Abstract

Spinoza, Explained

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Spinoza believes that everything has an explanation. He also is committed to the ideal of a unified science, which joins natural and speculative philosophy. That said, no thorough account of Spinozistic explanation exists. In the first part of my dissertation, I formulate such an account. I argue that for Spinoza, a scientific explanation is a causal narrative which links explanans and explanandum according to laws of nature, involves their essences, and situates the explanandum against some contrast class.

There is a major controversy in Spinoza scholarship over whether Spinoza endorses teleological explanations, with some (such as Don Garrett, Martin Lin, and Paul Hoffman) arguing that he does, and others (such as John Carriero and Jonathan Bennett) arguing that he does not. In the second part of my dissertation I give a novel argument that Spinoza does not think teleological explanations feature in a mature science. I argue that two important current readings, on which Spinoza does use teleological explanations, are in conflict with two of Spinoza's distinctive views – the *conatus* doctrine, according to which each individual thing strives to remain in existence, and Spinoza's views on action, according to which we are active exactly when our actions follow from our essence alone. I conclude by arguing that, for Spinoza, to the extent that we view ourselves as end-governed beings, we are less able to achieve the highest form of human happiness, blessedness.

In the third part of my dissertation, I engage two questions which arise from the analysis given in the first part. First, how, for Spinoza, do we come to know the essences of the explanans(tia) and explanandum(a)? I argue that he rejects the notion that essences are discoverable by experiment. I produce this account by a new reading of the Spinoza-Oldenburg-Boyle correspondence (which is, with some exceptions, not dealt with in de-

tail by the extant literature), and argue that Spinoza's epistemological views, and his views on the aim of science, militate against a science based on experiments.

Second, is the use of mathematical concepts in such explanations licit? Some recent scholarship (most notably represented by Alison Peterman and Eric Schliesser) argues that, for Spinoza, the use of mathematical concepts in the study of nature produces inadequate cognition. I argue that, while ordinary mathematical concepts may be inadequate, there is room in Spinoza's system for another kind of mathematical concept whose adequacy depends on having an entirely different causal history from the inadequate ones.

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Contents

Citation conventions

Unless otherwise specified in this section, all translations into English are my own.

All English quotations of Spinoza are from Spinoza (1985) and Spinoza (2016) unless otherwise specified. All Latin quotations are from Spinoza (1925) unless otherwise specified. I cite passages from *Treatise on the Emendation of the Intellect* as [section in TdIE]. I cite passages from the *Ethics* as E[part][preface/proposition/definition][scholium]. I cite passages from the *Theological-Political Treatise* as TTP.[chapter].[paragraph]. I cite passages from the rest of Spinoza's work as C.[Curley volume number].[page] / G.[volume of Spinoza (1925)].[page in Spinoza (1925)].

All English quotations of Descartes are from Descartes (1984a), Descartes (1984b), or Descartes (1991) unless otherwise specified. I cite passages from these as CSM [volume of Descartes (1984a), Descartes (1984b), Descartes (1991)].[pages in Descartes (1984a), Descartes (1984b), Descartes (1991)] / AT [volume in Descartes (1996)].[page number in Descartes (1996)]. I cite other passages from Descartes as [section/page in work] / AT [volume in Descartes (1996)].[page number in Descartes (1996)].

All English quotations from Leibniz are from Leibniz (1989) unless otherwise specified. I cite passages from Leibniz as AG.[page number in Leibniz (1989)] / G.[volume in Leibniz (1965)].[page in Leibniz (1965)], or [volume in Leibniz (1849-63)].[page in Leibniz (1849-63)].

I cite from de Fermat (1891-1896) as OF [volume in de Fermat (1891-1896)].[page in de Fermat (1891-1896)].

I cite from Hobbes (1839-1845) as EW [volume in Hobbes (1839-1845)].[page in Hobbes (1839-1845)].

All English quotations from Aquinas are from Aquinas (2006, 1956, 1947) unless otherwise specified. I cite passages from these as DPN [chapter].[paragraph], SCG [book].[chapter].[paragraph], and ST [part] [question] [article] respectively.

I cite from *Disputationes Metaphysicae* as DM [question].[section].[paragraph], from volumes 25 and 26 of Suarez (1856-1878). Though all translations are my own, I am indebted to Sydney Penner's excellent website.

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and for putting up with me in her philosophy of quantum mechanics course. I also want to thank Katherine Dunlop, who read early drafts of chapter 6, organized the UT Austin workshop on teleology in modern philosophy (February 2020), and introduced me to Isaac Barrow.

The intellectual community amongst the graduate students at Yale has been excellent. I worry that if I try to list off any in particular, I will leave off of the list someone who at one point gave exceedingly good feedback or advice. To avert this disaster, I will simply say: Thank you to everyone who was a graduate student in the philosophy department at Yale between 2017 and 2022. Y'all are awesome.

One person in particular should be thanked at this point: my mother. She inspired my love of learning early on, by responding, whenever I asked her a question to which she didn't know the answer, "why don't we go look it up!" That advice has served me very well indeed.

Finally, *SDG*.

Introduction

That Spinoza is a rationalist, in some sense of the word, is not, I think, significantly in doubt. (Just look at your typical early modern survey course!) The contours of his rationalism, as regards his views on, say, innate ideas or a priori knowledge, have been treated numerous times. In recent years, there has been a blossoming of scholarship pertaining to his supposed *explanatory* rationalism – that is, the role that the principle of sufficient reason plays in his thought.

It is the official position of this dissertation that Spinoza is *some* kind of explanatory rationalist. Its central goal is an analysis of Spinozistic explanation. Its guiding questions are these: what does such an explanation look like? What assumptions does it make? What account can Spinoza give of the essential components of such an explanation? And what kinds of explanations are legitimate according to his commitments? So far, these questions have been given scant attention in the literature. It is my goal to eliminate this lacuna.

The first part of the dissertation is devoted to an examination of the first question. In Chapter 1 I argue that, because he believes in the continuity of philosophy and science, Spinoza believes that all things have scientific explanations. I then go on to compare and contrast his view on scientific explanation against three contemporary views: the deductive-nomological account, van Fraassen's pragmatic account, and causal accounts.

In Chapter 2, I offer my official account of Spinozistic scientific explanations. I argue that these explanations take the following form: They are causal narratives which explain events against a contrast class of other events. They make reference to the essence both

of the things or events being explained and of its causes. Finally, it shows how each stage in the causal narrative follows from the next according to laws of nature. I conclude the chapter by comparing and contrasting Spinoza's account of scientific explanation with that of Descartes.

The second part of the dissertation is concerned with the question of whether teleological explanations play a legitimate role in a mature and worked-out science for Spinoza. In Chapter 3, I situate Spinoza's and Descartes' attack on final causation in what I think is an appropriate historical context. I argue that, rather than contextualizing their attacks against the background of earlier medieval Scholastic thinkers such as St. Thomas Aquinas, we should instead do so against the backdrop of later Scholastic thinkers (I use Francisco Suárez). I argue that, once placed in this context, we can come to a better understanding of why these two figures would think that an attack on the role of divine teleology in philosophy and physical science would suffice to defeat the use of teleology wholesale.

In Chapter 4, I take up the question of whether or not Spinoza can allow for teleological explanations in a mature science. I answer: No. There is a major controversy in Spinoza scholarship over whether Spinoza endorses teleological explanations, with some (such as Don Garrett, Martin Lin, and Paul Hoffman) arguing that he does, and others (such as John Carriero and Jonathan Bennett) arguing that he does not. I argue that two important current readings, on which Spinoza does use teleological explanations, are in conflict with two of Spinoza's distinctive views – the *conatus* doctrine, according to which each individual thing strives to remain in existence, and Spinoza's views on action, according to which we are active exactly when our actions follow from our essence alone. I conclude by arguing that, for Spinoza, to the extent that we view ourselves as end-governed beings, we are less able to achieve the highest form of human happiness, blessedness.

The third part of the dissertation comprises a sort of coda, in which I fill in the de-

tails of the accounts offered in the first two chapters. Chapter 5 takes up the question of how we come to know the essences of things. In this chapter, I intervene in a debate in Spinoza scholarship concerning the role of experience in Spinoza's epistemology, and argue that he rejects the notion that essences are discoverable by experiment or experience more generally. I produce this account by a new reading of the Spinoza-Oldenburg-Boyle correspondence (which is, with some exceptions, not dealt with in detail by the extant literature), and argue that Spinoza's epistemological views, and his views on the aim of science, militate against a science based on experiment or experience.

In Chapter 6 I defend the idea that cognition containing mathematical concepts can, for Spinoza, be adequate, and hence that explanations containing such concepts (and Spinoza does in fact offer such explanations) can result in adequate cognition. Some recent scholarship (most notably represented by Alison Peterman and Eric Schliesser) argues that, for Spinoza, the use of mathematical concepts in the study of nature produces inadequate cognition. In the fourth part of my dissertation, I show that this is not so. I argue that, while ordinary mathematical concepts may be inadequate, there is room in Spinoza's system for another kind of mathematical concept whose adequacy depends on having an entirely different causal history from the inadequate ones.

Throughout this dissertation, when I talk about thought and extension *qua* attributes of God, I'll do so using the typewriter font. So the divine attribute of extension, for instance, will be written as `Extension`, and ditto for the attribute of thought.

Chapter 1

What kind of explanation?

1.1 Setting the scene

Quentin Skinner coined the (perhaps not often used) turn of phrase "the mythology of doctrines". This takes many guises. "First," he writes, "there is the danger of converting some scattered or quite incidental remarks by a classic theorist into his 'doctrine' on one of the mandatory themes."[1] The temptation to do this is obvious and seductive. It is "set by the expectation that each classic writer...will be found to enunciate some doctrine on each of the topics regarded as constitutive of his subject."[2] So-and-so was a Great Mind, and hence must have had an opinion on the topic. The error here is easily discovered. Just ask yourself: Do I have a view, never mind a worked-out one, on every topic regarded as a live issue at my time? Or do the constraints of time and mental effort preclude this? And don't those constraints apply to Great Minds past and present?

So, one might hasten to ask: Why write this dissertation at all? That is, why think that Spinoza needs, or has, an account of explanation – scientific, metaphysical, or otherwise – at all? Isn't this mere anachronism? Am I not indulging in the mythology of doctrines?

I don't think so. Not only is this endeavor not anachronistic, it is vital to understanding Spinoza's enterprise. Or so I will argue. There are at least two reasons for this latter

1. Skinner (1969, 7)
2. Skinner (1969, 7)

position, which I will now present.

1.1.1 Explanatory Rationalism

Spinoza is typically classed amongst the rationalists, along with Descartes and Leibniz. Jonathan Bennett points out that "this can mean various things, of which at least three are true of Spinoza."[3] A rationalist, in the sense that Bennett is discussing, is concerned not with reason as a faculty (though as we will discuss, Spinoza is certainly interested in that), but with "the notion of a *reason for* a belief or a *reason why* something is the case."[4] Bennett explicitly mentions two of these aspects: explanatory rationalism and causal rationalism.

Explanatory rationalism, according to Bennett, is the doctrine that

> whatever is the case can be explained-that if P then there is a reason why P...It is the refusal to admit brute facts-ones which just are so, for no reason.[5]

It does not matter, in principle, what kind of entity P happens to be – thing, fact, state of affairs, state of a thing, what have you. It will have an explanation. Explanatory rationalism is effectively a statement of the Principle of Sufficient Reason (PSR); I will treat explanatory rationalism as equivalent to endorsement of the PSR. This doctrine which Spinoza and Leibniz certainly had in common, but which it seems that Descartes denied.

The reason for my attribution of the denial of the PSR comes mainly from Descartes' doctrine of the creation of the eternal truths.[6] The eternal truths are essential or conceptual truths, such as "2+2=4" and "there is no mountain without a valley". According to Descartes, God's creation of these truths is a free act of the will. Indeed, Descartes affirms that nothing can be true prior to God's willing it:

3. Bennett (1984, §8.1)
4. Bennett (1984, §8.1)
5. Bennett (1984, §8.2)
6. My account of this denial largely follows that of Lin and Melamed (2016, §4)

> I do understand, quite correctly, that there cannot be any class of entity that does not depend on God; I also understand that it would have been easy for God to ordain certain things such that we men cannot understand the possibility of their being otherwise than they are. (CSM II.294. / AT VII.436)

So according to Descartes, for any truth T, T is true exactly because God willed it to be true. So if the PSR is true, then it is true only by an antecedent instance of God willing it so. But if this is correct, then it seems that God's will cannot be constrained by the PSR. Otherwise, there would be some truth that is prior to God's act of willing that T be true. Hence, the PSR does not constrain God's will, and as a result, it is false in the unrestricted sense. Descartes can still adopt a restricted PSR, where it applies to all created things. But he cannot hold it in its classic formulation.

Causal rationalism is the doctrine that

> a cause relates to its effect as a premiss does to a conclusion which follows from it. When [Spinoza] speaks of 'the reason or cause why Nature acts' (4 Preface at 206/26), he thinks he is talking about one relation, not two.[7]

We should distinguish this from the doctrine that causes necessitate their effects, which I will call causal necessitarianism. While the causal rationalist believes that causes do, in fact, necessitate their effects, the causal necessitarian need not believe that the necessity involved is logical necessity (although some might). For instance, he might believe that the exertion of a causal power necessitates its effects with some sort of ceteris paribus conditions: Given the exertion of the causal power, and favorable conditions, the effect follows of metaphysical necessity.[8] Our chief concern at the moment is with causal rationalism.

7. Bennett (1984, §8.3)

8. Causal necessitarianism has been out of fashion since Hume, who famously held (in T.1.2-10) that there is no necessary connection between cause and effect (though it is not moribund; see Shoemaker (1998) for a somewhat contemporary defense). Since causal rationalism is a kind of causal necessitarianism, it follows that Hume's arguments, if successful, apply to causal rationalism as well.

Bennett is not alone in attributing this doctrine to Spinoza. Samuel Newlands, for instance, writes:

> In this passage [EIIIpref / G.II.138], Spinoza makes two important claims about explanation. First, everything can be understood or explained through "the laws and rules of Nature." This reminds us of Spinoza's general commitment to the explicability of all things, a view captured in his version of the Principle of Sufficient Reason (PSR): "For each thing,there must be assigned a cause or reason for its existence, if it exists, as well as for its non-existence, if it does not exist" (Ip11d).[9]

Yitzhak Melamed writes that "the PSR motivates many of the most important and intriguing doctrines of the Ethics (such as necessitarianism, the identity of indiscernibles, substance monism, and perhaps even the *conatus*)."[10] Martin Lin puts it as follows:

> Spinoza is a metaphysical rationalist. He believes that everything has an explanation. No aspect of the world is fundamentally unintelligible or incomprehensible. There is nothing brute. These claims each express what is often called the Principle of Sufficient Reason.[11]

An influential account of Spinoza's explanatory rationalism is given by Michael Della Rocca. According to him,

> Spinoza's commitment to intelligibility is extremely ambitious in at least two respects. First, he insists that each thing is intelligible, there are no facts impervious to explanation. Second, he holds that these explanations are—in principle—graspable by us. Our minds are, of course, limited in some ways; there are limits to how many things we can fully grasp...But this limitation is purely quantitative, not qualitative. While particular things may

9. Newlands (2018, 5)
10. Melamed (2013, xv)
11. Lin (2018, 133)

> elude our grasp because of our finite ability to keep many things clearly in mind, no thing is by its nature inaccessible to the human mind.[12]

Della Rocca claims that the entirety of Spinoza's philosophy can be seen as the working out of the consequences of the PSR. Specifically, he thinks that Spinoza's primary mode of philosophizing is what he calls a "twofold use of the PSR".[13] First, there is the simple application of the PSR to the study of nature. Second, there is the analysis of a particular phenomenon, such as causation or existence, as being "explained in terms of the notion of explanation itself."[14]

I have doubts about Della Rocca's method of interpreting Spinoza.[15] But in this he is surely right: Spinoza demands that "there must be, for each existing thing, a certain cause on account of which it exists."[16] And G. H. R. Parkinson points to Spinoza's "firm belief in the range of scientific explanation – a range that, in Spinoza's view, is in principle boundless."[17]

So his explanatory rationalism gives us at least one reason for demanding an account of explanation from Spinoza. Supposedly, everything in nature is explicable, intelligible, understandable. If that is true, then what does that explanation consist in? What is it to make a thing, or event, or fact, intelligible? What is it to have a proper understanding of it? This kind of question is perfectly legitimate when asked of someone with as strong a commitment to explanatory rationalism as Spinoza has.

12. Della Rocca (2008, 2)
13. Della Rocca (2008, 8–9)
14. Della Rocca (2008, 8)
15. For instance, he thinks that Spinoza holds to a PSR that is much stronger than the ones we find in the text: that all facts need explanations. But, as stated, the PSR that Spinoza employs simply says that existence facts require explanation. For an argument to this effect, see Lin (2019, 166–8); this supersedes Lin's earlier avowal of an unrestricted PSR.
16. EIp8s2
17. Parkinson (1977, 157)

1.1.2 Actual explanations

The second reason to think that Spinoza has some account of explanation in mind is the fact that he in fact offers explanations in his works. Specifically, he offers explanations of physical phenomena which he observes in experiments. Let me give a specific example.

This exmple comes from the correspondence with Robert Boyle (which I will address at length in a later chapter). There, Spinoza offers an explanation of a certain chemical phenomenon, the reconstitution of niter. He attempts to give a mechanical explanation of the events in question, and in doing so he cites the properties of bodies, the laws by which these bodies interact, and the nature of a chemical substance.

This gives us a picture of what Spinoza is up to. Specifically, it gives us an example of what he thinks scientific explanation consists in. At the very least, it involves the citation of properties of bodies, natures of bodies, and the laws governing them. I will examine the nature of each of these components in a later section, but right now I simply want to flag them as important elements.

From this, I draw the inference that Spinoza has *some* idea of what a scientific explanation should look like. It may be piecemeal. It may not be fully worked out. But there appears to be something behind the scenes which guides his account. Hence, it makes sense to ask what this background account is, or might look like.

One other issue arises here: the distinction between scientific and philosophical explanations. One might allege that I'm conflating the two. There's no reason, on the face of it, that we should expect them to be at all similar. But Spinoza does not, I think, see a sharp bifurcation between science and philosophy, as contemporary philosophers and scientists seem to. Concomitant to that is the fact that he does not see the method of science or of philosophizing as being as distinct as we like to think. As a result, the explanations that we give in the science should of the same sort as we give in philosophy.[18]

18. This is an approach that is, surprisingly, taken by some philosophers today. See for instance Wilsch (2016), who constructs a deductive-nomological account of metaphysical explanation, and Kovacs (2020), which defends a version of unificationism about metaphysics.

This is especially true in light of the fact that Spinoza, like Descartes, dreamed of what Edwin Curley calls a "unified science", the idea "that it is necessary, in a properly constructed philosophy, to proceed systematically, from metaphysical first principles, through an account of man and his place in nature, to a theory of the good for man."[19] Spinoza thinks that knowledge of things, be it scientific or philosophical, is knowledge of their causes and essences. Consequently, we should expect that to explain a phenomenon is to explain it through its causes whether the thing being explained falls within the realm of science or of philosophy.

1.2 Kinds of Explanation

Suppose we accept the idea that Spinoza needs an account of explanation (where this is construed as covering both scientific and philosophical varieties). We must then pass to the question of what kind of account this is.

Generically, an explanation is an answer to a certain kind of question. Why did a particular sports team win the championship? Because they scored more points, because their players were better, and so on. Why was the electron deflected when sent through a magnetic field? Because it had a certain spin, and quantum-mechanical laws dictate a certain sort of deflection in certain kinds of circumstances. There is nothing special about the type or domain of explanation at this level of generality. All we are doing is citing "reasons why".

But this is not very illuminating. We aren't just after an analysis of explanation as used in everyday language, and Spinoza definitely is not either. We are after the question of what makes a *good* *(philosophical or scientific) explanation. And to answer that question, we need to answer the question of the type of answers we should be giving to "why" questions.

To answer this question, I will be comparing Spinoza to some more contemporary ac-

19. Curley (1988, 4–5)

counts of scientific explanation: the deductive-nomological model, a pragmatic account, and a causal or ontic account.[20] I do this not because I think Spinoza will fit into any one of these molds; as we will see, it is likely he will not. Rather, I do so because the comparison can help us hone in on the specifics of his view. I am using them as a sounding board. By asking whether Spinoza would agree or disagree with the presuppositions of these accounts, or their form, I hope to converge on a better picture of just what his account is supposed to be.

In order to do this, it will be necessary to go into some detail about these accounts. This may strike the reader as somewhat tedious. And you got me – it is. But it's also necessary. If we're trying to understand what Spinoza's view might be by comparing it to contemporary views (as I think is a profitable strategy), we need to have an adequate understanding of those views. Consequently, it will pay to give attention to some of the nitty-gritty details. I will try to avoid unnecessary digressions into needlessly technical details, but some details are necessary.

Before we get started, I need to make a further point. Modern accounts of explanation have distinguished between an explanation as a certain kind of speech act, and an explanation as the product of that speech act. Achinstein (2010, Chapter 5) (borrowing from Achinstein (1985)), for instance, takes explanation to be a sort of illocutionary act which aims to produce certain effects in one's listeners. He goes on to give a number of necessary conditions for an act of explanation.

Here, I will not be concerned with the kind of speech act Spinoza thinks that explanation is. I do not think he had in mind any particular theory of interpersonal communication in stating his explanatory rationalism. Moreover, the kind of explanations that he requires are the kind that, plausibly, may only be grasped by the "infinite intellect" (EIp16), and hence not expressible by any human speech act. Instead, I will be focused

20. This will of necessity exclude other perfectly good accounts (e.g., Philip Kitcher's unificationist account; see Kitcher (1981)). This is not because I think these views defective, but rather because I think that the accounts I discuss provide better foils to Spinoza's views.

on what Spinoza thinks the *content* of a particular explanation should be, in an objective sense, as well as what worldly components correspond to the components of the explanation.[21]

1.2.1 The deductive-nomological account of explanation

One of the classic accounts of scientific explanation is the deductive-nomological account, elaborated in great detail in (among others) Hempel and Oppenheim (1948). I will now provide a summary of the relevant features of the account outlined therein.

Hempel and Oppenheim introduce a distinction between two components of an explanation: the *explanandum* (a sentence expressing the thing to be explained) and the *explanantia* (the sentences which are supposed to explain the explanandum, with singular *explanans*).[22] The explanantia consists of two sorts of sentences. First, there are sentences $C_1, \ldots, C_m$ stating antecedent conditions which enter into the explanation of explanandum E. Second, there are sentences $L_1, \ldots, L_n$ which state general laws.

Hempel and Oppenheim place a number of conditions on these sentences. First, there must be a valid deductive argument having $C_1, \ldots, C_m$ and $L_1, \ldots, L_n$ as premises, and E as a conclusion. Second, $L_1, \ldots, L_n$ must be necessary for the derivation of E: $C_1, \ldots, C_m$ and $L_1, \ldots, L_n$ minus some L_i must not entail E. Third, the sentence E must in principle be susceptible of experimental testing. These three conditions comprise the logical conditions of adequacy for a DN explanation. There is a further, empirical condition of adequacy: all the $C_1, \ldots, C_m$ and $L_1, \ldots, L_n$ must be true.[23]

The kind of explanation that Hempel and Oppenheim refer to is, according to them, a causal explanation. The causality in question has a distinctively empiricist or Humean flavor:

> If E describes a particular event, then the antecedent circumstances described

21. Achinstein (1985) makes this distinction in speaking of explanation as process and explanation as product.
22. Hempel and Oppenheim (1948, 136–7)
23. Hempel and Oppenheim (1948, 137)

> in the sentences $C_1, C_2, \ldots, C_k$ may be said jointly to "cause" that event, in the sense that there are certain empirical regularities, expressed by the laws $L_1, L_2, \ldots, L_r$, which imply that whenever conditions of the kind indicated by $C_1, C_2, \ldots, C_k$ occur, an event of the kind described in E will take place. Statements such as $L_1, L_2, \ldots, L_r$, which assert general and unexceptional connections between specified characteristics of events, are customarily called causal, or deterministic, laws.[24]

On this account, all it is for one event to cause another is for the one to be constantly conjoined with the other (I take this to be the meaning of "exceptionless regularities"). Hempel and Oppenheim also allow for statistical laws, though in the case of such laws the argument from premises to conclusion will not be deductive, but will merely confer a high degree of probabilistic support. They do not state this explicitly in the paper, but Hempel gives this in later writings (for instance, Hempel (1965, 381ff)).

