body itself, in which one never finds absolute rest. (G IV.509/AG 160).

The commitment to the notion of action as the fundamental ground to think about the very nature of substances underpins Leibniz's main objections to Sturm's account of the passivity of forms. Leibniz cannot accept that any natural being could ever be adequately conceived or taken to have any ontological consistency without referring to some kind of activity. Activity is what (in Leibniz's endorsement of the traditional scholastic position) makes substances what they are. However, Sturm rejects precisely Leibniz's fundamental commitment to activity as the ontological ground of substances, and as a result, Sturm hardly offers Leibniz any answer that would be satisfying from the latter's point of view.

This fundamental disagreement between Sturm and Leibniz uncovers how different conceptual elements that were deeply connected in the late scholastic framework are pulled apart by late seventeenth-century authors. For the scholastics, natural forms are explanatory because they are active causal principles. For Sturm and Leibniz, instead, it is time to make a fundamental choice between the explanatory role of forms and their causal activity. Leibniz opts for saving the activity of forms, which leads to conceive of them as ultimately metaphysical non-material entities. Sturm takes the opposite route: he saves natural material forms as explanatory principles by dismissing the idea that the explanation of natural phenomena requires efficacious causal powers embedded in forms themselves.

One may object that retaining forms that are completely deprived of causal powers does not seem to be a very promising strategy, since forms without powers could hardly explain natural phenomena. However, this (Leibnizian) objection fails to appreciate Sturm's eclectic effort to combine the best of the two worlds

of scholastic and mechanical philosophy. In the scholastic framework, substantial forms do most of the explanatory work. From a seventeenth-century point of view, the problem with this account is that substantial forms end up offering almost ad hoc explanations for specific phenomena. The scholastic account lacks the generality sought by early modern authors such as Descartes, who found in matter and motion two general and universal principles capable of explaining the greatest number of natural phenomena (in fact, all of them) without appealing to a variety of different specific principles. However, this same generality of mechanical principles comes with a whole array of problems, such as that of individuating different bodies in a continuum of matter and motion and accounting for the most complex natural phenomena (such as biological beings).

The relevance of Sturm's position may be better appreciated by considering how the fate of substantial forms in the early modern period is often discussed in today's scholarship. Pasnau, for instance, provides the following synthetic picture:

Substantial forms explain a substance's unity and persistence, but they do so by playing a specific causal role within a substance, rather than by serving as an abstract metaphysical principle. The consequence of this approach is to open the door to corpuscularianism. For when substantial forms are so understood, the theory stands or falls with the alleged failure of any reductive account of the alleged causal role. If the physical phenomena associated with persistence and unity can be explained mechanistically, substantial forms become unnecessary. (*Metaphysical Themes*, 559)

Sturm's case offers an interesting counterexample to Pasnau's narrative.⁴⁷ Sturm maintains that, in a mechanist account of the natural world, forms do have a physical role to play, although it is not the role of being the source of efficient causal efficacy. Forms are rather responsible for specifying matter in various configurations, which operate as *sine quibus non* conditions for God's own efficacious power. In this sense, forms are not made "unnecessary" by a mechanist account of nature, but they are rather necessary in such an account to provide the specific circumstances and dispositions of matter that make it possible for particular effects rather than others to obtain in certain conditions.

Sturm's approach combines the strengths of both the scholastic and seventeenth-century mechanist approach in order to remedy their reciprocal shortcomings. Passive mechanical forms (as scholastic forms) are particular principles of explanation that can be used to account for different specific phenomena. At the same time, passive mechanical forms (as mechanical principles) are ontologically nothing but modes of matter shaped by motion. Passive forms are different among themselves but they are all ontologically shaped by the same universal principles, which make explanations based on passive mechanical forms homogenous and uniform (from a conceptual point of view) without making them too general and abstract.

In the late seventeenth-century context in which Sturm operates, the connection between forms and efficient causation appears extremely problematic. Sturm's discussion, however, shows that such a connection was in fact avoidable and was

⁴⁷Richardson, "Formal Causality," stresses that Pasnau's emphasis on the fact that substantial forms come to play a crucial role as efficient causes does not entail, at least in Suárez, that the role of substantial forms as proper formal causes is abandoned.

itself the product of a long scholastic debate. Sturm travels back the scholastic path that ended up making forms inextricably entrenched in their active efficient causal powers. He recovers a deeper layer in the notion of form, understood as the principle of specificity and singularity of individuals (i.e. the reason why something is that kind of thing rather than something else). At this more fundamental level, the notion of form was at a conceptual crossroad. Scholastics took the path of establishing a strong connection between forms, causal activity, and efficient causality. Sturm takes the opposite path, by reserving proper causal activity to God alone and preserving forms as explanatory principles deprived of any efficacious intrinsic causal power. In doing so, Sturm does not deprive scholastic forms of their meaning, but rather challenges the idea that the scholastic view was in fact a homogenous and monolithic system. By deconstructing the notion of form, Sturm shows why the more fundamental layer of this notion can have a much better currency in the late seventeenth century than the more recent and elaborated late scholastic constructions.

Today, Sturm's thought is still largely unexplored and forgotten. Nonetheless, the thick volumes of his *Physica Electiva* and his numerous other publications may offer a new perspective to look at the tormented way in which the old and the new metaphysics of causation clashed and reshaped each other during the second half of the seventeenth century. Sturm himself presented his philosophical project as eclectic and ecumenical, namely, as able to make the best out of both worlds. An overly superficial glance at Sturm's position may lead us to relegate him to the obscure and dusty shelves on which unoriginal authors are confined. This paper aimed to show that, on the contrary, Sturm's work is more likely to be a precious and forgotten coffer, waiting for rediscovery.⁴⁸

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⁴⁸This paper is one of the outputs of my NWO Veni grant (275-20-051) *Occasionalism and the secularization of early modern science: Understanding the dismissal of divine action during the scientific revolution*, which ran at the Faculty of Philosophy at the University of Groningen (2015–2019). I would like to thank Han Thomas Adriaenssen, Brian Embry, Laura Georgescu, Helen Hattab, Christian Henkel, Sydney Penner, Martin Pickavé, Doina-Cristina Rusu, Tad Schmaltz, Tzuchien Tho, and Lukas Wolf for their helpful comments on previous versions of this paper.

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