Hempel and Oppenheim place a number of restrictions on the sort of laws admissible in this sort of explanation. Salmon (1990) summarizes the restriction on law-like sentences as follows:

1. They have universal form
2. Their scope is unlimited
3. They do not contain designations of particular objects
4. They contain only purely qualitative predicates[25]

These are the necessary and sufficient conditions for a sentence L to be law-like. To be a law, L must also be true. Hempel and Oppenheim leave questions as to the ontological basis of the laws unsettled. Furthermore, the laws in questions need not be causal, in the

24. Hempel and Oppenheim (1948, 139)
25. Salmon (1990, 13)

sense of revealing mechanisms by which effects are brought about. All that is required is that they are a certain kind of regularity. Newton's law of gravitation, for instance, counts as a perfectly good law-like sentence (and would count as a law were it true), in spite of not disclosing the causal mechanism of gravity.

In later writings, Hempel puts forth further necessary conditions for an adequate scientific explanation. In Hempel (1966), for instance, he articulates what he calls the requirements of explanatory relevance:

> [T]he explanatory information adduced affords good grounds for believing that the phenomenon to be explained did, or does, indeed occur. This condition must be met if we are to be entitled to say: "That explains it-the phenomenon in question was indeed to be expected under the circumstances!"[26]

This makes the DN model what Wesley Salmon calls an *epistemic* model of explanation. On the DN model, an explanation is legitimate only if it provides good grounds for belief.[27]

1.2.2 Van Fraassen's pragmatic account of explanation

Pragmatic theories of explanation take as their basic presupposition the idea that a particular explanation, scientific or otherwise, is always relative to a particular context and the interests of the audience and explainer. This bare requirement means that "pragmatic theories" of explanation comprise a very heterogeneous group. Instead of providing a comprehensive survey of such views, I will instead focus on the influential account give in van Fraassen (1987, Chapter 5) (which itself is based on the account given in van Fraassen

26. Hempel (1966, 48)

27. Hempel's and Oppenheim's account also includes a model for statistical explanations, called the "inductive statistical" model. This account ran into serious problems, however, since it had the upshot that (roughly speaking) unlikely events were not explicable. Further theories of statistical explanation (e.g., Railton (1978)) were later adduced to try and remedy this problem.

(1977)). I will not be entering into all the technical details of the account, but only the ones I judge important and relevant to our purpose.

According to van Fraassen, a theory of explanations is, at heart, a theory of why-questions.[28] Answers to such questions are context-dependent. A simple example of such context-dependence is given by sentences which contain indexical terms. The sentence "I am sitting down" is true in the context of this writing (as I am indeed sitting down) but will be false in the context of utterance if I am in fact playing basketball or walking to the theater. On this view, an explanation is not an argument, as it is the case of the DN model; "it is an answer".[29]

One of van Fraassen's main concerns is to argue that a why-question, and hence a why-answer, is always given relative to a context. He has two main motivations. The first is that constraints of relevance are determined by context. The second is that what he calls the contrast class is also so determined. We will examine these in turn (in a very simplified and abbreviated manner).

First, van Fraassen notes that giving causal explanations often involves listing "salient factors" of an event's causal history. Suppose that we are entertaining the why-question

(E) Why did Emily Inglethorp die?

This calls for some explanation. But, as van Fraassen notes, what the salient causal factors are, the ones which should figure in the answer given for (E), will differ depending on the person asking the question and his interests. If the coroner is asking the question, the answer will be "because she ingested large quantities of strychnine". If Hercule Poirot is asking the question, the answer will be "because her husband wanted her money and was romantically involved with another woman". Both of these answers are part of the complete causal background of the event described in (E), and so each of them is in an objective sense relevant to the topic. But each question is *also* relevant to the topic because

28. van Fraassen (1987, 134)
29. van Fraassen (1987, 134)

of the interests of the asker. And these interests will vary from context to context (as illustrated above by switching between different people asking the same question).

Second, van Fraassen introduces the notion of a contrast class. He notes that questions with the general form of

(†) Why is it the case that P?

can be construed in a number of different ways. To take his example, consider the question

(A) Why did Adam eat the apple?[30]

This question could be taken to be equivalent to, according to context, any one of the following:

(A') Why did *Adam* (as opposed to someone else) eat the apple?
(A") Why did Adam *eat* (as opposed to something else) the apple?
(A"') Why did Adam eat the *apple* (as opposed to something else)?

Each of these demands different explanations. Answering (A') might involve explaining why Adam ate the apple and Eve did not, for instance. Van Fraassen takes this to be evidence that the underlying form of the why-question is not (†) but instead

(‡) Why is it the case that P *in contrast to* (members of) X?[31]

where X is a set of possible alternatives to P, called the *contrast class*. X is not always made explicit. Instead, most of the time the range of alternatives is presupposed by the speakers. The contents of X are not unbounded, in the sense of containing all possible alternatives to P. Rather, they are pruned down by contextual factors such as the interests and goals and proclivities of the speakers. A group of theologians might well have

30. van Fraassen (1987, 127)
31. van Fraassen (1987, 127)

different presuppositions as to the appropriate contrast class of (A) than would a group of Sunday-schoolers.

We are now in a position to elaborate on van Fraassen's formal account. According to him, an abstract why question is an ordered 3-tuple $Q = \langle P_k, X, R \rangle$, where P_k is the topic of the question, X is the contrast class, and R is a relevance relation. We call a proposition A relevant to Q if it bears relation R to the 2-tuple $\langle P_k, X \rangle$. This is place, the form of the why-question is

(*) Why P_k in contrast to X?

The general form of the explanation that answers (*) is

(**) P_k in contrast to (the members of X) because A

The pragmatism of the view becomes even more apparent in the interpretation of the "because" above. What is being expressed, according to van Fraassen, is not any fact about counterfactuals (for instance, "if A had not occurred, P_k would not have occurred"). Rather, what is being asserted is that "A is relevant, in this context, to this question."[32]

1.2.3 Ontic accounts of explanation

So far, each of the accounts of explanation we have surveyed have been essentially epistemic ones. They aim to produce understanding of the event being explained by placing it into a network of reasons to believe it should have occurred.

But perhaps we should want more from explanation. Perhaps what we should be after is not merely an argument for the explanandum, or one which will satisfy our epistemic interests. Rather, we want to fit the the particular event we're trying to explain into the pattern of worldly causal events. An account of explanation that generates this

32. van Fraassen (1987, 143)

is called an *ontic* account. According to Wesley Salmon, "the explanation of events consists in fitting them into the patterns that exist in the objective world...explanations reveal the mechanisms, causal or otherwise, that produce the facts we are trying to explain."[33]

This is a desideratum which the DN model has trouble accounting for. Here is a classic counterexample (found in Salmon (1971, 34)). Suppose Jones has not become pregnant during a particular calendar year. He believes that he has avoided this because he has been taking his wife's birth control pills regularly.We can get the following universal generalization quite easily:

(BC) Every male who regularly takes birth control pills avoids pregnancy

Using this universal generalization, we can provide the following DN explanation:

1. Every male who regularly takes birth control pills avoids pregnancy.
2. Jones regularly takes birth control pills.

So: (3). Jones avoids pregnancy.

(BC) arguably meets the conditions for lawlike-ness. And so, assuming the premises are true, this becomes a perfectly good DN explanation. But this is highly counter-intuitive. The fact that John Jones was taking birth control pills is totally irrelevant to the fact that he did not become pregnant. The explanation of that, instead, is that he is male.

Since, as the above example shows, the premises of a DN explanation may be explanatorily irrelevant to the conclusion, the DN model is sometimes taken to be a poor model of scientific explanation. But this example reveals another problem with the model. It does not seem like the explanans and the explanandum have to be causally related at all for the one to explain the other.

Proponents of an ontic view offer criteria to determine whether a particular event is causally relevant to another. I will not go into these in detail, and instead only offer

33. Salmon (1990, 121)

a toy account which follows that of Wesley Salmon in Salmon (1984), sometimes called the statistical relevance account. On this sort of account, we can say that A is statistically relevant to C relative to background conditions B if $P(C|B \wedge A) \neq P(C|B)$; that is, if A changes the likelihood of C relative to the background conditions, we conclude that it is relevant to C.[34]

But mere statistical relevance does not suffice for causality. For instance, the dropping of mercury in a barometer is statistically relevant to whether or not there will be a storm. But clearly that dropping is not causally relevant to whether or not there is a storm. It does not, in any sense, cause the storm. To fix this defect, Salmon adopt a screening-off condition. Suppose that A is statistically relevant to C relative to background B, but is intuitively not causally related. Then suppose that there is some other fact or information D such that $P(C|A \wedge B \wedge D) = P(C|B \wedge D)$, but $P(C|A \wedge B \wedge D) \neq P(C|B \wedge A)$. Then we say that D screens off A – that is, it makes it statistically irrelevant. The basic notion is this: If we know that there has been a drop in atmospheric pressure, then whether or not the barometer has dropped makes no further contribution to the probability of there being a storm; rather, it is also a causal product of the drop.

Proponents of ontic views disagree about what causality is, exactly. What matters for our purposes is their insistence that there be a causal connection between explanans and explanandum. As Salmon puts it:

> Causal mechanisms, causal interactions, and causal laws provide the mechanisms by which the world works; to understand why certain things happen, we need to see how they are produced by these mechanisms.[35]

34. For a much fuller elaboration of this see Salmon (1984, 36)
35. Salmon (1984, 136)

1.3 Spinoza among the moderns

In the previous section, we went over three modern accounts of explanation. I think these can bring us closer to understanding what Spinoza's view of explanation might be. In this section, I will survey the similarities and differences between Spinoza's account of explanation and the modern accounts we have just surveyed.

1.3.1 The DN model

There is much in the DN model which Spinoza would agree with. Most importantly, he thinks that laws of nature have an important role to play. I will discuss this similarity below. There are, however, important points of difference, which I will also discuss.

1.3.1.1 Laws of nature

Spinoza writes in the *Treatise on the Emendation of the Intellect* that "everything happens according to the eternal order, and according to the laws of nature." (TdIE §12) Later in the same work, he writes that "all things happen according to certain laws of nature, so that they produce their certain effects, by certain laws, in an unbreakable connection." (TdIE §61n) The inference I draw from these passages is that to understand the causal structure of the world, in some sense, just is to understand the laws of nature. Cause proceeds to effect necessarily, according to these laws. So, since knowledge of nature proceeds from cause to effect (TdIE §85), to understand the laws is to understand how nature is fitted together. We further learn, from the *Short Treatise on God, Man, and his Well-Being* (henceforth KV), that laws are the "rules God has established in Nature, according to which all things come to be and endure...everyhing is disposed and ordered under them." (C.I.142 / G.I.104)

This insistence on the constancy and importance of laws of nature persists to Spinoza's mature philosophy. In the *Ethics* we see that events are governed according to the laws of nature: "All things, I say, are in God, and all things that happen, happen only through

the laws of God's infinite nature." (EIp152) And in EIVp2dem, he speaks of certain effects being able to be "deduced from the laws of our nature alone". In speaking of "laws of our nature" I take it that Spinoza means something like "rules which govern our essences." So it seems we can understand certain effects only by properly understanding the laws according to which they follow from their causes.

All this leads me to conclude that, for Spinoza, laws play an important explanatory role. For one thing, they describe how it is that a given cause follows from a given effect. For another, certain effects are said to follow from certain laws, and so to understand these effects we must understand the laws.

1.3.1.2 Points of difference

But there is one important point on which he differs from Hempel and his followers. He requires, for a particular thing to be understood, that it be understood causally.

In EIa4, Spinoza states that "[t]he knowledge of an effect depends on, and involves, the knowledge of its cause." This much is not original. It is a straightforward expression of an ancient view of science and scientific explanation, one which goes back at least to Aristotle in the *Posterior Analytics*.

But now combine this with what Spinoza writes in EIp8s2: "there must be, for each existing thing, a certain cause on account of which it exists." This is not the only place where Spinoza avows a version of the PSR. It is also found in his correspondence. In Ep. 34, to Johannes Hudde, he "[undertakes] to provide a demonstration of the Unity of God from the fact that his Nature involves necessary existence." In order to do this, he presupposes a number of hypotheses, among which is a version of the PSR: "There must necessarily be a positive cause of each existing thing, through which it exists." In this letter, he also equates the cause of a thing and the reason for a thing. He writes that

> What must also be investigated is the reason why neither more nor fewer than twenty men exist. For (according to the third hypothesis) concerning

> each man a reason and cause must be given why he exists. But (according to the second and third hypotheses) that cause cannot be contained in the nature of the man himself, for the true definition of man does not involve the number of twenty men. (C.II.25-6 / G.IV.180)

What Spinoza seems to be saying here is that when we ask why "neither more nor fewer than twenty men exist," we're after the *reason* or *cause* of this. To explain, then is, to cite causes.

This is the prime difference between Spinoza's notion of explanation and that of the DN account. Even correct DN explanations which actually are taken to function as explanations need not cite causal laws which link explanans and explanandum. For Spinoza, such a position would be anathema. To give a reason or explanation for something *just is* to give a causal explanation for something.

The key notion for the DN account is nomic expectability: if there is some lawlike connection between *F*-events and *G*-events, then when some *F* event occurs, we can expect a *G*-event to occur. But there need be no connection between them save a neo-Humean regularity. It is questionable whether this mere constant conjunction can afford the kind of understanding that Spinoza wants out of a proper explanation.

An example may help. Suppose the following were a law:

> (S) Every instance of β-decay of some appropriate kind is followed by a simultaneous supernova out of that event's light-cone

Strange though this law might be, it passes the neo-Humean test for causality. There is a constant conjunction between one event and another, one which has no exception throughout the natural order. It's part of the mosaic of the world.

Now consider a DN explanation for the event:

> (E) A particular star went supernova

Suppose that this was an instance of the pattern described by the law. That is, suppose there were a corresponding β-decay of the appropriate kind. Then the following would constitute a perfectly good DN explanation:

1. Every instance of β-decay of some appropriate kind is followed by a simultaneous supernova out of that event's light-cone.

2. There was a β-decay of the appropriate kind.

So: (3). A particular star went supernova

But this should not count as a causal explanation on Spinoza's terms. The β-decay provides us no *understanding* of the mechanism by which the star happened to go supernova, even though the two events are covered by the law. Conceiving of an effect through its cause would, by Spinoza's lights, involve conceiving of the supernova through the β-decay. But what understanding does this involve? How does this reveal to us the nature of the event in question? There is no conceptual connection between the two events, something that Spinoza treats as a necessary condition for there being a casual relation.

The Humean might claim differently. He might claim that all it is to understand an event is to understand the constant conjunction and the conjunct in question. But that will not satisfy Spinoza, given his strict account of what the essence of a thing is (which I will deal with later in the dissertation). In order to understand a thing, we must understand its essence, and its essence allows us to deduce all its properties. In some places (as we will see later; just be patient) Spinoza holds that the proper essence of a thing is the one which includes its efficient cause, from which all the properties of a thing may be deduced. But it seems clear that a particular β-decay will not allow us to deduce all the properties of a supernova. It gives no information about (say) the stellar mass involved. Of course, the Humean might push back even further, and question this conception of essence. In a philosophical debate, this would be perfectly acceptable. But here we are concerned with ascertaining what would be acceptable to Spinoza. Hence, the differences

I have pointed out suffice to show that Spinoza cannot accept this account of causation, and hence this account of laws.

1.3.2 Van Fraassen's pragmatic model

1.3.2.1 Pragmatism?

It seems odd to call Spinoza, that arch-rationalist, a pragmatist, or to wonder whether he should think a given explanation can be correct relative to our particular interests and goals, rather than relative to the standpoint of nature. But, surprisingly, there are some passages in his correspondence which give that impression.

In Ep. 60, to Jarig Jelles, Spinoza discusses what the true definition of a thing is. The question posed by Jelles goes as follows. Suppose that there are two adequate ideas of a thing. Since both are adequate ideas, each allows you to infer all of the thing's properties. But suppose that one can infer all a thing's properties more easily from the one than from the other. If this is true, then which of these two ideas should we choose as its nature? He gives a concrete example:

> [A]n adequate idea of a circle consists in the equality of the radii, but it also consists in the infinite rectangles, equal to one another, which are made from the segments of two lines [intersecting within the circle]. So it has infinite further expressions, each of which explains the adequate nature of the circle. And though from each of these everything else which can be known about the circle can be deduced, still, it can be done much more easily from one of these than from the other. (C.II.432 / G.IV.270)

Spinoza, in reply, holds that to find the true or adequate idea of an object, one must seek the one which "expresses the efficient cause." (C.II.433 / G.IV.270) He explicitly denies that one of the examples given of an adequate idea of a circle (that of infinitely many rectangles) is in fact an adequate idea, for it does not express the circle's efficient cause.

Instead, he proposes another definition: a circle is the figure formed by fixing one end of a line segment and allowing the other to vary. This mirrors the compass construction of a circle. He holds that "since this Definition now expresses the efficient cause of the circle, I know I can deduce all the properties of the circle from it." (C.II.433 / G.IV.271)

But something strange comes next. In discussing another example that Jelles raises concerning measurement of curves, Spinoza writes the following:

> I maintain absolutely that from certain properties of a thing (whatever idea is given) some things can be discovered more easily, others with greater difficulty—though they all concern the Nature of the thing. (C.II.433 / G.IV.271)

In this passage, Spinoza seems to be saying something like the following. Suppose I want to explain some property of a thing. I can do this in one of two ways, using one of two ideas. But one idea lets me deduce the property with more ease than the other. So I can legitimately choose the one idea over the other, *even though* each of these expresses the nature of the thing in question. What this sounds like is an affirmation of the position that a proper explanation can be one which takes human interests into account. That is, he seems to take a somewhat pragmatic view of explanation.

1.3.2.2 Contrast class

Another apparent point of convergence is the notion of a contrast class. Recall that van Fraassen holds that when we're asking a why-question, we are asking it with an implicit range of possible alternatives (see: the Adam example). It seems Spinoza is in agreement with this general position, at least with respect to certain kinds of facts.

After giving the statement of the PSR in EIp8s2, Spinoza offers the following inference:

> From these propositions it follows that if, in nature, a certain number of individuals exists, there must be a cause why those individuals, and why neither more nor fewer, exist.

> For example, if 20 men exist in nature...it will not be enough (i.e., to give a reason why 20 men exist) to show the cause of human nature in general; but it will be necessary in addition to show the cause why not more and not fewer than 20 exist. (C.I.415 / G.II.50-1)

It seems like Spinoza is affirming something very much like a contrast class requirement here. In order properly to explain why a particular number of individuals exists, we need to explain why this is *in contrast to* some other definite number of individuals.

The same inference appears in the other explicit mention of the PSR in Ep. 34 (which we also noted above). From the same 4 propositions that appear in the *Ethics*, he draws the same conclusion:

> From these presuppositions it follows that if some definite number of individuals exists in nature, there must be one or more causes which were able to produce precisely that number of Individuals, neither more nor fewer. For example, if twenty men exist in nature—to avoid all confusion I shall suppose that they exist together and without predecessors in nature—it will not be sufficient, to give a reason why the twenty exist, to investigate the cause of human nature in general. What must also be investigated is the reason why neither more nor fewer than twenty men exist. (C.II.26 / G.IV.180)

Here again, the notion of a contrast class emerges implicitly, in precisely the same way it did in the passage from the *Ethics*.

I am not claiming that Spinoza had anything like van Fraassen's account in mind. Rather, I am claiming that he is explicitly committed to a kind of explanation which has contrastive elements. These are rather constrained, if we take the text at face value: The only contrastive elements in Spinoza's account regard numerical existence facts. If the xxs exist, then there is an explanation for why those particular xxs exist, rather than the xxs and the yys (where these are relevantly similar sorts of things). We may suppose, however, that he has no opposition to the general notion.

1.3.2.3 Points of difference

While, as we have seen, Spinoza has some affinities with a pragmatic account of explanation, I do not think that he would go whole-hog and say that all explanations have a pragmatic character. This is because of his close linking of explanation and causation. For him, effects are most perfectly understood through their causes. He writes in TdIE §92 that "knowledge of the effect is nothing but acquiring a more perfect knowledge of its cause." In EIa4 he writes that "the knowledge of an effect depends on, and involves, the knowledge of its cause." So if we wish to explain an effect, we must do so through its (adequate) cause. And there is only one of these. (I argue for this in the final chapter of the dissertation; since development of this point is more crucial to my case there than my case here, I omit the argument and ask the reader just to trust me on this.)

There is still another difference. For van Fraassen, the "because" in explanations like (**) does not need to signify that A caused P_k. Depending on contextual factors, such as the relevance relation, no events in the causal history of the thing in question need be referred to by the "because" relation. Whether or not it does refer to causal factors will depend on the motives of the speaker and the interests of the questioner, and so forth.

Clearly, Spinoza will have none of this. For one thing, his equating of causes and reasons will not allow it. When we ask for the reason why it is the case that I got up early yesterday morning, what he thinks we are asking (or what we should be asking) is what the cause of this event is. He will *not* be satisfied by an answer such as "oh, no reason in particular; I just happened to wake up at that time." But on van Fraassen's account, such an answer is perfectly acceptable, depending on the context.

1.3.3 Ontic accounts

Here is where Spinoza is perhaps closest to some modern accounts of explanation. Like defenders of the ontic account, he emphasizes the importance of causal explanation.

1.3.3.1 Causal explanation

It is pretty clear that Spinoza is committed to the universality of causal explanation. We saw above that he is committed to a strong version of the PSR. Both the existence of things and their non-existence require causal explanations.

What is more, Spinoza seems committed to the thesis that particular things are explained, in great part, through their proximate causes. In TdIE, for instance, he writes that the definition of a created thing "will have to include the proximate cause." (TdIE §96) To know about a thing's essence, and hence to know what a thing is, we have to have some information on its causal history. (We will examine what kind of information we need to have about the causal history of particular things when we discuss Spinoza's doctrine of essences.) Spinoza also places a parallel restriction on the true definition of a thing in Ep. 60, to Tschirnhaus. There, he writes that

> To know which of the many ideas of a thing is sufficient for deducing all its properties, I pay attention to one thing only: the the idea *or* definition of the thing expresses the efficient cause. (C.II.433 / G.IV.270)

And in the TTP, he writes that "we ought to define *and explain* things through their proximate causes." (TTP.IV.4)

The moral I draw from these passages is that knowing the causal history of a particular thing is a key component in knowing its essence. If we think that Spinoza holds that scientific knowledge is intimately related with knowing the essences of things (as I will argue later in the dissertation), then knowing the causal history will be essential to scientific knowledge, and hence to scientific explanation.

1.3.3.2 Points of difference

The key difference between Spinoza and the modern proponents of an ontic view of explanation is in the sophistication of their views. I do not think Spinoza had any particular

account of the statistical relevance relation between two events. Nor can I find evidence that he accepted any sort of screening off condition for dispensing with spurious causes. So to that extent, his account differs from that of modern-day proponents of ontic explanation.

Further differences might lie in the accounts of causality that each holds. Spinoza holds, officially, that the only kind of causation is efficient causation. (There are complications here concerning formal and final causality, which we will address later.) He takes the causal relata (usually) to be things, rather than events. Following Hume, many modern proponents of the ontic account will take the causal relata in question, and hence the explanandum and explanantia, to be events. I think that Spinoza might be open to event causation, but it is clear that this is not the only kind he has in mind. Objects can cause objects, on his view. This is something the modern theorist might not countenance.

Another point of difference lies in his conception of lawhood. Spinoza is a necessitarian: everything that happens in nature happens necessarily. Consequently, he is a determinist. If he is right, then (one might think) there is no room for irreducibly statistical or probabilistic explanations or causal connections in nature. But this is something that many of the proponents of the ontic conception of explanation would reject. Some statements which seem very much to be laws are irreducibly statistical in character.

1.3.4 Wrap-up

Let's recap. We saw above that, while Spinoza might have several points of agreement with contemporary accounts of explanation, he also has important points of difference. He differs from the proponents of the DN model in requiring that the explanations in question be causal. He differs from pragmatic accounts of explanation in thinking that there is, ultimately, just one correct explanation. He differs from the ontic account least, perhaps, but his notion of causation and law-hood is certainly not statistical.

But what, exactly, is his account of explanation? What sorts of things can be ex-

plained? How are laws involved? It is hard to answer that question, since he does not give us an explicit answer. But I believe we can glean some clues from the text. It is to this project that I will now turn. First, I will consider what sorts of things Spinoza thinks can be explained, and make some conjectures as to how they fit into his ontology. Next, I will consider how laws of nature are involved in explanation. Finally, I will offer a conjecture as to what Spinoza's account of explanation might be.

Chapter 2

Spinozistic explanation

2.1 How broad is the PSR?

What, for Spinoza, can be explained? As we saw earlier in our discussion of Spinoza's explanatory rationalism, some commentators have taken the view that *everything*, every fact, has an explanation. My view is that this goes beyond the available textual evidence, though perhaps there are arguments which can supersede this lack of evidence.

The statements of the causal principle that Spinoza gives seem to imply a PSR which applies to existence facts. That is, Spinoza holds to something like the following principle:

(PSR_{ef}) For every thing x, x's existence or non-existence has an explanation.

Recall that the statement of the causal principle in EIp8s2 says that that the cause of the thing's existence is the thing "on account of which it exists". That is, a thing's cause explains the fact of its existence. Thus, the things that the explicit version of the PSR applies to are existence facts.

But Spinoza doesn't think *only* existence facts have explanations. He also arguably endorses an explanatory principle for events. In the TTP he writes that "[n]othing, therefore happens in nature which is contrary to its universal laws. Nor does anything happen which does not agree with those laws or does not follow from them." (TTP VI.10) So all

things that happen – that is, all events – follow from the laws of nature, or are consistent with them. From this I conclude that all events have explanations.[1]

This is not the only passage in which Spinoza says this. In TdIE §12 Spinoza states that "everything that happens happens according to the eternal order, and according to certain laws of nature." So things happen. This suggests there are events. Later, in TdIE §65, when speaking of confused ideas, Spinoza writes the following:

> [Certain fictions consist] in attending at once, without assent, to different confused ideas, which are of different things *and actions* [emphasis mine] existing in nature...Indeed we also cannot feign from [them] any actions that are not true; for at the same time we will be force to consider *how and why* [emphasis mine] such a thing happened.

Spinoza also writes in Ep. 13 that "all variations of bodies happen according to the Laws of Mechanics." (C.I.210 / G.IV.67) From these passages, I infer that Spinoza's metaphysics has room for something like events, and that these all have explanations as well.

In some sense, for Spinoza, events can also have causes. He writes. in EIIId2:

> I say that we act when *something happens* [emphasis mine], in us or outside us, of which we are the adequate cause...On the other hand, I say that we are acted on when something happens in us, or something follows from our nature, of which we are only a partial cause.

So we act, or are acted upon, when things happen to which we are causally related in appropriate ways. It's hard to see what these could be other than events.

So Spinoza seems to speak as if there are events. He also seems to speak as if these events all have explanations. I take this to be pretty good evidence that there is some room in Spinoza's philosophy for the explanation of events.

1. For a similar view see Curley (1969, 47)

2.1.1 What events are

So Spinoza thinks there are events. But he also thinks that everything that exists is either a substance or a mode. Since God is the only substance, it follows that events are modes of some kind.

But what kind of modes are they? Let's make the following distinction. Call a mode a first-order mode if it exists independently of an act of abstraction of a finite intellect. Let's call a mode a second-order mode if it depends on an act of abstraction by a finite intellect (elsewhere Spinoza calls these "beings of reason").[2] So are events first-order modes, or second-order modes?

I think that they are first-order modes. Spinoza says that events follow from and happen according to the laws of nature. If we think that nature's laws are mind-independent, we have some evidence in support of the first-order reading. For if the laws are mind-independent, it is plausible to assume that the things that they govern are themselves mind-independent, and hence first-order modes.

But this leaves questions open. Do events have internal structure? There is no direct textual evidence for or against any particular reading. We have seen that Spinoza talks like there are events, and that this isn't just loose way of speaking. But he gives us no clue as to their structure. This is recognized by, for instance, Lin (2018, 139), who correctly notes that it is unlikely that Spinoza considered these issues in any great detail, if at all. Any attempt to build up an ontology of events is speculation. But it need not be un-moored speculation. It can be anchored in Spinoza's other views.

Pre-theoretically, events seem to be structured, and to relate certain things to each other. The event of my throwing a baseball joins, in some sense, me and the baseball, which may be constituents of it. If events are modes and have this structure, they must relate other modes to each other. In other words, they must be modes of modes.

2. Note that if all we were to say is that these modes can exist independently of the activity of an intellect or mind, then no modes of `Thought` could be first-order modes, for the obvious reason: they are all dependent on the mental activity of God.

There are at least two precedents for this view elsewhere in Spinoza's corpus. The first comes in the Physical Digression (EIIp13def), where Spinoza gives his definition of an individual:

> When a number of bodies, whether of the same or of different size, are so constrained by other bodies that they lie upon one another, or if they so move, whether with the same degree or different degrees of speed, that they communicate their motions to each other in a certain fixed manner, we shall say that those bodies are united with one another and that they all together compose one body or Individual, which is distinguished from the others by this union of bodies.

So when modes of `Extension` stand in the right sort of relation, they make something new, an individual. This mode has multiple modes as constituents.

This individual at least partially inheres in multiple distinct modes at once. Recall EIa1: "Whatever is, is either in itself or in another". So if a particular individual exists, it either inheres in itself or in something else. It can't inhere in itself alone, since it's not a substance. So it must inhere in something else (in addition to substance), at least partially. Since it is a composite, it cannot inhere wholly in any one of its constituents. By exhaustion, then, it inheres in all of its parts at once (in addition to in substance).

The second precedent comes at EIId7:

> By singular things I understand things that are finite and have a determinate existence. And if a number of Individuals so concur in one action that together they are all the cause of one effect, I consider them all, to that extent, as one singular thing.

In this passage, when multiple modes coordinate to produce a particular effect, they are considered as an individual mode. And for the same reasons as before, it can't in-

here wholly in itself or any other single one of its parts. So it inheres in multiple modes simultaneously.

So there is some indirect support for the notion that a mode may inhere in multiple modes at once. If this is true, then we may be able to make sense of events on Spinoza's general ontological picture as follows.

Suppose C_1 through C_n are modes of `Extension`, E is another mode of `Extension`, and $C_1 \ldots C_n$ cooperate in bringing about E as an effect. Then $C_1 \ldots C_n$ can be considered as one singular thing, C, in virtue of the fact that they bring about E. Then the event "C's bringing about E" is itself a mode of the modes C and E.[3]

According to some secondary literature, there is also precedent for such a view in Descartes. Paul Hoffman thinks that Descartes is committed to what he calls "straddling modes", or "modes that belong to two subjects at once."[4] This is a result of Descartes' dualism, according to Hoffman. The key passage for his reading is: "Consequently we should recognize that what is a passion in the soul is usually an action in the body." (CSM I.328 / AT XI.328) This seems to commit him to the view that "when an agent acts on a patient, that event or process exists in both subjects simultaneously."[5]

There are two differences Hoffman's reading of Descartes and my reading of Spinoza. First, for Descartes, these straddling modes are modes of two *substances*. For Spinoza, they would be modes of two *modes*. Second, in Spinoza, a mode being a mode of both a body and a mind violates the causal and conceptual barrier between God's attributes. Modulo these differences, the positions are remarkably similar.

2.2 How laws help explain

We can sum up our conclusions at this point like so. First, for Spinoza, all things have explanations. This includes events, which are modes of modes. These events follow from,

3. Plausibly events may relate not only modes but also substances and modes.
4. Hoffman (2009a, 102)
5. Hoffman (2009a, 102)

or happen according to, laws of nature. But how, if at all, do these laws explain events? We now turn to this question.

To begin with, let's look at TdIE §101:

> The essences of singular, changeable things are not to be drawn from their series, or order of existing, since it offers us nothing but extrinsic denominations, relations, or at most, circumstances, all of which are far from the inmost essence of things. That essence is to be sought only from the fixed and eternal things, and at the same time from the laws inscribed in these things, as in their true codes, according to which all singular things come to be, and are ordered.

This passage gives us some clues as to the role of laws in explanation. When giving some sort of causal explanation of the coming to be and ordering of singular things or events, we must invoke laws.

Now turn to TTP.IV.1, where Spinoza gives us a definition of "law": "The word *law* taken without qualification, means that according to which each individual, or all or some members of the same species, act in one and the same fixed and determinate way." In the passage immediately following this one, Spinoza gives us some examples of laws, one a law of motion, and the other a law of psychology:

> For example, it is a universal law of all bodies, which follows from a necessity of nature, that a body which strikes against another lesser body loses as much of its motion as it communicates to the other body. Similarly, it is a law which necessarily follows from human nature that when a man recalls one thing, he immediately recalls another like it, or one he had perceived together with the first thing. (TTP.IV.2)

Each law can clearly play some explanatory role. Why did a body move in a certain way after a collision? Because of the sizes of the two bodies, and the law which dictates

the communication and loss of motion between the two. Why did a man have an idea of a robin when seeing an apple? Because he previously had both the idea of an apple and of a robin, and he had previously had the idea of the two together, and there is a law that governs the passage between the two.

As we saw above, for Spinoza explanation is causal explanation, and natural laws govern the causal interactions between finite things. So laws of nature are what get us from the explanans (the cause) to the explanandum (the effect). They provide an intelligible connection between the explanans and explanandum – intelligible, because of EIa4: the knowledge of an effect involves the knowledge of its cause. The laws glue cause and effect together *as* cause and effect rather than just disjointed successive events.

2.3 Essence and Definition

We almost have all the elements we need to reconstruct Spinoza's account of explanation. But only almost. Recall that Spinoza thinks we should explain things through their proximate causes (see TTP.IV.4). He also holds that the definition of a thing expresses its efficient cause. So to describe fully his account of explanation, we must first address his views on essence and definition.

Nowhere in the *Ethics* does Spinoza say conclusively what a definition is. Consequently, in order to examine this notion, I will pay close attention to the *Treatise on the Emendation of the Intellect*, where he does. While much changes from the TdIE to the *Ethics* (for instance, his typology of cognition), his doctrine of definition does not. Or at least so I will assume.[6]

I will take no stance on whether or not there are kind essences in Spinoza (as, for instance, in Curley (1988, 111–2), Melamed (2013, 78n81), Hübner (2015)), or just particular ones (as, for instance, in Della Rocca (2008, 95), Ward (2011)). I think the latter conclu-

6. There are arguments I could give here in motivation. But these would slow us down, so for now I will assume this without any such argument.

sion is more probable, but since it doesn't affect my argument here, I won't discuss this question.

2.3.1 Definition

It's difficult to separate out definition and essence in TdIE. Spinoza links them fairly closely, relating the particular affirmative essence of a thing to that thing's true definition (TdIE §93). For this reason I'll treat a thing's true definition and its particular affirmative essence as being related in the following way: A thing's true definition expresses its particular affirmative essence.

So for Spinoza, a true definition of a thing has to express the thing's essence. This, in turn, means that the definition cannot make use of any *propria*, or properties which are necessary attendants of a thing's essence but which do not constitute it. Here is an illustration. Consider the following definition of a circle:

> (C) `Circle`(x) $\iff$ for all lines l, l' drawn from x's center to its circumference, `length`(l) = `length`(l')

Spinoza claims this is an inferior definition of a circle, since it explains a circle only through some of its non-essential properties. What we should instead do is give a definition of a circle which expresses its essential properties. This, according to him (see TdIE §96, Ep. 60) is something like the following:

> (C') `Circle`(x) $\iff$ x is formed by fixing one end of some line l and leaving the other free to move through 360 degrees

But maybe this is circular. What we're trying to do is give a characterization of a particular affirmative essence in terms of a true definition. But we're also trying to give a characterization of definition by making reference to non-essential properties. So it seems like we're stuck with something like the following: the essence of X is a concept that doesn't contain any non-essential properties of X. This is true, but uninformative.

This is a legitimate worry, but it is not insurmountable. If we can give a characterization of a *proprium* that doesn't involve reference to the essence of a thing, we can skirt this danger. A point Spinoza makes in Ep. 60, to Tschirnhaus, is useful here. In this letter, Tschirnhaus claims that the following is a true definition of a circle:

> (C") `Circle(x)` $\iff$ the rectangles formed by the segments of any two lines lines l and l' through x, which intersect at a point A on the interior of x, are equal to one another[7]

If both (C') and (C") give a true definition of a circle (asks Tschirnhaus), then how are we to know which to use? Spinoza's answer is that (C") does not allow us to deduce all the properties of the circle. Specifically, it does not tell us what the efficient cause of the circle is. On the other hand, (C') does. Hence, (C') is the true definition of the circle.

So we might offer the following criterion (not a definition) for telling whether a property is a *proprium*:

> (`Proprium`) A property of a thing is a *proprium* iff one cannot infer all the thing's properties from it

On this construal, the property expressed in (C") counts as a proprium of a circle, since we cannot infer the circle's efficient cause from it. The property expressed in (C') does *not* count as a proprium, since we can (at least, according to Spinoza). So we've been able to give a characterization of *propria* that doesn't make crucial reference to a thing's essence. So we've escaped the feared uninformativeness.[8]

7. cf. Euclid's *Elements* III.35, EIIp5s

8. This proposal has some textual backing in the *Short Treatise* as well. First, in a footnote at C.I.64 / G.I.18, in speaking about the attributes of God, Spinoza says that

> God is, indeed, not *God* without them, but he is not God through them, because they indicate nothing substantive, but are only like *Adjectives*, which require *Substantives* in order to be explained.

In fairness, Gebhart suspects that this may be an interpolation. We also have another footnote at C.I.80 / G.I.35, where Spinoza writes that

2.3.2 Definitions of created things

Now we turn to Spinoza's characterization of true definitions in TdIE. He divides these up into two general classes. First, we have definitions of singular created things (TdIE §96). Any true definition of a created thing needs to meet two conditions:

> **Causal History:** the definition should encode the thing's proximate cause.
>
> **Completeness:** the definition should only encode features of the thing from which all its other properties can be deduced.

Spinoza takes it to be self-evident that these are the requirements such a definition needs to meet; it is "so plain through itself to the attentive that it does not seem worth taking time to demonstrate it" (TdIE §96). But this is perhaps not as obvious as he thinks it is. For example, one could hold that **Completeness** is a trivial requirement, or at least an overly weak one. It can be met by simply including all the properties of the thing in question in its definition.

The following analogy brings out the point. One of the properties of a first-order logical theory T which it would be nice to know is whether it's axiomatizable. But if all "axiomatizable" means is just "there is some subset of the sentences of T, A, such that every theorem of T is deducible from the sentences in A in a specified derivation system", then trivially any such T is axiomatizable: simply take A to be the set of all theorems of T. So what we should be interested in is a notion that is more restrictive, such as "finitely axiomatizable" or "recursively axiomatizable". The same goes for Spinoza's definitions:

> [certain attributes of God] are called *Propria* because they are nothing but adjectives which cannot be understood without their substantives. I.e., without them god would indeed not be God; but still, he is not God through him, for they do not make known anything substantial, and it is only through what is substantial that God exists.

We should care about more than simply whether a given property cluster suffices for the deduction of all the thing's other properties. As a result, we should want to have some more stringent restriction on what counts as an essence.

This is a good objection against the self-evidence of Spinoza's characterization of definition. But it need not destroy his project. In a charitable spirit, one can add the following stipulation for true definitions of created things:

No Propria: the definition should not encode any propria.

This restricts the range of properties that one can include in a thing's true definition such that we avoid triviality. It also has textual support. Spinoza writes the following, at TdIE §95: "To be called perfect, a definition will have to explain the inmost essence of the thing, and to take care not to use certain *propria* in its place."

Two points, before we go on. First, **Causal History** plausibly entails that a thing's causal origin is one of its essential features. This depends on how strong a reading one takes of that criterion. On the weak reading, all that **Causal History** requires is that the cause *type* be included in a thing's definition, and hence its essence. On the strong reading, what it requires is that the cause *token* is included in its definition and essence. Consider, for the sake of illustration, a particular copy of *Bonfire of the Vanities*. The weak reading says that its definition, and hence its essence, must only include information about the cause type – that it was printed, say. The strong reading, on the other hand, says that its definition must include information about the specific printing press that it did, in fact, come from.

Second, the strong reading of **Causal History** gives another motivation for Spinoza's necessitarianism. It is distinct from the justification given in, say, EIp29dem. The argument goes like this: if a particular thing exists, and it is essential to that thing to have been produced by a specific token cause, then that thing could not have existed except

by being produced by that cause. Now, ultimately, all things are caused by God. So if it is essential to every existing thing that it be caused by God, everything that exists either exists whenever God exists or not at all. Since God exists necessarily, everything either exists necessarily or not at all. And since everything that exists exists, everything that exists exists necessarily.

2.3.3 Definitions of uncreated things

The criteria for a definition of an un-created thing are a little more demanding. In addition to **Completeness** and **No Propria**, they comprise:

Self-Sufficiency: the definition should not encode any cause.

Obviousness: the definition leave no doubt about whether the thing exists.

No Abstraction: no term in the *definiens* be an abstraction.

No Abstraction is an expression of Spinoza's militant anti-abstractionism (that is, his opposition towards understanding things by means of abstract ideas or universals). Even though there are things that are, in a qualified sense, like universals or genera (see TdIE §101, EIIp36-40), everything which actually exists is particular. We will have much more to say about abstraction in a later chapter, but even with those further qualifications, this will still hold. **Obviousness** says that the essence of some un-created things should involve existence. And the need for **Self-Sufficiency** should be fairly obvious: un-created things of course have no cause.

Now that we have a working characterization of what true definitions are, we are

in a better position to understand what a thing's particular affirmative essence is.[9] The particular affirmative essence of a created thing consists of (a) that thing's causal history in either the strong or the weak sense and (b) a property cluster that both suffices for deducing all that thing's other properties and includes no *propria*.

Here we come to a potential problem. It begins with the thought that a thing might have multiple property clusters that suffice to infer all its other properties. Hence, a thing may in this sense have multiple essences.[10] One might think that here would be a good place to invoke a minimality condition, which – so continues the thought – isolates a particular, smallest property cluster which suffices for the deduction of all the other properties. But this doesn't really solve the problem: Why mightn't there be multiple property clusters of the same size which so suffice? Again, nothing that Spinoza has said here rules this out. It is, unfortunately, not possible to settle this question textually in my view.

2.3.4 Definition in the *Ethics*

Given the heavy reliance upon definitions in the *Ethics*, it is a little surprising that Spinoza nowhere in that work gives us a worked-out doctrine of definition. Nonetheless, the remarks that he does make on the topic harmonize well with the doctrine expressed in TdIE. For instance, in EIIp8s2, he writes that "the true definition of each thing neither involves nor expresses anything except the nature of the thing defined." This resembles the connection in TdIE between the definition of a thing and its particular affirmative essence. In EIIIp4, he writes that "the definition of any thing affirms, and does not deny, the thing's essence." Again, we have a statement of the connection between nature and essence found in TdIE. He also implicitly affirms a version of **No Propria** in EIIIp59def6, where he criticizes those who have defined love through a property of love, rather than

9. I here am not discussing formal or objective essences (TdIE §33). The distinction between the two is, I take it, the Cartesian one, and so there is not much more to say about them other than the one exists in the thing, and the other in a mind.

10. This is a position that some commentators reach on other grounds (e.g. Newlands (2018, Chapter 5)).

through its essence:

> This definition explains the essence of Love clearly enough. But the definition of those authors who define *Love* as *a will of the lover to join himself to the thing loved* expresses a property of Love, not its essence. And because these Authors did not see clearly enough the essence of Love, they could not have any clear concept of this property.

These passages provide some evidence of continuity between Spinoza's notion of definition in TdIE and that in the *Ethics*. Possibly they are also evidence for some continuity through these works on his account of essence, though this is more contentious.

2.4 The official account, first pass

Now, I claim, we have all the pieces we need to reconstruct Spinoza's view of explanation. In previous sections, I've argued that for Spinoza, the following are true:

- Explanations involve proximate causes
- Explanations involve a contrast class
- Explanations can be of events or of things
- Explanations of things or of events involve reference to their essences
- Explanations of things or of events involve laws of nature

But how does Spinoza actually apply these principles? Let's look at an *actual* explanation he gives, in the mediated correspondence with Robert Boyle. This correspondence is interesting for other reasons, as we will see in a later chapter. For the present, however, we are interested only in Spinoza's analysis of the explanation of a particular event

– the reintegration of niter. The experiment Spinoza carried out is explained by Curley as follows:

> In his experiment on the 'redintegration' of niter Boyle melted niter in a crucible, added a live coal which kindled the niter, and continued adding coals until the kindling stopped. The mixture was then heated further until all 'the volatile part' escaped. The remaining 'fixed niter' was then divided into two parts. Boyle dissolved one part in water, then added drops of 'spirit of niter.' This was continued until the effervescence stopped. The other part was treated similarly, except that the fixed niter was not first dissolved in water. Each solution was then set to evaporate near an open window. The first solution crystallized in a few hours, yielding niter. The second solution crystallized very slowly, but after water was added and the solution was evaporated, niter crystals were also produced. (C.I.173n15)[11]

Boyle's conclusion from these experiments is that niter is a substance composed of fixed and volatile parts. Spinoza, on the other hand, hypothesizes that it's made up only of volatile parts. Using this hypothesis, Spinoza tries to explain three distinct phenomena. The first is the reconstitution itself. The second is the fact that niter and spirit of niter have significantly different tastes. The third is that niter is inflammable and spirit of niter is not. Here we will only examine the explanation that Spinoza gives for the reconstitution. Rather than give a paraphrase, I will reproduce the entire passage here, and then give my analysis:

> This salt, or these impurities, have pores, or passages, hollowed out in them, of the size of the particles of Niter. But when the particles of niter were driven out of them by the force of the fire, some of the passages became narrower and consequently others were forced to dilate, and the very substance,

11. For a more thorough discussion of the experiment and the possible implications for Boyle's philosophy of chemistry, see Banchetti-Robino (2012).

> or walls, of these passages were made rigid, and at the same time very brittle. So when the spirit of Niter was dropped on the salt, some of the spirit's particles began to penetrate forcibly through those narrower passages. And since the particles are of unequal thickness..., they first bent the rigid walls of the passages like a bow, and then broke them. When they broke them, they forced those fragments to spring back; since they retained the motion they had, they remained as incapable of solidifying or crystallizing as before. Some [A, NS: particles of the spirit of niter] penetrated through wider passages; since they did not touch the walls of these passages, they were necessarily surrounded by a very fine matter, were driven upwards by it (in the same way the parts of wood are by flame or heat) and flew off in smoke. If they were plentiful enough, or if they mixed with the fragments of the walls and the particles entering through the narrower passages, they formed droplets flying upwards. But if, with the aid of water or air, the fixed salt is loosened and made more flexible, then it is sufficiently able to restrain the impetus of the particles of [A: spirit of] Niter and to force them to lose the motion they had, and come to rest again (just as a cannonball loses its motion when it hits sand or mud). The reconstitution of Niter consists simply in this coming to rest of the particles of spirit of Niter. (C.I.175 / G.IV.18-19)

Let's try and parse out what Spinoza is doing here. In order to explain this event (the particles coming to rest), Spinoza introduces an hypothesis about the nature of niter. Using this hypothesis, and some supplementary premises or hypotheses, he offers a mechanical narrative which explains the event in question. The explanandum[12] which we will examine in this case is the following:

> (*) The particle of spirit of niter came to rest.

12. Technically there are two, but for simplicity's sake we will focus only on the one.

The explanantia are a series of events which occur according to laws and properties of extended things, embedded in a narrative which ends in the explanandum. I'll summarize this narrative as follows:

1. The fixed salt was fired
2. The pores of the salt were made rigid and brittle by the fire.
3. Water or air was added to the fixed salt
4. The fixed salt was made flexible again by adding water or air.
5. The niter was added the flexible fixed salt solution
6. The flexible fixed salt restrained the impetus of the particles of niter

---

(*) The particle of spirit of niter came to rest

But this narrative is incomplete. We are missing the "causal glue" between the steps and the explanandum. What I want to claim is that there are tacit invocations of both the nature of niter and some laws of nature which govern bits of `Extension`.

The first claim is bolstered by some textual evidence. Spinoza outright claims that he wants to "explain this phenomenon as simply as possible" by positing that niter is composed of homogeneous parts, which differ only because some are in motion and some at rest. (C.I.174 / G.IV.17) So his hypothesis clearly plays an explanatory role here. His explanation of the reconstitution is simply that the parts of niter go from being in motion to being at rest. Further, his hypothesis dictates some of the properties of the interacting parts of the phenomenon in question (the fixed salt, the parts of niter of varying size, etc).

There is also conceptual evidence. In order to explain the interactions between elements of the causal chain, we (or Spinoza) must assume or know some things about the

essences of the things in question. Otherwise, we can know of no law-like interaction between them.

So how do laws play a role in this explanation? First, and most obviously, they play a role in the transition between (6) and (*). There we have a tacit invocation of a law which governs the interactions of bodies, in addition to the consequences of that interaction for the impetus of the two. Second, we have an implicit law-like interaction in the transition between (1) and (2). If Boyle is right that Spinoza assumes Descartes' theory of fire,[13] then this interaction will be governed by kinematic laws. Third, in the interaction between the water or air and the fired salt, which takes place between (3) and (4), there is an assumption of law-governedness. Recall that Spinoza thinks that everything happens according to laws of nature. Since this is true, if a cause produces an effect, it must do so in a law-like way. And since the transition from (3) to (4) is the production of an effect from a cause, it must be law-like.

So far, in this explanation, we have four of our five desiderata: proximate causes, events, reference to essences, and laws of nature. But we are missing the contrast class. But it's not far. Recall the specifics of the experiment. The solution which was dissolved in water first crystallized more quickly than the one which did not. Consequently, there is an implicit contrast between the case in which the niter was first dissolved in water and the case in which it was not first dissolved in water. In Spinoza's terms, this is a difference between particles in motion and particles at rest. The form of the answer, then, might be something like:

(EX) The particles of spirit of niter came to rest (as opposed to staying in motion) because of *X*.

What's *X*? My proposal is that it's the causal narrative that Spinoza articulates. It

13. And he probably is; compare Spinoza's account with the account of fire in Descartes (2004, 6–8).

provides (part of) the explanation of why *that* happened instead of something else.

This case study gives us what we need to put down an "official" account on paper. Here it is:

(SE) To explicitly explain some event E is to:

(a) Position it against some contrast class of events, $\mathcal{E}$

(b) Provide a causal narrative C which ends with E

(c) Make reference to the essences both of E and of the elements of C

(d) Show how the interactions in the causal narrative happen according to laws of nature $L_1, \ldots, L_n$, which govern the essences of the elements of both E and C.

This account bears a striking resemblance to what Peter Railton calls an "ideal explanatory text" . He writes:

> [A]n ideal text for the explanation of the outcome of a causal process would look something like this: an inter-connected series of law-based accounts of all the nodes and links in the causal network culminating in the explanandum, complete with a fully detailed description of the causal mechanisms involved and theoretical derivations of all the covering laws involved.[14]

There are salient differences. First, Railton's DNP model of explanations allows for probabilistic explanations. Arguably, since Spinoza is a necessitarian and a strict determinist, his does not. Second, On (SE), the laws need not be derived for an explanation

14. Railton (1981, 247)

to be acceptable. Third, there is no mention of a contrast class in Railton's account. But the similarities are, nonetheless, interesting.[15]

Not all explanations are explicit. One may leave out either (a), (c), (d), or some combination of these in an explanation and still have it be a good one. All you need is for them to be able to be filled in. But I don't think an implicit explanation may be acccceptable without citing (b). To eliminate the causal history of the event in question would be to leave that event unintelligible. This is because Spinoza believes that events are to be understood through their proximate causes.

2.5 The official account, second pass

Before moving on, I want to make sure that we haven't gotten too carried away with our modernization. In other words, I want to make sure that (SE) is a sensible thing to attribute to Spinoza given his context. To do this, we'll now contrast (SE) with the sorts of explanations provided in some places by Descartes. I will in great part be relying on the study in Clarke (1982, Chapter 5), though I'll differ from his account in certain places.

Desmond Clarke writes that

> [t]o explain a physical phenomenon, for Descartes, was equivalent to (i) specifying its efficient causes, and (ii) describing the mechanism by which the phenomenon results in some 'necessary' way from the assumed causes.[16]

One important point here is the needfulness of hypotheses. Since we can't observe all of nature's working, some hypotheses about underlying causal mechanisms are necessary. It's also important that these hypotheses be *mechanical*. Dellsén (2017, 315) writes that "all explanations of natural phenomena must necessarily be mechanical for Descartes, since

15. I make no claim here about any actual intellectual influence of Spinoza on Railton's account, of course. If you put a gun to my head and asked me to make a claim about it, I'd say there was no direct inspiration at all.

16. Clarke (1982, 108)

any nonmechanical explanation fails to be grounded in the principle of extension." And this is born out by the texts. Descartes writes the following in *Le Monde*:

> If you find it strange that, in explaining these elements, I do not use the qualities called 'heat', 'cold', 'moistness', and 'dryness', as the Philosophers do, I shall say that these qualities appear to me to be themselves in need of explanation. Indeed, unless I am mistaken, not only these four qualities but all others as well, including even the forms of inanimate bodies, can be explained without the need to suppose anything in their matter other than motion, size, shape, and arrangement of its parts.[17]

Descartes does two things here. First, he rejects typical Scholastic explanations, which use qualities such as "heat" and "cold," as insufficiently explanatory. This is because these concepts themselves require substantive explication. Second, and more boldly, he claims that *all* of natural science can be done in terms of the "motion, size, shape, and arrangement" of matter.

To glean more information, let's look at actual explanations Descartes gives. We start with a letter to Plempius:

> He [Fromondus] is convinced that my assumption that the parts of water are oblong like eels is rash and baseless. He should remember what is said on page 76 of the Discourse on the Method? If he would be good enough to read with sufficient attention everything I wrote in the Meteorology and the Optics, he would find countless reasons from which countless syllogisms could be constructed to prove what I say. They would go like this.
>
> If water is more fluid and harder to freeze than oil, this is a sign that oil is made of parts which stick together easily, like the branches of trees, while water is made of more slippery parts, like those which have the shape of eels.

17. Descartes (2004, 18)

> But experience shows that water is more fluid and harder to freeze than oil. Ergo, etc. (CSM III. 65 / AT I 422-3)

Descartes goes on to give several other "syllogisms" of this form. When taken together, they're supposed to "amount to a proof of it." The explanans (O) here is the fact that water is more fluid and harder to freeze than oil. The explanandum (E) is the hypothesis about the relative slipperiness of the parts of oil and water. The form of this sort of hypothetical explanation (following Clarke (1982, 114)) goes like this:

> If O, then probably E.
>
> O
>
> So probably E

While this is technically an answer to how you *confirm* E, it's easy to see how this becomes an *explanation* of O. Clarke writes elsewhere that

> In more general terms, a Cartesian account of any physical phenomenon involves locating an appropriate description of the explicandum within a broader framework in such a way that the description is deducible (in a rather loose, Cartesian sense) from a description of parts of matter, their motions and their interactions.[18]

This looks strikingly like (SE)! As a result, we can infer that (SE) is a sensible thing to attribute to Spinoza given his context. But there's at least one part missing from Clarke's account: the role of laws in this deduction. It is implicit, perhaps, in the talk about the interactions of bits of matter and their motions (which are law- or rule-governed). But

18. Clarke (1982, 111)

to be a full account, this must be made explicit. This is because Descartes thinks that all change in the material world is governed by natural laws:

> For it necessarily follows from the mere fact that [God] continues to preserve it thus that there may be many changes in its parts that cannot, it seems to me, properly be attributed to the action of God, because this action never changes, and which I therefore attribute to Nature. The rules by which these changes take place I call the Laws of Nature.[19]

Consequently all the motions and interactions Clarke analyses have to be deducible from the laws of motion (e.g. the ones in chapter 8 of the *Treatise on Light*), together with information about matter and its initial conditions. Again, the resemblance to (SE) is striking.

There is one important way that Descartes and Spinoza differ on my reading. Descartes does not require his explanatory hypotheses to be *true*. In fact, he explicitly says that hypotheses can be *false* and still do explanatory work. Here he is in *Principles* III.45 (CSM I.256 /AT VIIA.100):

> [I]f we want to understand the nature of plants or of men, it is much better to consider how they can gradually grow from seeds than to consider how they were created by God at the very beginning of the world. Thus we may be able to think up certain very simple and easily known principles which can serve, as it were, as the seeds from which we can demonstrate that the stars, the earth and indeed everything we observe in this visible world could have sprung. For although we know for sure that they never did arise in this way, we shall be able to provide a much better explanation of their nature by this method than if we merely described them as they now are <or as we believe them to have been created>.

19. Descartes (2004, 25)

A little later on (at *Principles* III.46 (CSM I.256-7 / AT VIIIA.101)), he seems to endorse some kind of instrumentalism (a view where the truth of theories or hypotheses is irrelevant to their role in science):

> Since there are countless different configurations which God might have instituted here, experience alone must teach us which configurations he actually selected in preference to the rest. We are thus free to make any assumption on these matters with the sole proviso that all the consequences of our assumption must agree with our experience.

See also *Principles* IV.204 (CSM.I.289 / AT VIIA.327):

> *With regard to the things which cannot be perceived by the senses, it is enough to explain their possible nature, even though their actual nature may be different <and this is all that Aristotle tried to do>.*
>
> However, although this method may enable us to understand how all the things in nature could have arisen, it should not therefore be inferred that they were in fact made in this way. Just as the same craftsman could make two clocks which tell the time equally well and look completely alike from the outside but have completely different assemblies of wheels inside, so the supreme craftsman of the real world could have produced all that we see in several different ways. I am very happy to admit this; and I shall think I have achieved enough provided only that what I have written is such as to correspond accurately with all the phenomena of nature.

So whether these causal mechanisms Descartes articulates are the ones that *actually* brought about variation in the material world doesn't matter. All he needs are hypotheses that allow us to infer the observed phenomena. Clarke draws a different conclusion (see Clarke (1982, Chapter 6)), but I think that these texts run the gamut from suggestive to decisive on this point.

But this isn't a dissertation on Descartes. Examination of the minute details of Descartes' view would take us too far afield. What's relevant for us is that Spinoza seems to have read this kind of instrumentalism into Descartes. He (Spinoza) writes in his geometrical re-working of the *Principles* that:

> [S]ince the best way to understand the nature of Plants and of Man is to consider how they gradually come to be and are generated from seeds, we shall have to devise such principles as are very simple and very easy to know, from which we may demonstrate how the stars, earth and finally all those things that we find in this visible world, could have arisen, as if from certain seeds—even though we may know very well that they never did arise that way. For by doing this we shall exhibit their nature far better than if we only described what they now are. (C.I.295 / G.I.226)

And a little further down, we get this:

> We have said, finally, that we are permitted to assume a hypothesis from which, as from a cause, we can deduce the Phenomena of nature, *even though we may know very well that they have not arisen in this way* [emphasis mine]. (C.I.295-6 / G.I.227)

Should we attribute this view on the role of false hypotheses to Spinoza? McKeon (1928) does. He reads Spinoza as basically a pragmatist about scientific hypotheses. For his Spinoza, "to explain the phenomena of nature, absolutely any hypothesis may be formed, provided only that it be clear and simple and that the phenomena of nature can be made to follow from it by mathematical inference."[20] This reading derives from part III of the work we just quoted:

> We have said, finally, that we are permitted to assume a hypothesis from which, as from a cause, we can deduce the phenomena of nature, even though

20. McKeon (1928, 116)

> we may know that they may not have arisen in this way...we are permitted to assume any hypothesis we please to explain the features of nature, provided that we deduce all the Phenomena of nature from it by mathematical consequences.
>
> And what is more worthy of note, is that we shall hardly be able to assume anything from which the same effects could not be deduced, though perhaps with more difficulty, through the Laws of nature explained above. (C.I.295-6 G 1/227-8)

This passage and others look like pretty good evidence for McKeon's reading. Spinoza seems to be saying outright that any old hypothesis is as good as any other, provided it saves the phenomena, is simple, and so on. These conditions can be me even when the explanation offered isn't the *correct* one. But there are at least three reasons to doubt that this evidence is as good as it seems.

First, there is excellent textual reason to believe that Spinoza does not endorse everything in this work. In its preface, Lodewijk Meyer writes:

> I should like it to be particularly noted that in all these writings...our Author has only set out the opinions of Descartes and their demonstrations...So let no one think that he is teaching here either his own opinions, or only those which he approves of. Though he judges that some of the doctrines are true, and admits that he has added some of his own, nevertheless there are many that he rejects as false and concerning which he holds a quite different opinion. (C.I.229 / G.I.131)

From this, I infer that we shouldn't think, just because Spinoza articulates a view in this work, that he endorses it. If there is good evidence from other works that he did hold this view, then we can impute it to him in good conscience. But if there is no evidence, or if it conflicts with other views he holds, we shouldn't attribute it to him.

Second, we've established that truly explanatory hypotheses involve both laws of nature and the essences of the constituents of the causal narrative. Truths about essences, if known at all, must be known adequately. I will argue for this claim in a later chapter. For now just take my word for it. Moreover, the explanations that Spinoza actually offers are causal. This is important because he holds (in EIa4) that the cognition of an effect depends upon a cognition of its cause. So any causal narrative which includes false hypotheses about a thing's causes cannot produce adequate cognition of that thing. So if we want explanations to produce adequate cognition of how a thing came to be, we cannot offer false explanations. To produce such cognition, an explanation must correctly detail the causal trajectory of the thing being explained.

Third, as we saw in a previous section, cognition of a thing's essence necessarily involves cognition of its proximate cause. If we introduce a false hypothesis about the proximate cause of some bit of a causal narrative, then we fail to get at the true causal trajectory of the thing. And this doesn't produce adequate cognition. As a result, if we think that what Spinoza wants from an explanation is adequate cognition of a thing (and there is excellent reason to think he does), Spinoza can't actually believe the view he puts forth in the PCP.

There's a potential complication. To see what it is, I have to distinguish between a how-actually explanation and a how-possibly one. A how-actually explanation tells us how that thing is *actually* explained. A how-possibly explanation only gives us a potential explanation of the thing being explained. It can give some mechanism which may have produced it, but makes no pretense to giving the *true* one.

Now, the potential complication is that Spinoza appears to offer a how-possibly explanation in the demonstration of EIIp17cor. The explanandum there is the ability of the mind to think of non-existent or non-present external objects "as if they were present". The demonstration Spinoza gives is quite unlike any other demonstration that Spinoza gives anywhere else in the *Ethics* that I can find. Instead of giving a quasi-mathematical

proof, what he offers us is a physiological (and at bottom physical) story of how these images are produced. The precise details of this account are interesting, but not relevant here. What *is* relevant is what Spinoza writes in the scholium to EIIp17cor:

> We see, therefore, how it *can* [emphasis mine] happen (as it often does) that we regard as present things that do not exist. This can happen from other causes also, but it is sufficient for me here to have shown one through which I can explain it *as if I had shown it through its true cause*; still, I do not believe that I wander far from the true [cause] since all those postulates which I have assumed contain hardly anything that is not established by experience which we cannot doubt, after we have shown that the human Body exists as we are aware of it (see P13C) [emphasis mine throughout].

The problem should now be pretty clear. In this passage, Spinoza explicitly says he is fine with causal explanations that don't mirror actual causal mechanisms.

I admit this counts against my view. But Spinoza says things here which bring him closer to how I have read him. For example, after he has said that he is giving something like a how-possibly explanation, he nonetheless goes on to say that he doesn't think the explanation he has offered is very far off from the real one. He explicitly says that the hypotheses he uses are ones which "contain hardly anything that is not established by experience which we cannot doubt." This indicates, at the very least, a sensitivity to the truth of explanatory hypotheses, and therefore to the truth of explanations of particular phenomena. In any case, I think the balance of the evidence shows that even if Spinoza *were* here committed to how-possibly explanations being able to yield adequate cognition (which I doubt), this should be construed as a departure from his considered view.

2.6 Wrap-up

The first part of the dissertation is now complete. I've argued, first, that Spinoza views everything in nature as having and requiring explanation. Substance is self-explanatory, and modes (including events) must have explanations that involve their essences, their proximate causes, and the natural laws which govern them. The type of explanation we can reconstruct from his views bears notable resemblances to prominent modern accounts, but departs from them in interesting ways. These explanations are not merely how-possibly explanations, but how-actually explanations.

That battle has now been fought and won. Its spoils are the official account of Spinozistic explanation, given by (SE). The rest of the dissertation will be a mop-up action. There are still questions that we might want to answer about (SE). For example, how do we come to know the essences which any true explanation requires? What of explanations which involve mathematical concepts – can those be adequate? And, perhaps more pressingly, what about teleological or final-causal explanations? We now turn to these questions.

Chapter 3

Descartes, Spinoza, and Suárez on Irrational Teleology

In this and the next chapter, I'll examine what Spinoza has to say about final-causal or teleological explanations. Most of what I conclude will be negative: Spinoza rejects teleological and final-causal explanations wholesale. Every correct explanation is an efficient-causal one. I will explore the arguments for and implications of this position in the next chapter. But before we get to that, we need to do a little stage setting.

In this chapter, I want to put the attacks that Spinoza and Descartes make on final causes in the context of the late Scholastic positions on final causality. I'll argue that their polemics against final-causal explanations make more sense when read against this context than against, for example, that of Thomas Aquinas. To do this, I'll first discuss these polemics. Next, I'll set forth and examine the views of Aquinas and Francisco Suárez, in that order. Subsequently, I will give a reading of each polemic through the lens of Suárez's declaration that in order for an end to be a cause, it must be cognized. I choose Suárez for this purposes not because he stands out amongst the late Scholastics, but because he is representative of their views on final causality.[1]

In the next few chapters I'll often treat teleological and final-causal explanations inter-

1. For an admirably detailed survey of these, see Des Chene (1996, Chapter 6)

changeably. This is, in a sense, sloppy of me. A generic way of characterizing teleological explanations is as an answer to a "why" question which contains "in order to" or "for the sake/purpose of" or some similar locution.[2] A final-causal explanation can be understood as supplying this sort of answer against a particular metaphysical background. To conflate the two, one might grumble, is to confuse species with genus.

While I don't dispute the distinction the grumbler presents, I contend that this sloppiness is warranted. I'm going to discuss final-causal explanations insofar as they are a type of teleological explanation. The particular metaphysical background against which they are positioned is important, from an historical standpoint, but not as relevant to my discussion. I'll keep the vocabulary of final-causal explanations mostly because my subjects (Descartes and Spinoza) do this, but I will not import the Scholastic metaphysics which they strictly speaking presuppose (much as they do not).

3.1 Descartes' and Spinoza's attacks on final causes

3.1.1 Descartes

Descartes' dismissive attitude towards final causes is well-known. He writes in Principles I.28 that "[w]hen dealing with natural things we will, then, never derive any explanations from the purposes which God or nature may have had in view when creating them...For we should not be so arrogant as to suppose that we can share in God's plans." (CSM.I.202 / AT.VIIIA.15) In Meditation IV he writes that "for this reason alone I consider the customary search for final causes to be totally useless in physics; there is considerable rashness in thinking myself capable of investigating the <impenetrable> purposes of God." (CSM.II.39 / AT.VII.55) And in the Fifth Set of Replies, he writes:

2. See for instance Skow (2016, 18, Chapter 6), Wright (1976), Nagel (1961, 403), Taylor (1970, 84), Sehon (1997, 195–6), Achinstein (1978, 551–2) and Bedau (1992). I should note that I am gliding over a distinction between functional and teleological explanations here; functional explanations also contain "in order to", but it is a matter of debate as to whether they are teleological in the right sort of way.

> The function of the various parts of plants and animals etc. makes it appropriate to admire God as their efficient cause — to recognize and glorify the craftsman through examining his works; but we cannot guess from this what purpose God had in creating any given thing...[I]n physics, where everything must be backed up by the strongest arguments, such conjectures are futile...Nor should you pretend that none of us mortals is incapable of understanding other kinds of cause; they are all much easier to discover than God's purposes, and the kinds of cause which you put forward as typical of the difficulties involved are in fact ones that many people consider they do know about. (CSM.II.258 / AT.VII.374-5)

The arguments that Descartes puts forward in these passages goes like this. For final causes to be useful in natural philosophy, we'd have to know God's purposes. But we can't know these, so final causes aren't useful in natural philosophy.

Here we're most interested in the first premise. Why, we might ask, is Descartes entitled to it? It presupposes that the only way final causes could be useful to natural philosophy is through divine teleology. If an extended substance is directed at an end, Descartes seems to think, it could only be so directed by God.

Descartes is not wholly consistent on this. He does offer some teleological explanations in his physiology. When offering a description of the natural dispositions of the "tiny fibres that make up the substance of the brain"[3], he explicitly invokes God's actions:

> [I]n order to show you in what the natural [dispositions] consist, consider that, in forming them, God so disposed these tiny fibres that the passages He left between them are able to conduct the spirits, when these are moved by a particular action, toward nerves which allow in this machine just those movements that a similar action could incite in us when we follow our nat-

3. Descartes (2004, 162)

ural instincts. instincts.[4]

This passage assumes that God carried out a certain action – leaving certain passages between fibers – for a certain purpose – allowing the spirits to be conducted towards certain nerves. It is hard to excise the teleological tenor of this text.[5] This isn't the only place where Descartes does this, either. In Meditation VI he writes:

> My final observation is that any given movement occurring in the part of the brain that immediately affects the mind produces just one corresponding sensation; and hence the best system that could be devised is that it should produce the one sensation which, of all possible sensations, is most especially and most frequently conducive to the preservation of the healthy man. And experience shows that the sensations which nature has given us are all of this kind; and so there is absolutely nothing to be found in them that does not bear witness to the power and goodness of God. (CSM.II.60 / AT.VII.87-8)[6]

Here Descartes makes a striking claim: Experience shows us that our constitution is the one best suited for securing human health. This constitution is given to us by God, and so an appeal to divine purposes is not only implicit but required. Dennis Des Chene writes that "In Descartes' physiology, the operations of the body, though undoubtedly physical, cannot be completely understood except by referring them to ends...the role of norms in defining the functions of the body must be acknowledged, and with it that of the rational agent, God, whose intentions in creating animals establishes those norms. The ban on the consideration of ends in natural philosophy must be lifted."[7]

But this inconsistency (be it real or merely apparent) shouldn't distract us from the fact that the teleological explanations Descartes uses involve essential reference to an in-

4. Descartes (2004, 163)

5. For a broad treatment of teleological and functional language in Descartes' physiology, see Des Chene (2001, Chapter 6)

6. See Simmons (2001) for more on Descartes' teleological account of sensation.

7. Des Chene (2001, 140)

tentional divine agent. Matter by itself is inert, and cannot intend any ends. This point is echoed by later Cartesians. For instance, Claude Clerselier writes to Pierre de Fermat, criticizing Fermat's derivation of the sine law of optics, that

> [t]hat path which you estimate to be the shortest because it is the most quick, is nothing but a path of error and confusion which nature does not follow and cannot have intention to follow. For, as she [nature] is determinate in al that she does, she never tends to anything except to conduct her movements in a straight line.[8]

The principle Fermat relied on was that "Nature always acts in the shortest ways." Clerselier's criticism is that (extended) nature can't act in that way, since it can't intend *anything at all*. The assumption here is that for something to have a goal (in this case, taking the shortest way) some kind of cognitive activity is required. If it were permissible to invoke divine purposes in physics, then one could reintroduce this kind of cognitive teleology. But, as we have seen, Descartes officially rejects this.

3.1.2 Spinoza

Spinoza's attacks on final causes center around two passages in the *Ethics*, EIapp and EIVpref. In the former, Spinoza makes his intention plain quickly:

> All the prejudices I here undertake to expose depend on this one: that men commonly suppose that all natural things act, as men do, on account of an end; indeed, they maintain as certain that God himself directs all things to some certain end. (EIapp / G.II.78)

Here, Spinoza targets the idea that God directs nature to some end. This strikes at some views which were prominent at the time of writing. To study nature, on one view, was to uncover the plans God embedded in it. Douglas (2015a) notes that

8. OF II 468-9; translation my own. For a treatment of this controversy see Dugas (1988, Chapter 5 §2)

> [o]n this pre-modern view, there was no division between the task of understanding the causes of natural phenomena on one hand and that of drawing moral and spiritual inspiration from nature on the other…To ask for an explanation of some natural phenomenon was not only to ask what the natural cause of that phenomenon was, but also to ask what role it played in God's final purpose.[9]

This attitude is illustrated nicely by, of all people, Sherlock Holmes:

> Our highest assurance of the goodness of Providence seems to me to rest in the flowers. All other things, our powers, desires, our food, are all really necessary for our existence in the first place. But this rose is an extra. Is smell and its colour are an embellishment of life, not a condition of it. It is only goodness which gives extras.[10]

Spinoza, as one might expect, is not having any of this. As I read it, his argument in EIapp has two parts. First, there's an etiological stage. Here he gives an explanation of how it is that people come to give final-causal explanations, on the assumption that they are false. His argument here proceeds from the thesis that "all men are born ignorant of the causes of things, and that they all want to seek their own advantage, and are conscious of this appetite." (EIapp / G.II.78) This given, he proceeds to tell an elaborate story about the emergence of the belief in natural or divine purposes. This story is elaborate and draws some of its character from earlier works in Jewish philosophy.[11]

In this stage Spinoza makes a great show of deriding the popular prejudices that certain natural phenomena. He writes mockingly about people who assume that "storms, earthquakes, diseases, etc." (EIapp / G.II.79) are intended by God or nature. These are

9. Douglas (2015a, 10)
10. Doyle (1970, 455–6)
11. See Melamed (2020, §5.4) for an excellent discussion. Melamed notes that some of the language that Spinoza uses throughout is strikingly similar to that used by Maimonides in the latter's critique of teleological reasoning. (Melamed (2020, 142))

events in extended nature (the earth, lightning, human bodies, etc). So we can infer that, in at least some bits of extended nature, Spinoza denies any role for final-causal or teleological explanations.

Second, there's an argumentative stage. Here Spinoza gives positive arguments that God or Nature has and can have no ends set before him (or it). Here he argues that "Nature has no end set before it, and that all final causes are nothing but human fictions." (EIapp / G.II.80) His argument here has two main prongs. First, he says that since "all things proceed by a certain eternal necessity of nature," final-causal explanations are illegitimate. (EIapp / G.II.80) Second, he writes that

> this doctrine concerning the end turns nature completely upside down. For what is really a cause, it considers as an effect, and conversely. What is by nature prior, it makes posterior. And what is supreme and most perfect, it makes imperfect. (EIapp / G.II.80)

I won't go into these arguments in detail here. All I'll say is that the first two points in this argument seem utterly question-begging. It is certainly true that, if all causation is efficient causation, then the charge of confusing causes for effects finds purchase in people who treat ends or goals as causes. But of course this thesis can't then be used to argue for the position that all real causes are, in fact, efficient causes. Much the same holds for the claim about confusing prior and posterior. In the next chapter, however, I'll develop in detail a line of argument from some of Spinoza's other views that rule out any legitimate or true final-causal explanations.

But notice what happens, from a Cartesian standpoint, if the arguments in the second stage (or the ones that I'll develop later) are in fact successful. If Spinoza is right that God has and can have no ends at all, then *any* appeals to final causes in nature collapse. Descartes had to invoke divine purposes to do explanatory work in his physiology, as we saw above. Other than God's (or ours), there are no final causes at all. But if God has

no purposes, then there can be no teleology in the inanimate world *full stop*, whether in physics or physiology.

In EIapp we find passages which Spinoza might be directing against Descartes. Spinoza writes:

> [W]hen they see the structure of the human body, they are struck by a foolish wonder, and because they do not know the causes of so great an art, they infer that it is constructed, not by mechanical, but by divine, or supernatural art, and constituted in such a way that one part does not injure another. (EIapp / G.II.81)

Because, Spinoza says, men do not know the true *mechanical* causes of the body's workings, they explain its functions teleologically. These explanations, of course, refer to Divine purposes. As a result, Spinoza's critique is more far-reaching than Descartes'. It seeks to remove all final causes from a proper philosophical (and hence scientific) analysis of nature.

There's some debate over the scope of this argument. Some commentators (perhaps most notably Garrett 2002) have argued that Spinoza does not intend to condemn final causal explanations wholesale. Dealing with this question will have to wait until the next chapter. For now, I'll only assume that Spinoza's attack on teleology in EIapp is an attack on the idea that God created anything in the world with a particular end in mind. He rejects divine ends, and hence any explanations which appeal to such ends.

3.1.3 A gap in the arguments

There is something peculiar about both Spinoza's and Descartes' arguments against final causes. They both assume that the only way to get legitimate teleological arguments is by invoking *divine* teleology. What makes this peculiar is that there is an important philosophical tradition (starting with Aristotle and running through medievals like Thomas

Aquinas) which holds that this is not so. To see how this interacts with the arguments offered by Descartes and Spinoza, I'll give a brief account out the model of teleological explanation laid out in some of Aquinas' works, the *Summa contra Gentiles*, *De Principiis Naturae*, and the *Summa Theologiae*.

First, let's do some (brief and somewhat over-simplified) table-setting on the Thomistic analysis of generation, focusing primarily on *De Principiis Naturae*. Generation, according to Aquinas (in DPN 1.5) is a motion to form (*motus ad formam*). (Recall that in the Aristotelian-Scholastic tradition, motion in our sense is merely one kind of motion, *local* motion; motion generally is basically just *change*.) This happens when something, say a substance, changes from potentially being something (seated, say), to actually being that thing. What does the moving from potentiality to actuality is called the matter (the material cause), and that from which the matter has existence is form (the formal cause). (DPN 1.2,4) For example, a man can be white, and thus is potentially. But the thing which actually explains a man's actual whiteness once he is white is the form of whiteness. (DPN 1.4)

But these two principles, form and matter (along with a third, privation, which we won't discuss) don't suffice explain generation totally. Aquinas maintains that this is because some matter can't change *by itself* from potentially possessing a form to actually possessing a form, nor can a form *by itself* change itself from potentially being in matter to actually being in matter. Here we can hear the echoes of a causal principle: No change without a change-maker. There has to be an agent, something that changes the matter from potentially having some form to actually having it. And this thing that does the changing is called the efficient cause. It *makes it the case* that the matter has such-and-such form. It is the source the form's being, the thing that acts to bring about the form being in some matter. (DPN 3.1)

But this still doesn't complete our catalog of explanatory categires. Aquinas, following Aristotle, argues that nothing acts except by "intending" something. We'll go into

more detail about what this means in a moment, but the idea seems to be this. To explain why the efficient cause makes the matter take on form A rather than form B, we have to think of the efficient cause as "aiming" at A rather than B. And this thing the efficient cause aims at is the final cause of the process of generation.

Officially, Aquinas thinks that things which lack intellect and will can only tend towards an end if they do so because of the direction of an agent with intellect and will. This is the basis of the Fifth Way, one of Aquinas' arguments for the existence of God:

> [W]hatever lacks intelligence cannot move towards an end, unless it be directed by some being endowed with knowledge and intelligence; as the arrow is shot to its mark by the archer. (ST I q2 a3)

Aquinas reasons from this premise, and the premise that all things in nature act for an end, to (oversimplifying somewhat) the existence of a supreme agent that orders all things towards an end. Later, he writes:

> But those things that lack reason tend to an end, by natural inclination, as being moved by another and not by themselves; since they do not know the nature of an end as such, and consequently cannot ordain anything to an end, but can be ordained to an end only by another. (ST I-II, q1 a2)

And in SCG 3.1.1 he writes: "Still other beings, devoid of understanding, do not direct themselves to their end, but are directed by another being." Here Aquinas infers that, since things without intelligence do in fact act for an end, that they must be directed to that end by some intelligent agent.

I'll now consider Aquinas' premise that things without intellect and will act for an end for a moment. The arguments that he gives for this position, by themselves, do not entail that things without intellect and will cannot act for an end *intrinsically*.[12] First, I'll examine the argument in ST I-II q1 a2:

12. In interpreting these arguments, I am relying on the scholarship of commentators such as Hoffman (2009b), Hoffman (2011), and Davies (2016).

> [M]atter does not receive form, save insofar as it is moved by an agent; for nothing reduces itself from potentiality to act. But an agent does not move except out of intention for an end. For if the agent were not determinate to some particular effect, it would not do one thing rather than another: consequently in order that it produce a determinate effect, it must, of necessity, be determined to some certain one, which has the nature of an end.

What does "intention for an end" mean? We can give a stripped-down definition drawn from ST I-II q12 a1: "Intention, as the very word denotes, signifies, to tend to something."[13] So Aquinas seems to be arguing as follows. Change tends towards one thing rather than another. For this to be so, the thing changing has to tend towards the one change endpoint rather than another. Whatever something tends to is called an end, and hence all change tends towards an end.[14]

Notice that there is no distinction between mindful and non-mindful tending here. The characterization of "intention" is almost dispositional: Things tend to do a particular thing in a particular circumstance.

DPN.3.2 contains a very similar position:

> And because everything which acts, acts only by intending something...there must be some fourth thing, namely that which is intended by that which is doing the work. This is said to be the end.

Aquinas continues:

> [I]t should be understood that, although every agent, both natural and voluntary, intends an end, it does not follow nonetheless that every agent knows, or deliberates about, the end.

13. Suárez seems to recognize a similarly weak definition of intention in *De voluntario et involuntario* 6.1.2: "To *intend* by a certain meaning is to tend towards another... and sometimes inanimate things are said to intend their ends." He does, later in the same work (at 6.1.3), say that properly speaking intention is a certain act of the will.

14. For ease of exposition I'm eliding the Thomistic distinction between changes, which require an endpoint, and activities, which don't.

Aquinas thinks that, while deliberation and cognition of an end is necessary in the case of agents whose natures don't by themselves determine their action, it isn't necessary in the case of agents who simply have a natural or essential tendency to act in a certain way. He concludes:

> It is possible, therefore, that a natural agent intend an end without deliberating about it. And this intending is nothing other than having a natural inclination toward something.

Note that the sense of "intention" at play here is the same as in the *Summa Theologiae*. Aquinas gives a different argument in the *Summa Contra Gentiles*:

> Just as the entire likeness of the result achieved by the actions of an intelligent agent exists in the intellect that preconceives it, so, too, does the likeness of a natural resultant pre-exist in the natural agent; and as a consequence of this, the action is determined to a definite result. For fire gives rise to fire, and an olive to an olive. Therefore, the agent that acts with nature as its principle is just as much directed to a definite end, in its action, as is the agent that acts through intellect as its principle. (SCG 3a.2.8)

A "natural" agent is an agent lacking intellect and will. (SCG 3a.2.8) As the examples used (fire, olives) make clear, the argument is meant to apply to both animate and inanimate nature. Here Aquinas relies on the premise that the likeness of some activity's result pre-exists *in* the natural agent. This is stronger than the premise used earlier, that the agent in question tends towards a certain endpoint and not another.

But in both cases, natural agents don't need the guidance of mindful agents to be able to act for an end. Note that this is a position quite different from the one he offered in the *Summa Theologiae* when presenting the Fifth Way. There, the arrow can only fly towards the target because I fire it directed at the target. Any natural agent can only act for an end if it is so directed by an agent with intellect and will.

My point here is not to imply that Aquinas held positions that were mutually inconsistent.[15] It is simply this. First, there are two strands in his thought, spanning different works. Second, one could consistently hold the one and not the other. In other words, one can consistently hold, given the arguments Aquinas offers, that natural agents don't need the action of mindful agents to act for an end.

Hoffman (2011) makes this point the crux of an argument against Spinoza's (and thus Descartes') polemics against final causation. He starts from the premise that both Spinoza and Descartes made inertial motion an important part of their systems:

> The upshot of [these arguments] is that inertial motion, which is the fundamental concept of mechanism and is typically thought to provide the crucial counterexample that undermines Aristotelian final causation, in fact falls under the scope of Aquinas's argument. The central premise of Aquinas's argument is that to tend to x is to have x as an end. Thus we can say on Aquinas's behalf that a body tending to move in a straight line, by that very fact, has the end of moving in a straight line.[16]

We'll look at Hoffman's claim in more detail next chapter. What I want to draw attention to here is that this seems like a counterexample to the Spinozistic and Cartesian critiques. Natural agents need not be directed by mindful agents to tend towards an end. Consequently, non-mindful agents can exhibit teleological behavior without some sort of direct divine intervention. Why, then, does neither of them deal with this objection? Why does each, instead, simply argue against divine teleology? Why do they implicitly assume that such teleology is the only game in town?

I don't claim to know the *actual* reasons for this choice. I do want to claim, however, that this oversight makes more sense when we read Spinoza's and Descartes' arguments

15. Though others have argued that there are other tensions in Aquinas' thought; see for instance Schmid (2011).

16. Hoffman (2011)

against the backdrop of later Scholastics – I will choose Francisco Suárez as a representative of these – rather than Aquinas.[17] Simply on a chronological level, this makes more sense. And since there are (as we'll see) substantive differences between later Scholastics and Aquinas, it makes good philosophical sense as well.

While there were other Scholastic writers closer to Spinoza, I focus on Suárez for two main reasons. First, his account is arguably the most worked-out one available. Second, it's very close to, if not the same as, that taken by writers such as Adriaan Heereboord and Franco Burgersdijk. Both of them were influential in early modern Dutch philosophy, and Spinoza would've been familiar with their works. Burgersdijk, for example, writes that that "[the] intelligible being or cognition of the end is a necessary condition for the exercise of the final cause, just as propinquity is necessary to efficient causality."[18] As we will see, this is almost exactly what Suárez's view on final causality is as well.[19] And Heereboord thinks roughly the same thing. He puts the following disputation forward in his *Meletemata philosophica*:

> Intelligible being of the end is a necessary condition for final causality to be exercised , or [*seu*], it is necessary for the practical cognition of the end to intercede. But it is not given to natural things...to know their end. Therefore they do not act for an end.[20]

By "natural things", Heereboord means inanimate objects and vegetative things.[21] In putting this disputation forward, Heereboord wants to argue for its *negation*. He wants to show that "all natural things act on account of an end" because of God's direction.[22] But he doesn't do this by rejecting either the idea that natural things do not have knowl-

17. This kind of contextualization against later Scholastic views is not unique to me. Sangiacomo (2016), for instance, contextualizes Spinoza's attack on final causes against the backdrop of Adriaan Heereboord, likely a teacher of Spinoza's, who adopted many late Scholastic assumptions concerning final causality.
18. Burgersdijk (1640, 182); translation mine.
19. See Ruestow (1973, Chapter 2) for details of Burgersdijk's role in late Dutch Scholasticism.
20. Heereboord (1665, 267); translation mine throughout.
21. Heereboord (1665, 267)
22. Heereboord (1665, 267)

edge of their ends or that "intelligible being" is a necessary condition for final causality. Instead, he affirms that God has knowledge of their ends, and therefore He directs their actions accordingly.[23]. As we'll see, this is basicaly Suárez's position.

Much of what I said above about Spinoza is also true of Descartes. Perhaps even more strongly, too, for we have good reason to think Descartes read Suárez. He directly references the *Disputationes Metaphysicae* in the Fourth Set of Replies, in his account of material falsity. (AT VII 235 / CSM II.164) To contextualize Descartes against the background of a Suarezian conception of final causation seems appropriate.

Suárez's account of final causation was also very similar to that of other authors with whom Descartes would've been familiar. Take Eustachius a Sancto Paulo, a Cistercian monk whose work *Summa philosophiae quadripartita* (originally published in 1609) was used extensively as a textbook in the beginning of the seventeenth century. We have good reason to believe that Descartes was familiar with it, since praises it as "the best book of its kind ever made." (AT III.232 / CSMK 156) In the second part of that work, Sancto Paulo engages the question of whether "all men act on account of an end."

Sancto Paulo says that things act on account of an end in two senses. The first or "absolute [*absolute*]" sense is when a thing "acts for the sake of some thing [*alicuius rei gratia operatur*], whether it cognizes the end or that thing, or not; or, also, whether it directs itself towards that end, or whether it is directed towards the same by another."[24] He concludes that, in this sense, "all things act on account of an end," since in this sense "all agents, when they act, intend some good towards which either they direct themselves or are so directed by the author of nature."[25] The second, and "indeed more proper" sense, is when "it acts for the sake of some thing, and tends towards that thing such that it cognizes it [*ut illum cognoscat*] it, and directs itself towards it [*ad illum se et sua dirigat*]."[26]

23. Heereboord (1665, 267)
24. a Sancto Paulo (1647, II.13–4). Translation my own throughout.
25. a Sancto Paulo (1647, II.13–4).
26. a Sancto Paulo (1647, II.13–4).

In this sense, "it is only proper to intellectual creatures to act for the sake of an end."[27] Thus, strictly speaking, only beings with intellect act for an end. As we shall see, this is basically Suárez's view.

Margart Osler writes that "in the hands of many of the seventeenth-century natural philosophers final causes came to be understood as imposed from without rather than as immanent."[28] I heartily agree. Both Descartes and Spinoza are hostile to final causes because they think the only ones there can be come from God. What I want to argue here is that this understanding began before the seventeenth-century mechanists came along, by *at the latest* Suárez's time. I'll now go into his views in detail.

3.2 Suárez on irrational final causality

Suárez begins DM XXIII.10.1 by inquiring "whether true final causality may intercede in the actions of natural and irrational agents". At this point he has already dealt with those possessing intellect and will. He takes it for granted that "each natural agent has, from the propensity of its own nature, a definite operation, and way of operating, and a certain terminus to which it tends by its own operation." (DM XXIII.10.3) This by itself might trigger the inference to the existence of true final causality in natural agents. It would, though, only if we stuck with the thin view found in our examination of Aquinas. Suárez states outright that "[natural agents] act not by chance and blindly but by tending in a definite way to some fixed target…[T]hese natural agents operate, not by accident or chance, but by a definite way of tending to another certain target." (DM XXIII.10.3)

Suárez goes on to question whether this suffices for considering natural agents to act for an end, and "whether their actions can properly be said to be caused by the final cause." (DM XXIII.10.4) One of his reasons for this doubt that "the end, with respect to these actions, is not as a principle, but only as a terminus" (DM XXIII.10.4) The question

27. a Sancto Paulo (1647, II.13–4).
28. Osler (1996, 391)

here is whether a thing's towards a certain determinate end suffices to make the end the cause of the action. This, as we saw above, is one of Aquinas' views.

Suárez does think that the actions of natural agents genuinely have a final cause, "not as coming out of the natural agents themselves, but as they at once are from the first agent, which operates in and through all things." (DM XXIII.10.5) In this sense, he agrees with Aquinas' official position. But to understand the motivations for his view, we have to look more closely at where he defines the term "principle."

Suárez proffers the following definition: "something is called a principle because of some per se habitude [*habitudinis*][29] between itself and that of which it is a principle such that the latter in some way would come to exist per se from the former." (DM XII.1.5) What we're interested in now is when this happens by a "positive influx and communication of its [the principle's] own being." (DM XII.1.5) This "true influx" is what makes a cause a cause (and hence what makes a principle a cause). (DM XII.3.17) In this sense, that of "granting being," a terminus is not a principle. For "the end is last in execution [but] is first in intention and *under that reckoning* [*sub ea ratione*, emphasis mine] has the true nature of a principle." (DM XII.3.3; see also XXIII.1.10)

Here Suárez isn't using "intention" in the stripped down sense of just tending towards something determinate. We can conclude this because he states that "for the end to cause, it is altogether necessary that it be foreknown [*praecognitus*]." (DM XXIII.7.2) It's clear, then, that simply intending an end, in the thin sense, doesn't make that end a principle or a cause. A natural thing can intend some end in the thin sense, but not in the think sense of cognizing that end.

Here I read Suárez as making the following argument:

1. In order for an end to be a cause, it must be a principle.

29. Another possible translation might be "disposition" or "relation". *Habitudo* and its cognates often denoted a logical relation between terms in the medieval period. Thinkers such as Peter Tartaretus (see Bellucci (2016, 54)), and Rodolphus Anglicus (see Green-Pederson (1983, 306)) conceived of it as a relation between antecedent and consequent in a conditional. Suárez, on the other hand, seems to have distinguished between relations generally and *habitudines* specifically; see for example Penner (2013, 3, fn. 13). I will follow Penner in using the archaic "habitude" to mark out a distinguished category of relation.

2. Mere termini are not principles.

3. All that natural agents have by themselves are termini.

4. So all natural agents have by themselves is a terminus, and not an end.

Suárez argued for (2) and (3) in the passage we just saw. Note that Aquinas, on his thin view, would reject (2): a mere terminus, and hence something not cognized by the agent, may be a principle. So what Suárez has to show is that for an end to be a cause, it must be cognized. Aquinas explicitly denies this:

> [A]lthough every agent, both natural and voluntary, intends an end, still it does not follow that every agent knows the end or deliberates about the end. To know the end is necessary in those whose actions are not determined, but which may act for opposed ends (as, for example, voluntary agents). Therefore, it is necessary that these know the end by which they determine their actions. But in natural agents the actions are determined; hence, it is not necessary to choose those things which are for the end. (DPN 3.2)

There are good systematic grounds for Suárez to accept what I attributed to him just above (that to cause an end must be cognized). In DM XXIII.7.3 he argues as follows:

> [I]n order for a real cause to cause, it needs to be somewhere. But the final cause does not necessarily postulate the being of real existence properly and in itself. Therefore, it at least requires being in cognition, and so it happens that the end often causes when it does not exist, as was seen above, but never if it not be cognized.

Here's the argument as I read it. For something to be a cause, it has to exist in some way. But something's being an end doesn't imply its existence out in the world. I can intend to go to the store and buy some milk. But this by itself doesn't thereby bring it

about that I go and buy the milk. My efforts might also be frustrated, so that the end *never* comes about. I might trip and sprain my ankle, or my car battery may die. So it seems clear that intending an end doesn't effect[30] it.

If the end doesn't exist "out there," the other alternative is for it to exist the way that the objects of thought do (whatever that happens to be). And, remember, the end has to exist somehow to be a cause or principle. So if it is a cause or principle (and Suárez thinks it is), it must exist as an object of thought.

So, Suárez concludes, all final causation requires some cognitive relation between agent and end. This eliminates final causes which use the thin sense of intention as detailed by Aquinas. On Suárez's view, these aren't genuine causes *at all*, and hence not genuine *final* causes. And it's pretty clear why. If for x to be y's principle is just for x to produce y *per se*, then of course an end that doesn't exist in *any* way can't give its being to x to produce some change. It doesn't have any to give in the first place.

3.3 Descartes and Spinoza in light of Suárez

Now that we have Suárez's view in place, let's go back to Descartes' and Spinoza's polemics, beginning with Descartes.[31]

3.3.1 Descartes

Recall Descartes' main criticism: appeals to final causes don't explain anything. This is because in order for them to do so, we'd have to know God's purposes, which we don't (and can't). Read Thomistically, this seems strange. After all, for some change (a body's change in motion say) to have a final-causal explanation is just for the changing thing to have a natural tendency towards some end. And inanimate matter has just such a tendency to rectilinear motion. So it looks like we can use final causes just fine, even if

30. Yes, I mean "effect," not "affect." Look it up.
31. See Simmons (2001, 50–2) for a reading like the one I'm about to offer.

Descartes' point about God's purposes is correct.

But things make more sense when the background is Suarezian rather than Thomistic. A final cause only causes if it can transfer being to the thing of which it's the cause. Inanimate matter can't do this by itself, since the end configuration of a material change doesn't exist formally (to use Descartes' terminology) until the end of the change, and nothing exists objectively in matter. So if we want to use final-causal explanations, they'll have to be intentional in the thick sense. That is, they'll require a cognitive agent, which can't by itself be material (since no extended substance can think; see Meditation 6 at CSM.II.54 / AT.VII.78 and Principles I.53 at CSM.I.210-11 / AT.VIIIA.25). The only candidate for such an agent in the study of natural philosophy is God. But if Descartes is right, then God's purposes are inscrutable to us. And if that's right, then of course it's pointless to inquire after them. From this, it easily follows that final causes are useless in the study of extended nature.

Somewhat surprisingly, Descartes' position is one of intellectual humility. We're but fallible and limited human beings, despite our impressive ability to grasp the laws of nature. To think that we can share in the plans of an immense and omnipotent God would be the height of intellectual arrogance.

In reading Descartes this way, I depart from commentators such as Machamer (1976). He reads Descartes against Aquinas rather than Suárez. He writes that "it is not really final causes to which Descartes objects, but rather this medieval manner of treating all final causes as fulfilled intentions."[32] He calls this point of view "animistic" and rightly notes that Descartes rejects it.

But if my arguments about Aquinas' views here are correct, this story makes little sense. If Machamer is right, and Descartes viewed final causes as "fulfilled intentions", then he must have in view the thick sense of "intention". But this, as we've seen, is not the Aquinas' view. Or at least, it isn't the only one. He explicitly denies that agents need

32. Machamer (1976)

to cognize an end to act with it as their end. This renders the animism charge impotent. If, on the other hand, we read Descartes as objecting to the thick sense of intention, then it is not Aquinas he objects to. Instead he must be criticizing philosophers like Suárez.[33]

3.3.2 Spinoza

Some commentators have noted the late Scholastic background of Descartes' criticism. But I believe the late Scholastic context of Spinoza's attack on final causes has not been given the attention it deserves. To take just one exanple, Carriero (2004) has given a very elegant reading of Spinoza's views on final causation against a Thomistic backdrop. Such readings are often illuminating, but they are not the whole story.

We saw that Descartes' criticism of final-causal explanations comes from a place of epistemic humility. But Spinoza has no such modesty. He claims to have shown that God has no goals whatsoever. Any attributions of end-directed activity to God or nature is nothing but human foolishness. This serves, for all practical purposes, the same function in a critique of final causality as Descartes' argument, provided that we use the background provided by Suárez. If the only way that natural agents could have ends is through divine agency, its absence vitiates final-causal explanations wholesale.

Note also what Spinoza says in EIVpref / G.II.206-7:

> [W]e have shown in the Appendix of Part I, that Nature does nothing on account of an end. That eternal and infinite being we call God, *or* Nature, acts from the same necessity from which he exists. For we have shown (IP16) that the necessity of nature from which he acts is the same as that from which he exists. The reason, therefore, *or* cause, why God, *or* Nature, acts, and the reason why he exists, are one and the same. As he exists for the sake of no end, he also acts for the sake of no end. Rather, as he has no principle or

33. Here I join such commentators as Des Chene (1996, Chapter 6) in reading Descartes against the more temporally proximate Scholastics. By contrast, Brown (2012, 79–81) gives a very straightforward reading of Descartes against Aristotle.

[*vel*][34] end of existing, so he also has none of acting.

So according to Spinoza, God has no end or principle of existing. And, since act and existence come together in God, it follows that he can have no end or principle of acting either. Now if we understand "principle" to mean what Suárez takes it to mean (or something like it), this makes sense. For God to have no principle is for him to have nothing distinct from himself from which he gets being. And since God is self-caused for Spinoza, this needs to be true anyway.

But we should notice something else. Spinoza goes on:

> What is called a final cause is nothing but a human appetite insofar as it is considered as a principle, *or* primary cause, of some thing.
>
> For example, when we say that habitation was the final cause of this or that house, surely we understand nothing but that a man, because he imagined the conveniences of domestic life, had an appetite to build a house. So habitation, insofar as it is considered as a final cause, is nothing more than this singular appetite. It is really an efficient cause, which is considered as a first cause, because men are commonly ignorant of the causes of their appetites. (EIVpref / G.II.207)

There's a lot going on here, and I'll have more to say about it in the next chapter. But for now, note what Spinoza seems to be saying. What we consider final causes *in human action* are nothing but efficient causes. So here he's pushing much further than Suárez would have. We may think that an end is first in intention when we act, and hence is a cause of our actions. But this is just the result of our ignorance. Were we to know the true causes of things, we would come to realize that all that contributes to our actions are efficient causes. Final causes are, in the final analysis, nothing but human fictions.

34. Since Spinoza usually uses *sive* and its cognates to note equivalence rather than a disjunction, I take it that the implication of the use of *vel* here is that no equivalence is assumed.

How far Spinoza has gone from Suárez! The latter held that an end can be a true principle if it's cognized by some being. In Spinoza's terminology, this might mean something like "insofar as some thinking mode has an idea of it". But Spinoza explicitly claims that it is the appetite, and *not* the representation of the end, that causes the action action. What really inflows being, according to Spinoza, is this appetite. This clearly has implications for Spinoza's psychology and theory of action. I'll deal with these in the next chapter.

3.4 Wrap-up

If my arguments in this chapter are right, then we should read Descartes's and Spinoza's attacks on final causes as directed again the late Scholastic position. This is that irrational agents only display teleological behavior insofar as they inherit it from agents with intellect and will. Further, this reading suggests that Spinoza's attack is directed against much more than simply divine teleology. If successful, it would eliminate all non-cognitive teleology as well. This is one line of evidence against a full-blown teleological reading of Spinoza. But it is only one, and it still leaves open whether he would accept teleological explanations of human action. I will turn to this question in the next chapter.

Chapter 4

World Without Ends

In this chapter, I will lay out my case that Spinoza rejects the use all teleological explanations in properly conducted science and philosophy.[1] This runs against a significant strain of recent scholarship which interprets Spinoza as making widespread use of teleological explanations, in both the extended and thinking worlds. My contention, in this chapter, is that this has things fatally wrong. Not only does Spinoza reject teleological explanations in the attribute of `Extension`, he rejects them in `Thought` as well.

This chapter will has four parts. First, I'll lay out my main argument that Spinoza rejects teleology wholesale. In doing so, I'll identify the key premise of the argument – that there are no instances of teleology in `Extension`.

Second, I'll look at arguments against this premise in the secondary literature. I'll assess arguments given by Don Garrett and Paul Hoffman, to the effect that the extended world is shot through with teleology.[2] A key part of my argument is that, for Spinoza, a thing's striving to persevere in its being is not, contrary to many interpreters, teleological. I'll also argue that Spinoza's theory of action conflicts with end-directedness. To the

1. Originally, I my title was original. This produced no small amount of self-satisfaction. Then I discovered that Des Chene (1996, Chapter 10) had beat me to the punch, forcing me to gorge on humble pie. Still, I am content to be treading in such worthy footsteps.

2. Other commentators adopy this general position as well – for instance, Martin Lin (in Lin (2019, Chapter 6) and Lin (2006)). The reason I won't be addressing the arguments Lin offers is that they're not relevant to the key premise of my argument. Lin accepts the premise that "either all natural creatures are governed by teleological principles or none of them are". (Lin (2019, 148)) I'll argue that this is correct, but draw the opposite conclusion: Since Spinoza holds that some natural creatures aren't, none of them are.

extent that we are active rather than passive, we do not act for ends. Finally, I'll conclude that none of the arguments against the key premise of my main argument work.

Third, I'll offer positive arguments for the key premise. In addition to my argument about the *conatus* principle, I'll offer two lines of evidence for the premise. First, I'll argue that the plain meaning of Spinoza's words comes down in favor of the idea that there's no teleology in `Extension`. Second, I'll argue that a thing can't have more than one adequate cause, and hence can't have both a final and efficient cause. Since Spinoza thinks that all things in `Extension` have an adequate efficient cause, nothing in `Extension` has a final cause.

Fourth, and finally, I'll look at the consequences of this rejection of teleology. I'll examine the revisionist stance that Spinoza takes towards teleological explanations, and go into one of his examplesof just how such a revision looks in practice. As opposed to our folk explanations of action, which often involve an "in order to" clause, Spinoza thinks that in mature science and philosophy, there are only non-teleological, "because" explanations.

4.1 The main argument

In this section, I'll offer my main argument. I should be clear about what this argument is intended to show. It is not exactly an exegetical argument about what Spinoza believed (though it is partially that). Nor is it a reconstruction of a less explicit demonstration he is supposed to give. Rather, it is an argument from premises that Spinoza probably accepted, along with arguments that the proponents of teleological interpretations of Spinoza accept, to the conclusion that Spinoza rejects or ought to reject teleological explanations.

Here is the argument:

(P1) If there are no instances of teleology in an attribute, then there are no teleological explanations in that attribute.

(P2) There are no instances of teleology in `Extension`.

(P3) There are teleological explanations in `Extension` iff there are teleological explanations in `Thought`.

So: (C1) There are no "correct" teleological explanations in `Extension`. (from P1, P2)

So: (C2) There are no "correct" teleological explanations in `Thought`. (from P3, C1)

I take "_____ explanation" to mean such an explanation that actually captures the relevant worldly causal structure. A correct teleological explanation would then be one which accurately reflects what happens in the world. So to say that there are no teleological explanations isn't to say that nobody offers them. Instead, it's to say that no such explanation mirrors the real goings-on. Remember: For Spinoza, what counts are causal explanations that latch onto the causal trajectory of whatever is being explained. As a result, an explanation which does *not* do so is no explanation at all. I'm also purposefully leaving the sense of "cause" vague here. I don't want to beg the question against the teleological interpretation of Spinoza. So, at the outset, I'll assume that there is nothing about a causal explanation which keeps it from also being teleological.

Let's be more precise. A teleological explanation is one that captures the causal trajectory of the thing being explained. This trajectory must make reference to a goal or endpoint of the causal process being addressed, and this reference has to be *essential*. Any rephrasing which loses the teleology also loses its hold on the worldly goings-on.[3] This explanation must cite the essences of everything involved in the explanation, the causal history must be law-governed, and it must be positioned against a contrast class.

3. I don't have any particular picture of "causal process" in mind here

On to the premises. (P1) is accepted by proponents of the teleological interpretation of Spinoza. Don Garrett writes that "[n]o proposed teleological explanation, no matter how appealing or compelling, can be correct unless it cites an actual example of teleology."[4] Garrett takes teleology to consist in "the phenomenon of states of affairs having etiologies that implicate, in an explanatory way, likely or presumptive consequences of those states of affairs."[5] On this view, no teleology means no teleological explanations.

(P3) follows from Spinoza's doctrine of parallelism. This is expressed most succinctly in EIIp7 – "the order and connection of ideas is the same as the order and connection of things" – and more fully in EIIp7s: "whether we conceive nature under the attribute of Extension, or under the attribute of Thought, or under any other attribute, we shall find one and the same order, *or* one and the same connection of causes, i.e., that the same things follow one another." One implication of this is that the causal history of some mode of `Extension` is "isomorphic" to the causal history of the mode of `Thought` corresponding to it. This is because, again according to EIIp7s, "a mode of extension and the idea of that mode are one and the same thing, but expressed in two ways."[6] So if the explanation of a particular mode of `Thought` makes essential reference to some endpoint or goal, then so does the explanation of the corresponding mode of `Extension`.

(P2) is the premise defenders of a teleological interpretation of Spinoza will want to reject. So it's the one which I will spend the most time discussing. Let's first turn to arguments offered against attributing (P2) to Spinoza.

4. Garrett (2002, 310)
5. Garrett (2002, 310)
6. See Bledin and Melamed (2020, 5) for a precise formalization of this and other conceptual machinery of the *Ethics*.

4.2 Arguments against (P2)

4.2.1 Don Garrett

The most extensive case for Spinoza as teleological explainer is probably Garrett (2002). On the view expressed there, teleological explanations "[explain] why something is so by indicating what its being so is for."[7] Teleology, for Garrett, is "the phenomenon of states of affairs that implicate, in an explanatory way, likely or presumptive consequences of those states of affairs."[8] And, as we saw just a moment ago, for there to be teleological explanations, there must be some teleology in the world.

According to Garrett, mechanical explanations are ones that "[explain] a state of affairs by indicating how it arises from a previously existing physical structure and the distribution of forces within it."[9] Accordingly, mechanism is "the phenomenon of states of affairs having etiologies that implicate, in an explanatory way, the previous arrangement and distribution of forces within an extended physical structure."[10] As with teleology, Garrett holds that no mechanical explanation works unless what's being explained is an instance of mechanism.

This set up, Garrett argues that "although Spinoza maintains a certain rhetorical distance from the Aristotelian vocabulary of final cause, he fully and consistently accepts the legitimacy of many teleological explanations, at least as I have defined them."[11] He outlines argument as follows:

> First, I will summarize the reasons for interpreting Spinoza as accepting the legitimacy of at least some teleological explanations. Second, I will try to rebut each of five reasons usefully surveyed by Jonathan Bennett (1983; 1984, chap. 9; 1990) for interpreting Spinoza as rejecting all teleological explana-

7. Garrett (2002, 328)
8. Garrett (2002, 328)
9. Garrett (2002, 328)
10. Garrett (2002, 328–9)
11. Garrett (2002, 329)

tions. Third, I will appeal to Spinoza's distinction among three kinds of knowledge to indicate how teleological explanations can be accommodated within his mechanistic worldview.[12]

For now, I'll examine the first and third lines of evidence.

4.2.1.1 Evidence from Spinoza using teleological explanations

The first line of evidence that Garrett draws on is that Spinoza offers what look very much like teleological explanations throughout his work. For example, Spinoza writes, in TdIE §§1-14,that much human activity is directed towards the ends of "wealth, honor, and sensual pleasure"[13] Indeed, the entire beginning of TdIE is saturated with apparently goal-directed language. Spinoza speaks of inquiring "whether there was something which, once found and acquired, would continuously give me the greatest joy, to eternity," (TdIE §1) and about whether he "would be forced to abstain from seeking [honor and wealth] if I wished to devote myself seriously to something new and different." (TdIE §2)

Spinoza also writes in TdIE that "all those things men ordinarily strive for, not only provide no remedy to preserve our being, but in fact hinder that preservation, often cause the destruction of those who possess them, and always cause the destruction of those who are possessed by them." (TdIE §7) He goes on to give some examples. For instance, he writes: "Nor are there fewer examples of people who, to attain or defend honor, have suffered most miserably." (TdIE §8) Here Spinoza again seems to endorse teleological explanations. There are things that people strive for, things which people take as goals.

4.2.1.2 Evidence from human ends

The second line of evidence that Garrett draws on is some remarks Spinoza makes in EIapp. According to Garrett, while the thrust of EIapp certainly is anti-teleological, the

12. Garrett (2002, 329)
13. Garrett (2002, 330)

teleology it targets is just *divine*. Human ends, at least, are still acceptable. He bases this conclusion primarily on two passages found in that appendix:

> All the prejudices I here undertake to expose depend on this one: that men commonly suppose that all natural things act, as men do, on account of an end.
>
> Men always act on account of an end, namely, on account of their advantages, which they want. (EIapp / G.II.78)

This looks like an obvious endorsement of human teleology. If men act on account of an end, then we have a genuine instance of teleology. Some causal process is explained by essential reference to its goal or endpoint. According to Garrett, "[s]uch explanations would be teleological in the sense that I have defined."[14]

4.2.1.3 Evidence from the *conatus* of singular things

The second line of evidence that Garrett draws on is Spinoza's doctrine of universal *conatus*. This doctrine is found in EIIIp6 (C.I.498 / G.II.146)):

> Each thing, as far as it can by its own power [*quantum in se est*], strives to preserve in its being.

Garrett notes that the unrestricted language of "each thing", which according to EIIIp6d means each finite singular thing, implies that this striving applies to such thing – organic or inorganic, mode of `Thought` or mode of `Extension`.[15] Garrett interprets EIIIp6 as implying that "Spinoza seems to hold that each thin has at least some causal power whose exertion is a striving or tendency of the thing to persevere in its being."[16]

14. Garrett (2002, 331)
15. Garrett (2002, 331)
16. Garrett (2002, 331)

So we can explain the actions of finite singular things by saying that they strive towards a goal: self-preservation.

4.2.1.4 Evidence from Human Striving

Finally, Garrett thinks some passages in the *Ethics* support a teleological picture of human striving towards certain ends.[17] The passages are:

> We strive to further the occurrence of whatever we imagine will lead to Joy, and to avert or destroy what we imagine is contrary to it, or will lead to sadness. (EIIIP28)

> When we love a thing like ourselves, we strive, as far as we can, to bring it about that it loves us in return. (EIIIp33)

> A free man who lives among the ignorant strives, as far as he can, to avoid their favors. (EIVp70)

According to Garrett, "[e]ach of these claims seems intended to license teleological predictions and explanations of human actions."[18] And on first blush, it's hard to disagree. Each of these propositions can be put in something like the following form: "x φ-ed because humans strive to get ψ." Here, much turns on what the term "striving" (*conatus* and its cognates) means. If it's teleological, then "striving" explanations are too. But if it's not, they need not be.

4.2.2 Paul Hoffman

Hoffman (2011, 2009b), following Carriero (2004), thinks that, to understand Spinoza on final causes, we must understand his Scholastic philosophical forebears. Both he and

17. Garrett (2002, 332)
18. Garrett (2002, 332)

Carriero situate Spinoza's view against that of Aquinas As I argued in the last chapter, this is not the whole story, or maybe even the most important part. But it still produces illuminating distinctions and conclusions.

One point Hoffman brings out is that, for Aquinas, efficient causation presupposes final causation. Aquinas' argument is:

> Matter does not attain form except insofar as it is moved by an agent, for nothing brings itself from potency to act. But an agent does not move except from intention of an end; for if an agent were not determined to some effect it would not do this rather than that. Therefore, to produce a determinate effect it must be determined to something certain which has the nature of an end. (ST IaIIae q1 a2)

Hoffman notes (as I did in the previous chapter) that all that Aquinas means by intention istending towards something. (ST IaIIae q12 a1) No mindfulness is assumed for intentionality, and hence for final causation. The thing in question need only to be disposed to act in a particular way. He writes:

> So Aquinas' argument amounts to this. In order to do one thing rather than another, an agent has to tend to something. What it tends to has the nature of an end. Therefore, efficient causation presupposes final causation.[19]

He goes on to argue that inertial motion counts as tending towards an end under this broad definition. Insofar as objects have a "natural tendency" to remain in the same state when not interfered with, they count as tending towards an end. The key premise, for Hoffman's Aquinas, is that "to tend to x is to have x for an end."[20]

Hoffman then reasonably concludes that Spinoza's system does incorporate teleology. One of Spinoza's central doctrines is a prime example what Hoffman has in mind.

19. Hoffman (2011, 42)
20. Hoffman (2011, 42)

The *conatus* principle, that everything insofar as it remains in itself strives to persevere in being, clearly presents things as *tending* to ends. To be clear: Hoffman's point is not that Spinoza consciously endorsed teleology. rather, it is that there is in fact teleology in Spinoza's system whether Spinoza intended it or not.

Hoffman goes on to offer a teleological reading of Spinoza's *conatus* doctrine. While Carriero offers a "deflationary" account of striving, on which it is just metaphysical inertia, Hoffman offers one on which what finite things strive for is "to increase their activity in order to maximize the amount of themselves that is eternal."[21] Hoffman thinks, not implausibly, that it's difficult to see how this could be made to fit a totally deflationary version of striving. Perfection, according to Hoffman's reading of Spinoza, is not merely a mode of thinking. Instead, it's something real in the world.[22]

4.3 Sed contra: Garrett

As we saw above, Garrett makes four main arguments in favor of the teleological reading of Spinoza. I'll address each of these in turn

4.3.1 Spinoza's apparent use of teleological explanations

Garrett is right there are places where Spinoza seems to employ teleological explanations. He seems to think that people strive for things, or seek to attain them. Hence, Garrett infers, Spinoza countenances teleological explanations.

This argument seems weak. We can find numerous places where Spinoza takes expressions which have an ordinary meaning and gives them a specific technical one. For one, in the TTP, Spinoza does this with God's will:

> in relation to God we affirm one and the same thing when we say that from eternity God decreed and willed that the three angles of a triangle are equal

21. Hoffman (2011, 45)
22. Hoffman (2011, 47)

> to two right angles, or [when we say] that God understood this. (TTP IV.25)

For another, Spinoza does this with the definition of will and appetite in EIIIp9s, where he relates both of these to his doctrine of striving: "When this striving is related only to the Mind, it is called Will; but when it is related to the Mind and Body together, it is called Appetite." Here it seems quite clear that Spinoza is taking ordinary language terms and giving them a new, technical definition.

In fact, Spinoza offers just such a re-interpretation of teleological talk in EIVpref (which we will deal with in more detail later). All final causes are "nothing but a human appetite insofar as it is considered a principle, *or* primary cause, of some thing." (C.I.544 / G.II.207) In this preface he also advocates an elimination of final-causal talk to efficient-causal talk. (Or maybe a reduction; more on that later.)

On the basis of this and the preceding examples, I think Garrett's argument here doesn't work. We can't conclude simply on the basis of teleological-sounding talk, that Spinoza endorses teleology in his system. Maybe he has substantive theoretical grounds for doing so, but that's a separate argument.

4.3.2 Spinoza's apparent endorsements of human ends

Garrett's second line of evidence relies upon some passages from EIapp, which I will repeat:

> All the prejudices I here undertake to expose depend on this one: that men commonly suppose that all natural things act, as men do, on account of an end.
>
> Men always act on account of an end, namely, on account of their advantages, which they want. (EIapp / G.II.78)

Garrett reads these passages as saying that human beings act for ends. This is certainly a plausible reading of these passages in isolation, so I don't want to claim that this is no evidence for his reading. Instead, I want to point to an alternate reading which is compatible with the denial of teleology. This will not settle the point, but it will establish a dialectical impasse and stop up this line of evidence.

Let's take each passage in turn. The first can be read at least two ways. Garrett favors the first, which is:

- ...that men commonly suppose that [p, which Spinoza agrees with]

I favor the second, which is:

- ...that men commonly suppose that [p, which Spinoza disagrees with]

Which reading agrees better with context? This isn't immediately clear. The Latin of the passage (at G.II.78) is no help either:

> *Et quoniam omnia, quae hîc indicare suscipio, praejudicia pendent ab hoc uno, quod scilicet communiter supponant homines, omnes res naturales, ut ipsos, propter finem agere*.

Clearly what men commonly suppose here is "*omnes res naturales, ut ipsos, propter finem agere*." But this gets us no closer to telling whether Spinoza agrees with it. We might say that the fact that this is a *prejudice* tells us something about Spinoza's attitude towards it – surely, Spinoza would not consciously endorse something he just called a prejudice! But this doesn't help either. It's not clear whether the prejudice is meant to be (a) that men suppose that natural things act like they do – that is, according to ends – or (b) that both the belief that natural things act for an end *and* the belief that men act for ends. It seems we are no closer to a definitive reading.

But we don't need to be. All I need to do, at this point, is neutralize the reading that Garrett has given by offering one that is at least as plausible as his. Given this reading, I

suggest that we should not read him as expressing agreement with the belief which immediately follows. This is distinct from saying that we should read him as *disagreeing* with it. Rather, I suggest a kind of quietism on this passage: Since it's not determinate either way, we should treat it as evidentially inert.

The second passage – "men always act on account of an end" – is more problematic for my interpretation. To answer it, let me point to what I said above about apparent endorsement of final causes in other texts. In order to understand what Spinoza means, we must position a passage like this against the broader backdrop of his thought. This involves paying close attention to whether he might be using any terms with a technical meaning in mind, or at least one foreseen. With "advantage", I'd suggest that we look to EIVp20, where Spinoza seems to give it a characterization, and perhaps a definition:

> The more each one strives, and is able, to seek his own advantage, i.e., to preserve his being, the more he is endowed with virtue; conversely, insofar as each one neglects his own advantage, i.e., neglects to preserve his being, he lacks power.

And later, in the scholium to the same proposition, Spinoza writes that "No one, therefore, unless he is defeated by causes external, and contrary, to his nature, neglects to seek his own advantage, *or* [*sive*] to preserve his being." Read in this light, what the passage from EIapp says is that men always act for an end, viz., to preserve their being. So whether this is teleological action will depend upon whether the striving to persevere in being is itself teleological. I will later argue that it is not, but for now I simply want to flag this dependence. If Garrett establishes that the *conatus* doctrine is teleological, he thereby establishes that these passages are evidence for his reading.

4.3.3 Striving and *conatus*

The question of what this striving is, and hence what the *conatus* doctrine means, needs at this point to be settled. In this section I'll offer an argument for the conclusion that

the *conatus* doctrine is *not* teleological.

Here is the beginning of the argument:

1. The conatus principle applies to everything cross-attribute. (premise)
2. Everything in `Extension` exhibits conatus. (from (1))
3. The conatus of each thing is an example of natural teleology. (premise)
4. Everything in `Extension` exhibits natural teleology. (from (1)-(3))
5. Some things in `Extension` do not exhibit natural teleology.
6. Contradiction. (from (4) and (5))

We need to reject one of the premises, but which? I propose that we should reject (3). Premise (1) is an expression of the plain reading of EIIIp6, which tells us that "each thing" strives to persevere in its being. There is no obvious reason to restrict this to a single attribute. Spinoza indicates otherwise in EIIIp9:

> Both insofar as the Mind has clear and distinct ideas, and insofar as it has confused ideas, it strives, for an indefinite duration, to persevere in its being and it is conscious of this striving it has.

This suggests that the doctrine applies to all things in `Thought`. And in EIIIp9s, Spinoza writes that "when [this striving] is related to the Mind and Body together, it is called Appetite." (C.I.500 / G.II.148) This confirms that the striving is related to modes of `Extension` as well as modes of `Thought`. Add to that the plain meaning of EIIIp6 and (2) follows right away.

Now we come to the crucial premise, (5). To see whether Spinoza endorsed this premise, we should look at the texts. Specifically, I think we should look at EIVpref. I'll reproduce the relevant passage in its entirety (C.I.544-5 / G.II.206-7):

> For we have shown in the Appendix of Part I, that Nature does nothing on account of an end. That eternal and infinite being we call God, or Nature, acts from the same necessity from which he exists. For we have shown (IP16) that the necessity of nature from which he acts is the same as that from which he exists. The reason, therefore, or cause, why God, *or* Nature, acts, and the reason why he exists, are one and the same. As he exists for the sake of no end, he also acts for the sake of no end. Rather, as he has no principle or end of existing, so he also has none of acting. What is called a final cause is nothing but a human appetite insofar as it is considered as a principle, *or* primary cause [*causa primaria*], of some thing.
>
> For example, when we say that habitation was the final cause of this or that house, surely we understand nothing but that a man, because he imagined the conveniences of domestic life, had an appetite to build a house. So habitation, insofar as it is considered as a final cause, is nothing more than this singular appetite. It is really an efficient cause, which is considered as a first cause, because men are commonly ignorant of the causes of their appetites. For as I have often said before, they are conscious of their actions and appetites, but not aware of the causes by which they are determined to want something.

The first part of the passage is straightforward enough. God has no end for which he acts because he has no end for which he exists. But understanding what comes next requires a little more careful analysis.

What does Spinoza mean by "principle, *or* primary cause"? My suggestion is that he means more or less what Suárez meant: a source of being or existence. I have no direct line of evidence for this, but I do have two indirect ones. First, since in the last chapter I argued that Spinoza was engaging a broadly Scholastic framework (which Súarez would have inhabited) in his polemic against final causes in EIapp, it would make sense for him

to use this context again when arguing against the same target. Second, as we will see below, interpreting him in this way helps make sense of what Spinoza is arguing here.

What Spinoza says here is that what think is a final cause is really just a human appetite insofar as it is the source of existence of some thing. Or at least, that's what our folk physics and psychology tell us. What does he mean by appetite? The natural way of reading this is to give it the meaning he proposed in EIIIp9s. There, appetite is the *conatus* of a thing insofar as it is related to the mind and the body of that thing. So Spinoza holds something like the following:

(FC) x is the final cause of y *iff* x is a human striving related to both mind and body that is the source of existence of y

This biconditional is, on my reading, not an equivalence but a reductive definition. The left hand side is being reduced to, and defined in terms of, the terms on the right hand side. This reading is supported by the words "we understand [*intelligemus*]" in Spinoza's example of the house. Is he saying: "surely this is what we all mean when we say this"? I think not. He seems to mean this in the technical, definitional sense, since he almost always uses some conjugation or cognate of *intelligo* in his definitions. So when Spinoza says "when we say habitation was the final causes of this or that house, surely we understand that...", I read him as giving a reductive definition of final cause – reductive, because he says that a final cause is "nothing more than" a singular appetite, and that "it is really" an efficient cause.

Let's apply this analysis to the example that Spinoza gives. According to (FC), habitation is the final cause of a house *iff* habitation is a human striving related to both mind and body that is the source of existence of the house. It seems odd to say that habitation is a human striving, but the text seems clear: It is "nothing more than this singular appetite." It's also clear from the text that he thinks this habitation, and hence this appetite, is nothing but an efficient cause considered in a particular way.

Consider what this implies. If Spinoza really did think that the *conatus* of individual things is teleological, then it seems to make little sense for him to try and reduce an overtly teleological explanation (the final causal one) to another overtly teleological one (the *conatus*-based one). What would be the point? Additionally, the text seems clearly to say that human *conatus* (both psychological and physical) reduces to a particular sort of efficient cause (a human appetite). I conclude, on the basis of these considerations, that Spinoza does not think that the human *conatus* is teleological.

One potential objection here is: Maybe Spinoza means to reduce one teleological notion to another, more adequate one. Maybe final-causal explanations don't work, not because they're teleological, but for some other reason (appeals to substantial forms, say). So, in offering his reduction, he isn't eliminating teleology, but instead regimenting it.

I don't doubt that this is something which Spinoza sometimes does. We saw in an earlier chapter, for example, that he did this with the idea of God's will. But I don't think this is a plausible reading of the text. Recall what we saw him say above: "[H]abitation, insofar as it is considered as a final cause, is nothing more than this singular appetite. It is really an efficient cause, which is considered as a first cause, because men are commonly ignorant of the causes of their appetites." (C.I.544 / G.II.207) The reduction here is to an *efficient cause*, which is resolutely *not* teleological. Unless one thinks that Spinoza wants to teleologize efficient causation, the potential interpretation is unconvincing.

One might now object that this is still not enough. I haven't yet shown that there is no teleology in Spinoza. All I've done is argued that one particular bit of his system isn't teleological. This is true, as far as it goes. But it's also irrelevant. All I intended to argue here was that Spinoza thinks some things in `Extension` don't exhibit teleology. That's enough to get us to reject (3).

This doesn't yet get us to the conclusion that there's no teleology at all. It only gets us to the conclusion that the *conatus* of some things isn't teleological. But this is sufficient to get us the conclusion that striving is not teleological *in all cases*. Hence, the

fact that something strives for a particular thing cannot by itself be used as evidence for a teleological explanation of that action.

There is trouble ahead for the defender of teleology. If we add the premise, accepted by most of those that accept the teleological interpretation of Spinoza, that "either all natural creatures are governed by teleological principles or none of them are,"[23] it follows right away that *none* of them are. This principle is fairly well-supported by the text, particularly EIIpref. There, Spinoza writes of those who "conceive man as a dominion within a dominion," one which "disturbs, rather than follows, the order of nature." (C.I.491 / G.II.138) A little further down he writes that

> nature is always the same, i.e., the laws and rules of nature, according to which all things happen, and change from one form to another, are always and everywhere the same. So the way of understanding the nature of anything, of whatever kind, must also be the same, viz., through the universal laws and rules of nature. (C.I.492 / G.II.138)

So if natural laws govern all that happens in nature, they govern both the things which we know are not teleological and things which, at this point in the argument, we aren't sure about. But, since they're the same *everywhere*, it must be the case that the rest of nature is *not* governed by teleological principles. This concludes my argument.

Notice one final thing. The reductive project that Spinoza carries out concerns, not the motion of bodies or the growth of plants, but human action. He wants to reduce final-causal explanations of human actions to efficient-causal ones. The only reason we offer final-causal or teleological explanations in the first place that "[we] are not aware of the causes by which [we] are determined to want something." (C.I.545 / G.II.207) Were we given a God's eye view of the phenomena in question, we would see that such explanations are spurious and misguided.

23. Lin (2019, 148)

This has radical implications for Spinoza's theory of action. If none of our actions is taken for the sake of an end – and that is what Spinoza seems to be saying – then our entire folk psychology is turned on its head. No longer can we in seriousness offer explanations of action which involve goal-directed behavior. We will explore some of these consequences in a later section.

4.4 Sed contra: Hoffman

We can restate the argument Hoffman attributes to Aquinas like so:

1. In order to do one thing rather than another, an agent has to tend to something.
2. What it tends to has the nature of an end

So: (3) Efficient causation presupposes final causation

According to Hoffman, anyone committed to inertial motion is committed to end-directed behavior: "we can say…that a body tending to move in a straight line, by that very fact, has the end of moving in a straight line."[24] Elsewhere he offers a subtly different but related reading of Aquinas which leads to the same conclusion: "Aquinas is arguing that if cause C is determined to a particular effect E as opposed to some other effect, then that by itself is sufficient for E to have the nature of an end."[25] This should be especially congenial to Spinoza, who writes in EIp28 that

> Every singular thing, *or* any thing which is finite and has a determinate existence, can neither exist nor be determined to produce an effect unless it is determined to exist and produce an effect by another cause, which is also finite and has a determinate existence; and again, this cause also can neither exist nor be determined to produce an effect unless it is determined to exist

24. Hoffman (2011, 42–3)
25. Hoffman (2009b, 297)

> and produce an effect by another, which is also finite and has a determinate existence, and so on, to infinity.

So if Hoffman's Aquinas is right, and being determined to a particular end is sufficient for having an end (this is what (2) affirms as well), then Spinoza should be committed to final-causal explanations being legitimate.

If the reading of Spinoza we've offered in the previous chapter is correct, this argument wouldn't work. If Spinoza accepts the late Scholastic background, then (2) doesn't follow. Against this background, it is not sufficient for having an end that motion has a fixed terminus. Given this, Spinoza can deny that tending towards something is sufficient for having an end the same as Suárez does.

But let's grant *arguendo* that I was wrong to read Spinoza this way. Let's grant that Suárez's argument needn't work. I claim that Hoffman's argument still fails. To see why, we'll have to delve into Spinoza's account of action and adequate causation. So, let's.

First, let's rephrase the argument slightly, in a way that should preserve all the relevant features of the original:

(1') If α does ϕ instead of ψ, then α must tend towards ϕ.

(2') If α tends towards ϕ, then ϕ has the nature of an end.

So: (3') If α does ϕ instead of ψ, ϕ has the nature of an end.

Now let me introduce a principle which I take to implied by (2') (I will not argue for this implication here):

(P) If α tends to ϕ, then α has ϕ as an end.

Hoffman seems to accept (P). He writes, for instance, that "to be determined to a determinate direction is to have that direction as an end"[26], and that "if Aquinas is right,

26. Hoffman (2009b, 300)

to tend to move in a given direction is to have motion in that direction as an end."[27] Based on this, it seems likely he accepts some version of (P).

Here is another principle that Hoffman and Aquinas would probably accept:

(A) If α acts to bring about ϕ, then α has ϕ as an end.

According to Aquinas, acting to bring about ϕ is a sufficient condition for having ϕ as an end. He writes that "every agent, whether natural or voluntary, intends an end." (DPN 18) The natural reading of this passage is that, if something acts, then it intends something (else). And since he also thinks that "that which is intended by the agent [*ab operante*]...is called an end," (DPN 18) one gets (A) just by transitivity of the conditional. Aquinas also accepts, on the authority of Aristotle, the converse thesis that "everything which acts acts only by intending something". (DPN 18) I don't think that the converse of (A) is required for the argument that follows, so we won't assume it's true.

(A) should also be accepted by anyone who also accepts the argument Hoffman attributes to Aquinas. Suppose that α acts to bring about ϕ. Then if α does ϕ instead of ψ – which it does, since it acts to bring about ψ – it must tend towards ϕ rather than ψ. And since the argument is supposed to establish (P), it follows that if α acts to bring about ϕ, then α has ϕ as an end.

Does Spinoza have problems with (P) and (A)? I think the answer is yes. Let me explain why.

4.4.1 Problems with (A)

First, let's see what (A) would mean in Spinoza's system. To being with, let's look at what he says about action in the *Ethics*:

> I say we act when something happens, in us or outside us, of which we are the adequate cause, i.e. (by D1), when something in us or outside us follows

27. Hoffman (2009b, 300)

> from our nature, which can be clearly and distinctly understood through it alone. On the other hand, I say that we are acted upon when something happens in us, or something follows from our nature, of which we are only a partial cause. (EIIId2)

Here, for Spinoza, being (fully) active means being the sole cause of our doings. In this sense, only God is truly active. I think we can parse this as:

(Act) α acts to produce ϕ *iff* α is the adequate cause of ϕ

What is it to be an adequate cause? Spinoza tells us at EIIId1: "I call the cause adequate whose effect can be clearly and distinctly perceived through it." Other parts of the *Ethics* link having clear and distinct perceptions to being the causal source of our ideas. In EIIp29s Spinoza writes that "so often as [the mind] is disposed internally...then it regards things clearly and distinctly." Further, perceiving clearly and distinctly entails perceiving adequately (according to EIIp38c).

Elsewhere, Spinoza suggests that to the extent we have more adequate ideas, we are more active. As a result, to that extent we are the cause of our doings. In the demonstration of EVp17 (which states that God is without passions) he writes:

> All ideas, insofar as they are related to God, are true (by IIP32), i.e. (by IID4), adequate. And so (by Gen. Def. Aff.), God is without passions.

To the degree that something has more adequate ideas, it less passive and more active. So to be an adequate cause of our doings is for them to be clearly and distinctly conceived through us (i.e., following from our nature). This goes along having more adequate ideas.

Now let's use this better to understand (Act), and hence (A). First, let's substitute like terms in to (Act) to get

(Act') α acts to produce ϕ *iff* ϕ can be clearly and distinctly perceived through α

Now using this equivalence, we can get

(A') If ϕ can be clearly and distinctly perceived through α alone, then α has ϕ as an end

My contention here is that, for Spinoza, the consequent is false when the antecedent is true. Hence, he would reject (A'). Let's see why.

There are two lines of argument available. First, if I can show that Spinoza rejects the compatibility of these two claims in *one* case, I'll have shown that he rejects the conditional. So all I need for that route is a single counterexample.

Second, even though I'm arguing that there are no teleological explanations in `Extension`, I can do so by arguing against teleological claims in `Thought`. This is because of parallelism. If I can show that a particular mode of `Thought` doesn't have a teleological explanation, the corresponding mode of `Extension` won't either.

Let's take the first line of argument first. In a sense, Spinoza has already established (A') is false: God is perfectly active, and yet has no ends. We could stop there, and declare that Spinoza rejects (A'). But let's suppose God doesn't count as a counterexample. We can do this by restricting α to being a finite thing. Would this help? I think not.

Let's first consider what it is for some human agent to have ϕ as an end. If ϕ is already actual, then there is no need for striving towards it. Consider Spinoza's words concerning God in EIapp (C.I.442 / G.II.80): "[I]f God acts for the sake of an end, he necessarily wants something which he lacks." Given this, it seems a conceptual impossibility for Spinoza to aim at ϕ if ϕ is already actualized.

But maybe there are counterexamples. Consider the following case. Suppose I presently have the virtue of courage, and I wish to continue to be courageous. Isn't the state of affairs which I intend already actual? And if so, mightn't it constitute an end?

I think this purported counterexample gets something important right. It is possible that the state of affairs at which we aim may contain some component that is in fact actual – for example, my possession of courage. But it also gets something wrong about the object of my intention. For my end is not to possess that thing at the present moment,

but to possess it *going forward*. Each thing, insofar as it is in itself, strives to *persevere* in being, after all. So the real target of my intention is something ongoing, not purely actual.

So it seems like something must be at least partially non-actual to be an end. I now suggest that in order to aim at end, we must do so using the imagination. EIVpref strongly suggests this. It speaks of a man having an appetite "because he imagined the conveniences of domestic life".

But this is just a suggestion. It does not amount to a cogent, systematic reason *why* this is so for Spinoza. Indeed, there seem to be counterexamples to this principle in the text of the *Ethics*. Take for instance EIp8s2, where he talks about "how we can have true ideas of modifications which do not exist". If these are true ideas, then by EIIp41 they cannot be ideas of the imagination.

It is clear, however, that we sometimes think of non-actual things using the imagination. We can see this, first, by asking how it is that we come to regard an external thing as actually existing, or as present. Spinoza thinks that this happens "if the human body is affected with a mode that involves the nature of [that] external body". (EIIp17) He thinks this follows from the idea of the mode by which we are affected involving the nature or essence of the external body (EIIp16), and that if we have an idea that involves the essence of an external body, we have an idea that posits the existence of the external body. (EIId2)

Spinoza then goes on to explain, in EIIp17c, how it is that the mind can regard external bodies by which we have been affected previously as being present when they're not. We examined the complicated physiological story he tells in Chapter 2, so we won't rehearse it in detail here. The gist is that, when we are put in something like the same bodily state which we were in when the external body actually affected us, we will imagine that body as present again. What Spinoza seems to have in mind in the statement of both p17 and p17c is memory. But elsewhere, he seems to use fully general language. In EIIp17s he says that the explanation he has just given shows "how it can happen...that we regard as

present things that do not exist." This is clearly not restricted to the objects of memory.

So it seems like we're stuck. On the one hand, Spinoza thinks we can have true ideas of non-existent modes. On the other hand, he thinks that we can also imagine non-existent modes. What I *want* to say is that to think of non-existent modes is to imagine them. But it seems clear, from the textual evidence, that this is false. So this argumentative path seems like a dead end. Where do we go from here?

Let's look at EIIIp18. In its demonstration, Spinoza claims that "[s]o long as a man is affected by an image of a thing, he will regard the thing as present, even if it does not exist...he *imagines* [emphasis mine] it as past or future only insofar as its image is joined to the image of a past or future time." This suggests that to regard ϕ as non-actual in the sense of being something to be brought about in the future, ϕ must be joined with the image of a past or future time. And to have ϕ as an end, we must think of ϕ as something to be achieved. Combine these two, and we seem to get that, since in order to have ϕ as an end we must think of it as joined to a future time. To have ϕ as an end means we must imagine ϕ.

And now we have enough pieces in place to get the argument going:

1. α acts to bring about ϕ (premise)

2. α has ϕ as an end (premise)

So: (3) The idea of ϕ that α has must involve a future time (from (2))

So: (4) The idea of ϕ that α has must be imaginative (from (3)

So: (5) The idea of ϕ that α has must be inadequate (from (4), def of imagination and adequate idea)

So: (6) ϕ may be clearly and distinctly understood through α (from (1), def of action)

(7) If (6), then ϕ may be clearly and distinctly understood through α by α (premise)

So: (8) ϕ may be clearly and distinctly understood through α by α (from (6) and (7))

So: (9) Contradiction (from (5) and (8))

This argument is valid. If either (1) or (2) is denied, then I've succeeded in showing that, for Spinoza, acting (in Spinoza's sense) to achieve ϕ is incompatible with having ϕ as an end. The route for the defender of Hoffman's reading is therefore to deny (7). To do so requires that they say there is at least one case in which ϕ may be clearly and distinctly understood through α but which *cannot* be so understood *by* α.

But this is problematical. In EVp4, Spinoza writes that "there is no affection of the Body of which we cannot form a clear and distinct concept". Such affections would, by EIId3, include both actions and passions. We act, according to EIIId2, when something outside us follows from our nature, which can be clearly and distinctly understood through it alone. Hence, we can form adequate ideas of such affects.

Now, if we can form adequate ideas of those affects, then it follows that we can form adequate ideas of whatever follows from them. This is a result of EIIp40, which tells us that "whatever ideas follow in the Mind from ideas that are adequate in the mind are also adequate." Hence, if we act to produce something – or, equivalently, if it can be clearly and distinctly understood through our nature alone – we can clearly and distinctly understand that thing through our nature alone. This is enough to establish (7). So to deny (7), the defender of Hoffman's reading would have to deny one of the Spinozistic assumptions from which it follows. I don't think this is a route to be taken lightly.

4.4.2 Problems with (P)

So much for (A). Now I need to justify my claim that Spinoza would have trouble with (P) – which, to refresh our memory, was

(P) If α tends to ϕ, then α has ϕ as an end.

There are at least two counterexamples to this principle in Spinoza's system. First, we have God, who tends towards certain things rather than others out of the necessity of his nature. From EIp16 we learn that infinitely many things follow from the divine nature, in infinitely many modes. It seems unproblematic (though hold that thought) to say that, for Spinoza, God tends towards these things rather than others. But, as we've seen above, and as is pretty much uncontested by Spinoza interpreters, God has no ends. So here we have an example where the antecedent of (P) is fulfilled, but the consequent falsified.

Another counterexample comes from our analysis of EIVpref. I take myself to have shown that, at least in some cases, Spinoza wants to say that, although we think we act for ends, in fact we do not. These are cases that are related to our striving to persevere in being. If we are striving to persevere in being by means of house-building, then it certainly seems fair to say that we tend towards the house-building. But in this case, Spinoza wants to deny that habitation is the final cause of the house. In this case, nothing over and above efficient causation is going on.

This is also implied by EIVd7: "By the end for the sake of which we do something I understand appetite." Here, again, Spinoza seems to want to say that we can tend towards something (by having an appetite, in his technical sense, for it) without having it as an end in the sense relevant here. We only think of it as an end because we are "commonly ignorant of the causes of [our] appetites." (EIVpref) This is our second counterexample.

But hang on. Is it unproblematic to claim that God (or we, for that matter) tend towards something when it follows from our nature? It seems to me that it is wholly unproblematic. Certainly the proponent of Hoffman's reading would want to say that we tend towards what we strive for. And we strive to persevere in being as a consequence of our nature.

So it doesn't seem that an analysis of tendency can rescue the proponent of Hoffman's interpretation here. What about an analysis of "end", instead? Is there some stripped-down notion of end that can help us here? Here's one candidate:

(E) α has ϕ as an end iff α is determined to produce ϕ rather than ψ_1, ψ_2,...

Substituting this into (P) gets us:

(P') If α tends towards ϕ, then α is determined to produce ϕ rather than ψ_1, ψ_2,...

This looks promising. If we can analyze the notion of having an end in terms of determination to do one thing rather than another then perhaps there is a route to a teleological reading os Spinoza after all. And it's certainly in the spirit of Hoffman's proposal

But this analysis is problematical. First, since God is determined to produce certain things rather than others, this analysis counts God as having ends as well. And Spinoza explicitly denies this. Second, this would count all instances of our striving to persevere in being as end-directed, since we tend to persevere in being rather than not. We have seen above that, in the case of EIVpref at least, Spinoza wants to deny that this striving is end-directed. If we adopt the reading proposed in (E), we are committed to positions which Spinoza explicitly wants to deny. I conclude, then, that the reduction or rephrasing proposed in (E) is implausible as a reading of Spinoza.

4.4.3 Recap

To summarize: I've argued that the two attacks which can be launched on (P2) of the master argument fail to be persuasive. This leaves us at an impasse. To break that stalemate, I need to provide positive reasons for Spinoza's acceptance of (P2). In the next section, I will do just that.

4.5 Arguments for (P2)

There are three lines of evidence in support of (P2):

1. The plain reading of the relevant texts.

2. An argument from the concept of adequate causation

3. Arguments that neither inertial motion nor conatus are teleological

We encountered the third line of evidence above in our discussion of Garrett and Hoffman. I'll now discuss the other two.

4.5.1 Plain meaning

First, there is evidence from the plain reading of the relevant texts. I claim this leads us to believe that Spinoza reduces, if not eliminates, teleological or final-causal concepts from the ideology (in Quine's sense) of a mature science or philosophy.

The texts I want to focus on here are EIapp, EIVpref, and EIVdef7. These are relevant because they represent the places where Spinoza goes into the greatest detail about the role of teleology within his system. While other passages might be relevant for other reasons, these three are arguably the most important passages when examining plain meaning.

We have already discussed the negative attitude towards final causation and teleology Spinoza displays in these texts. But it will be helpful to have a brief recap.

In EIapp, Spinoza writes to expose the prejudice that "all natural things act, as men do, on account of an end." (C.I.439 / G.II.78) There's a broad and a narrow reading available. On the broad reading, Spinoza is trying to say that *no* natural thing acts for an end. On the narrow reading, all he is trying to say is that *not all* natural things act for an end. Given his naturalism, however, either all natural things act for an end, or none of them do. Here, even on the narrow reading, we have an indication that at least *some* natural things do not act on account of an end. Put this together with the aforementioned naturalism and you get the conclusion that no natural thing acts for the sake of an end. This might make it puzzling that Spinoza seems to say that men act for an end. However, as we saw in §3.2, we don;t need to give read the passage this way.

Spinoza goes on to make the following striking statement: "Nature has no end set before it, and…all final causes are nothing but human fictions." It would be hard to imagine a stronger prima facie denial of the role of final causes in a mature metaphysic. This suggests that Spinoza means to take not only a reductionist, but an eliminativist posture towards teleology and final causation.

In EIVpref Spinoza writes that a final cause is "nothing but a human appetite," that it is "really an efficient cause, which is considered as a first cause, because men are commonly ignorant of the causes of their appetites." (C.I.544 / G.II.207) The plain reading of this passage is that Spinoza is giving an error theory of final-causal talk. There really is nothing out in nature that fills out out such talk. The things that we think are final causes are, in fact, efficient causes. And we are mistaken about this because when it comes to causal ascriptions we're just plain wrong about things.

In EIVdef7, Spinoza gives a revisionist definition of an end (by "end" he seems to mean the same thing as a final cause): "By the end for the sake of which we do something I understand appetite." And by "appetite", as we saw above in §3.3, Spinoza just means the conatus of an individual thing understood in a certain way. Whether or not an end is teleological will depend in part on a more thorough account of the conatus of a singular thing. But the context of EIV suggests that we should not interpret appetite teleologically, since otherwise Spinoza is just giving a definition of the core teleological concept of "end" in terms of another, a concept which is more central to his system but is still teleological.

One could object that this is false. Spinoza could simply be replacing one deficient teleological concept with another one which lacks that deficiency. But the tone of EIVpref counts against this. The reason we engage in end- or that-for-the-sake-of-which-talk at all is because we are ignorant of the causes of things. It's hard to square this attitude with the idea that Spinoza is regimenting teleological concepts rather than doing away with them.

In §2.1.1, we saw that there are a number of passages in which Spinoza, on an initial reading, seems to endorse teleological or final-causal explanations. I argued that it is possible to give these passages a non-teleological reading. The reader might well wonder: Can't the defender of the teleological reading of Spinoza do the same here, and offer a reading whereby he doesn't mean to jettison all teleological talk?

I think that this is possible, but inadvisable. Such a reading goes against the surface meaning of the text, which indicates a thoroughly hostile attitude towards teleology and final causation. There ought to be a good theoretical or systematic reason for giving such a reading. The burden of proof rests on the person who is offering an interpretation which goes against the surface reading of the text.

This raises still another question: Am I not accusing the defender of the teleological explanation of the same thing that I have done in the case of the textual evidence pointed to in §2.1.1-2? In a sense, yes. But I do not think that these are equivalent cases. What I am doing is reading Spinoza's use of idiomatic phrases or terms in light of his more considered views on the terms used. Given the choice between doing so or interpreting the passages in which he gives his considered views on the topic in light of the more idiomatic passages, I think we should go with the former.

4.5.2 Argument from adequate causes

We can get more indirect support by considering an argument drawn from Spinoza's conception of an adequate cause. As we can recall from the discussion of adequate causation in §4.1, x is the adequate cause of y if y can be understood through x's nature alone. The argument goes from this definition to the conclusion that a certain kind of overdetermination is impossible: A thing cannot have more than one adequate cause. Here it is:

(1) If I know an effect E, then I know its cause (EIa4)

(2) If I do not know the cause of E, I do not know E (from (1))

(3) C_1 and C_2 adequately cause E. (Premise, for reductio)

(4) I know E. (Premise)

(4.a) I know E through C_1 and do not know C_2 (Premise, assumed WLOG[28])

(4.b) I do now know C_2 (from (4.a))

(4.c) I do not know E (from (2), (4.b))

(4.d) Contradiction (from (3), (4.c))

(5) If I know E, I know E through C_1 and C_2, and not one of them alone (from (4.a)-(4.d))

(6) I do not know E through either C_1 or C_2 alone (from (4), (5))

(7) C_1 and C_2 are not the adequate causes of E (from (6), EIIId1)

(8) Contradiction (from (3), (7))

Really what we've proved is a disjunction. Either a thing can have more than one adequate cause, or else we cannot know effects. However, Spinoza appears to think that we can indeed know effects (see, for instance, the definition of the third kind of cognition in EIIp40s). So if the argument is successful, Spinoza would reject a view of adequate causation that allows for over-determination.

It's useful to contrast Spinoza with Leibniz here. The latter held that there are two explanatory orders in nature, those of final and of efficient causality. Sometimes he refers to these as "the kingdom of efficient causes and the kingdom of final causes".[29] In *A Specimen of Dynamics* (1695), Leibniz claims the following:

> In general, we must hold that everything in the world can be explained in two ways: through the *kingdom of power*, that is, through *efficient causes*,

28. Without loss of generality, meaning we could run the argument as well with C_2 as with C_1.
29. Leibniz (2016, 21)

> and through the *kingdom of wisdom*, that is, through *final causes*...these two kingdoms everywhere interpenetrate each other without confusing or disturbing their laws, so that the greatest obtains in the kingdom of power at the same time as the best in the kingdom of wisdom. (AG 126 / GM VI 243)

Elsewhere he connects this to his monadological metaphysics. Perceptions in a particular monad arise from one another according to final-causal laws, whereas "changes in bodies" and physical phenomena in general happen according to efficient-causal laws. These two lawful orders are supposed to exhibit a "perfect harmony" with one another, a harmony "preestablished from the first". (AG 207-8 / G VI 598-9) Elsewhere, in *Monadology* (1714), he writes that

> Souls act according to the laws of final causes, through appetitions, ends, and means. Bodies act according to the laws of efficient causes or of motions. And these two kingdoms, that of efficient causes and that of final causes, are in harmony with each other. (AG 223 / G VI 620)

There appear to be two positions on display here, which might illustrate an evolution in Leibniz's thought. The first, exhibited in the *Specimen*, holds that all natural events have two sorts of explanations: final- and efficient-causal. The second, exhibited in *Monadology*, holds that nature has two sets of laws, each of which govern distinct realms in nature.[30]

Spinoza would have a problem with each of these positions. On the first, he would take issue with the apparent overdetermination. Because of his doctrine of adequate causation, he would reject the idea that we can explain an event *adequately* in two ways. On the second, he would see this doctrine of the two realms as a violation of his naturalism. If there are two sets of laws for two different types of things, that amounts to singling out parts of nature as "a dominion within a dominion" – and this is unacceptable.

30. See McDonough (2008) for a much more thorough study of what he calls the "two realms" doctrine.

4.6 Fallout

If the arguments I've given above go through, Spinoza rejects teleological or final-causal explanations wholesale. These are part of our folk explanatory apparatus, and have no place in a mature metaphysics or science. All teleological or final-causal explanations are to be replaced by efficient-causal explanations, which follow the pattern we identified in Chapter 2.

What happens if this is right? What are the consequences for our manifest image? I believe they are wide-ranging and deeply revisionist. I will now try to go into some detail about these consequences.

First, there's a profound effect on how we think of human action. One of the recurring themes in Spinoza's philosophy, and the *Ethics* in particular, is that we are ignorant of the true causes and natures of things. If I am right, then this is especially true of our final causal or teleological explanations of human action.

Let me give an example, one drawn directly from EIVpref. Suppose a man builds a house. According to Spinoza, the folk explanation of this action is something like: the man built the house in order to have somewhere to live. The locution "in order to" expresses an important and essentially explanatory relation between being able to have somewhere to live and the man's building the house. The state of affairs of the man living in the house, which is subsequent to the building of the house, plays an important explanatory role in the relevant action.

But according to Spinoza, this is all wrong. Instead, what is going on is the following:

> The man built the house
>
> because
>
> The man had an appetite to build a house

which, as the definition of "appetite" makes clear, is equivalent to

The man built the house

because

The man's conatus dictated that he build the house

But since our appetites have causes, the explanation goes further, for Spinoza:

The man built the house

because

The man's conatus dictated that he build the house

because

The man imagined the advantages of having a house

But we can go even further than this. EIIp17s tells us the following:

> [T]he affections of the human Body whose ideas present external bodies as present to us, we shall call images of things, even if they do not reproduce the [NS: external] figures of things. And when the Mind regards bodies in this way, we shall say that it imagines.

Here Spinoza tells us what he'll mean by the imagination. First, the human body comes into contact with certain external bodies. Next, since the mind has an idea of the affections of the body (by EIIax4), it has an idea that corresponds to that particular affection of the body. Now, if the mind regards as present the content of that idea – that is, the external body which is the cause of the affection of our body, whether or not it is actually present, and whether or not the content of the idea accurately represents the external body in question – the mind imagines that external body.

With this in play, we can expand the explanation even further. That is, we can substitute the definition of imagining in the last step of the explanation, and obtain:

The man built the house

because

The man's conatus dictated that he build the house

because

The man thought of as present the advantages of a home through representations of images of the affections of his own body.

This last line tells us more about the causal history of the action in question. If we can find out more about the causal history of the idea of the advantages of the home, then we can plumb even further the causal history of the action in question.[31] It's easiest to do this by thinking about what the causes of the affections of the man's body are. We can explain the image which is the result of the interaction of the human body and external bodies by referencing the interaction of the two bodies. So the man in question had the image in question because of an interaction between certain bodies in `Extension`. And since the causal order of `Extension` maps onto the causal order of `Thought`, the same should hold with respect to the relevant ideas. That is, we can expand our causal explanation out to the following:

The man built the house

because

The man's conatus dictated that he build the house

31. Strictly speaking I am offering an explanation across attributes, which the reader might think violates the causal separation between attributes. I do not think this is the case, because Spinoza himself refers appetite to both the mind and the body (see EIIIp9s). So in some sense, to give a causal history of an appetite is to give the causal history of a finite mode when conceived under `Thought` and `Extension` together. It may make things easier to view me as offering two explanations, both of which are intertranslatable. In one explanation, we refer simply to modes of `Thought`. The explanandum in the one case is the mode of `Thought` which corresponds to the mode of `Extension` which constitutes the event of building the house, and in the other case is the event in extension of the house being built. The explanantia in both cases are the corresponding modes of `Extension` and `Thought`. Because of parallelism, both causal explanations map onto one another, and I take this to be a sufficient criterion of intertranslatability.

because

The man thought of as present the advantages of a home through images of the affections of his own body.

because

The idea(s) of the thing external to the human body causally interacted with the idea of the human body.

And there we have it – a small part of the complete causal explanation of the human action in question. We've been able to eliminate the locution of "in order to" from the explanation entirely.

I do not think this would be solely a linguistic oddity, for Spinoza. There's simply no room for any final-causal talk to seep in here. All the explanatory work is done by efficient causation. There is no need to appeal to an end, in the folk sense of the word, to account for the behavior or the process of building a house. If, as McDonough (2011) writes,

> [a]t a bare minimum, a teleological explanation purports to explain an event, process, or state of affairs in terms of a likely or possible consequence of that event, process, or state of affairs[32]

then what I am suggesting is that Spinoza rejects even this minimal level of teleological explanation. The presumptive consequences of an action play no *explanatory* role when explaining why an event came about. The fact that the man in question is imagining the advantages of a home is not enough to re-introduce an element of goal-directed behavior, because the advantages are conceptualized as *present*, not as something that the man needs to take certain actions in order to enjoy.

In some ways, I am reading Spinoza to be a precursor to a view expounded by Ernest Nagel (in Nagel (1961)), upon which a functional explanation (in biology, for Nagel)

32. McDonough (2011, 180)

can be given a formulation which "contains no locution distinctive of teleological statements." (Nagel (1961, 405)) He writes also that

> when a function is ascribed to a constituent element in an organism, the content of the teleological statement is fully conveyed by another statement that is not explicitly teleological and that simply asserts a necessary (or possibly a necessary and sufficient) condition for the occurrence of a certain trait or activity of the organism. (Nagel (1961, 405))

Though we have been working here in a psychological model, rather than a biological one, the similarities are striking. I make no claim as to whether Spinoza influenced Nagel on this point, and I suspect no such influence occurred. Spinoza is mentioned only twice in the aforementioned work, and in neither case is it in connection with explanation, let alone teleological explanation.

Spinoza's view is a radical departure from our folk explanations of human action. Ordinary discourse is drenched with "in order to" explanations. But if Spinoza is right, all this is so much vanity. There are no pulls in nature, only pushes.[33] The level at which we offer teleological explanations – whether or human action or the behavior of inanimate objects – is not the ground floor. Once we reach that metaphysical bedrock, we see that the true structure of the world consists only of efficient causes operating according to determinate laws.

Alright, but so what? Sure, when we're doing metaphysics we can parse all teleological explanations in terms of efficient-causal ones, but what does that matter? When it comes to action, the business of everyday life, aren't these explanations still useful? What is the *practical* import of Spinoza's rejection of teleology?

I want to argue that this rejection has at least one far-reaching consequence for Spinoza's system. To be more specific, I want to argue that the achievement of human blessedness

33. I thank Liam Bright for this way of putting the point. As a means of appreciation, I will boost his h-index by citing Heesen and Bright (2020).

requires that we understand that we're not end-directed creatures.

Let's work backwards. In what does human blessedness consist? In "in the knowledge of God alone," (EIIp49s4A) or the "intellectual love of God", which is said to be "our salvation" (EVp36s). Elsewhere, he says that it "is nothing but that satisfaction of mind that stems from the intuitive knowledge of God." (EIVappIV) "But," Spinoza continues,

> perfecting the intellect is nothing but understanding God, his attributes, and his actions, which follow from the necessity of his nature. So the ultimate end of the man who is led by reason, i.e., his highest Desire, by which he strives to moderate all the others, is that by which he is led to conceive adequately both himself and all things that can fall under his understanding. (EIVappIV)

So human blessedness, and indeed salvation, consists in understanding "God, his attributes, and his actions, which follow from the necessity of his nature." These actions, I take it, include those by which the infinity of infinite and finite modes are produced. It is, furthermore, the intuitive knowledge of God, which "proceeds from an adequate idea of the formal essence of certain attributes of God to the adequate knowledge of the [NS: formal] essence of things." (EIIp40s2)

I draw the following moral from these passages. The blessedness which Spinoza thinks is the highest good of humanity springs in part from the knowledge of the causal order of the world. This is suggested by how he speaks of knowing *how* God's actions follow from his nature, and of knowing God intuitively, which consists in knowing how the essences of singular things follow from – or in other words, are caused by – the divine essence.

This is supported by other passages as well. In EVp6dem Spinoza claims that

> The Mind understands all things to be necessary (by IP29), and to be determined by an infinite connection of causes to exist and produce effects (by

> IP28). And so (by P5) to that extent [the mind] brings it about that it is less acted on by the affects springing from these things, and (by IIIP48) is less affected toward them, q.e.d.

Consider what Spinoza is claiming here. To the extent that we understand that all things are determined by infinitely many causes and produce effects, we are less acted upon and more active. Since a greater degree of human activity corresponds to a greater degree of freedom of mind – or blessedness (EVpref) – to the extent that we understand better the causal structure of the world, to that extent we are more blessed.

Notice what happens if we assume that this is true and that our behavior is not actually end-directed. If we were to understand our actions as directed by ends – that is, if we were to understand them has having an adequate teleological explanation – we would be misunderstanding the actual causal chains that make up our complex patterns of behavior. To the extent that I think I go to the refrigerator in order to pour myself a cup of water, I am failing to understand the series of proximate causes which lead me to perform that act. If I understand my actions in these final-causal terms I fundamentally misapprehend the actual structure of the world. And this makes me *less blessed*.

So if I'm right, understanding that things do not exhibit end-directed behavior is not important for just our metaphysics and science (though it is that). It is absolutely essential for achieving human blessedness. This comes through quite clearly in TdIE. There, as we'll see in the next chapter, the true Method mustfollow the aim of securing "the knowledge of the union that the mind has with the whole of nature." (TdIE §13) And, Spinoza writes later in discussing the aim of the second part of the method discussed in TdIE,

> so that all ideas may be led back into one, we shall strive to connect and order them so that our mind, as far as possible, reproduces objectively the formal character of nature, both as to the whole and as to the parts. (TdIE §91)

In order to secure this union, we must order all of our ideas so that they stand in the same ordering as the things to which they correspond do. Yet again, it seems that the understanding of the causal structure of the world is an essential part of achieving salvation. It's difficult to think of something of greater importance to our conduct and life than this.

Chapter 5

Essence, Experiment, and Under-determination

5.1 Introduction

The pantheon of great early modern scientists includes some philosophers of the first rank, but there is one notable absence – Spinoza. This is justified, to an extent. While other early modern philosophers (Leibniz and Descartes, for example) were fully immersed in both the science and the scientific culture of their day, Spinoza contributed relatively little to these, and, apart from his geometrical reworking of Descartes' *Principles of Philosophy* and the so-called physical digression in the *Ethics*, wrote relatively little in the way of explicitly scientific treatises.[1]

But this does not mean that, upon a closer look, Spinoza has nothing to say on the topic. While Spinoza made no explicit and significant contributions to the actual content of the natural sciences, he had a good deal to say about proper scientific methodology. To bring this out, in this chapter I'll be paying close attention to an exchange between Spinoza and Boyle, mediated by Henry Oldenburg.

Some philosophers have argued that Spinoza did not think experimental science was

1. For a fairly comprehensive treatment of his contributions, see Gabbey (1995).

up to deciding the most important scientific questions. Alan Gabbey points out that for Spinoza, "sensory knowledge belongs to the imagination, the knowledge of essences and causes to the intellect alone." (Gabbey (1995, 177)) Wim Klever, while holding that Spinoza does have an important place for experience in his view of science, nonetheless argues that Spinoza's view was that of an anti-falsificationist, by which he means that for Spinoza, "experiments and/or experience can never prove or disprove definitively that something is or is not (necessarily) the case." (Klever (1990, 133)) And, in his extended study of Spinoza's interaction with experimental science, Richard Mckeon argues that "adequate knowledge does not come from experience; experimentation can not in the nature of things lead to a knowledge of what things are." (McKeon (1928, 145))

But why is this, and what can experiment in fact do? These are the questions I will attempt to answer in this chapter. On my reading, Spinoza believed that experimental science simply was not up to the task of doing what true science is supposed to do. While commentators such as McKeon and Klever have tried to contextualize Spinoza's criticisms of Boyle and the experimental method against his epistemological views expressed elsewhere, mostly their argument is that, according to Spinoza's view, experience could not yield knowledge of essences. And since, according to Spinoza (though not necessarily other of his contemporaries), the point of science is to discover essences, that's that.

While there is much correct about these interpretations, they does not give a deep understanding of just *why* Spinoza holds this view. I intend to give positive arguments as to *why*, on Spinoza's view, this happens. In particular, I will argue that he held that empirical evidence under-determines theory, and that this under-determination is closely tied to his views on essences and epistemology.

A subsidiary aim of the chapter is to give a positive account of just what the role of experience and experiment is, if they do not discover essences. In the latter part of the chapter, I offer a hypothesis as to what role experiments and sense experiences generally *do* play in the sciences, for Spinoza: They have the effect of persuading interlocutors by

means of producing an idea in them that is more powerful than those corresponding to their prior beliefs.

I should clarify the scope of my claims. I am *not* claiming that the interpretation of Spinoza as holding that we can only learn of essences by intuitive knowledge and not via experience is novel. Such an interpretive position, along with a justification of this position, has been given by a number of commentators (c.f. Della Rocca (1996, Chapter 5); Hübner (2015, 11); Soyarslan (2013); Primus (2017)). But my reading is novel, I believe, in at least three ways.

First, most of these readings (including the ones I have just mentioned) focus primarily on the *Ethics*. They do not focus on the *Treatise on the Emendation of the Intellect* or on the Boyle correspondence; mine does (though I will at times bring in the *Ethics* when these other lines of evidence fail). Second, none of these authors either impute to Spinoza an under-determination thesis or argue that such a thesis would lead him to reject the possibility of knowing essences through sense perception. My interpretation does both. This allows us to see Spinoza's comments and commitments in the Boyle correspondence as not being simply ad hoc responses to problems raised by his interlocutors, but as principled extensions of positions he already held. Third, they have generally not given a reading of the positive role of experience and experiment for Spinozistic science; I do.

5.2 Setting the stage: Why use the *Treatise*?

Before getting started, I should say something about my choice of interpretive framework – that is, why I am choosing, as my interpretive touchstone, the *Treatise on the Emendation of the Intellect*. There are at least three reasons for this. None of them is definitive, but jointly they provide a solid justification for turning our attention to TdIE.

First, we may consider an appeal to fruitfulness. In the extant literature, if any effort is made to place Spinoza's comments in these letters in the context of his thought

more broadly, it is usually done by reading this correspondence against the *Ethics*.[2] (I will at times use the *Ethics* as an interpretive tool, but only when necessary – i.e., when the resources of the other texts in question are exhausted.) So in choosing another one of Spinoza's works as giving the intellectual framework of the correspondence, one may uncover new and perhaps useful insights into Spinoza's thought more generally. One of the great benefits of studying the history of philosophy is that one may be exposed to new avenues of thought, new conceptual categories, and new arguments. Surely, then, a new interpretation may be beneficial on those grounds.

Second, we may consider a question of context. If one wishes not merely to discover interesting arguments but discern what a particular historical figure was indeed arguing, it is useful to place any particular argument or exchange against the broader context of what this figure thought at the time. Appeals to the *Ethics*, though perhaps useful, stand less of a chance of doing that, since they lie at a greater historical remove. When it comes to interpreting Spinoza's exchange with Boyle, then, where should we look? The obvious candidates are the extant letters written around the same time, the *Short Treatise*, and TdIE.[3]

There is some evidence that Spinoza was at work writing a treatise that resembled the (unfinished) TdIE in some respect at the time of the correspondence we're examining. At the end of Ep. 6, Spinoza writes the following:

> As for your new question, how things have begun to be, and by what connection they depend on the first cause, I have composed a whole short work devoted to this matter and also to the emendation of the intellect. (C.1.188 / G.IV.36)

2. Schliesser (2018) primarily reads them against the *Tractatus Theologico-Politicus*.

3. I do not include his *Principles of Cartesian Philosophy*, since as the preface of that work indicates, Spinoza is there recapitulating Cartesian physics, much of which we know he did not agree with. Taking anything from PCP as stating Spinoza's own view, then, can really only be justified by looking to see whether he agrees with that view in other, contemporaneous works. Hence, I focus on these and leave to the side an examination of PCP.

A natural inference, given the specific phrasing, is that Spinoza is referring to a work at the very least containing what would become what we now possess as the *Treatise on the Emendation of the Intellect*. If that is the case, then we might take the positions presented in TdIE as representative of Spinoza's positions at the time of the writing of Ep. 6. A version of the work mentioned above was underway by the mid-1660s at least. Curley (C.I.405) suggests that a first draft was near its end by 1665. Probably it was begun in the early 1660s (see Nadler (1999, 155); C.I.40).

On the other hand, Filippo Mignini (in, e.g, Mignini (1979, 1987)) argues that the work referred to in the above passage in Ep. 6 is the second part of KV, rather than TdIE. This is a common assumption of most contemporary Spinoza scholarship, with Piet Steenbakkers writing that "[m]ost [Spinoza] scholars now share this view." (Steenbakkers (2021, 20–1)) If this is correct, then we cannot *automatically* assume that the contents of TdIE represent Spinoza's thoughts at the time of Ep. 6. I do think, however, that we may reasonably make the following hypothesis: where TdIE does not conflict with KV, we may (defeasibly) take TdIE to represent Spinoza's thoughts at the time of the correspondence.

What motivates this hypothesis? Simply this: I think it is reasonable to hold that, if an historical philosopher writes a work that contains his or her doctrines on particular topics, and does not (at least not until a certain date) write anything which indicates that he or she has given these doctrines up, we should hold to the maxim that *qui tacet consentire videtur*. Hence, absent positive divergence in the period stretching from the composition of TdIE and the writing of the correspondence (and therefore, Spinoza's work on KV), we may infer that Spinoza still held to his positions on the questions involved in TdIE.

As I will say later on in this chapter, there are (at least) three questions taken up in TdIE whose answers bear directly on arguments made in the Boyle correspondence. These are, first, Spinoza's arguments concerning the proper aims of the sciences; second, his categorization of the four kinds of cognition and his arguments concerning which of

these bears on the aims of the sciences; and third, his discussions towards the end of TdIE concerning essences. Of these, only one is touched on in any detail in KV: the four kinds of cognition, in KV II. When we examine these later on in the chapter, I will discuss the points of continuity between TdIE and KV, and argue that, for my purposes, we may treat the doctrine expressed in TdIE as indicative of what was held at the time of Ep. 6. For now, then, we assume merely that in the other two points, Spinoza thought the same things when writing Ep. 6 as he did when writing TdIE.

Third, and finally, there is a question of aptness of topic. All of what I have written in this section is not to say that there is *no* discontinuity between KV and TdIE, or that there might not be valuable points to be gleaned by instead using KV as an interpretive framework. It is true, however, that KV is simply devoted to a different topic than is TdIE. As we will see, TdIE is a treatise on method, or "on the way by which [the intellect] is best directed toward the true knowledge of things." (C.I.7 / G.II.35) KV on the other hand is, as has sometimes been noted, a sort of proto-*Ethics*. The two parts of it concern, in order, "God, and what pertains to him," (C.I.61 / G.I.15) and "a Perfect Man, capable of uniting himself to God." (C.I.93 / G.I.51) If, then, we wish to inquire which of Spinoza's works to consult when trying to figure out the broader methodological implications of his specific arguments given in the Boyle correspondence, we should (all else being equal) look at works which deal substantially with methodology. In other words, in this case and on this count (and not necessarily on any others) we should look to TdIE instead of KV.

5.3 Background of the correspondence

We have no reason to believe Spinoza and Boyle ever met. Spinoza was acquainted, however, with Henry Oldenburg, an active member of the the Royal Society, with whom he kept up a correspondence between 1661 and 1676 with a hiatus between 1665 and 1676. The first report we have of their meeting is in August 1661, when Oldenburg writes (in Ep. 1) of a meeting between him and Spinoza in Rijnsburg, where they "talked about

God, about infinite Extension and Thought, about the difference and agreement of these attributes, about the way the human soul is united with the body, and about the Principles of the Cartesian Philosophy and of the Baconian."[4] (C.163-4 / G.IV.5-6) (C.I.163-4 / G.IV.5-6) In this letter, Oldenburg informs Spinoza that there is a new work on the presses, "written by an English Noble of exceptional learning", which makes a treatment of "the nature of air and its Elasticity...of Fluidity, Solidity, and the like." By October 1661, Oldenburg had sent the letter. The version that he sent to Spinoza was almost certainly the Latin translation, *Tentamina quaedam physiologica*, since Spinoza (by his own admission; see Ep. 26 (C.I.394 / G.IV.159)) could not understand English.

Boyle, for his part, had met Oldenburg when the latter was serving as tutor for Boyle's nephew, Richard Jones. They would stay in close contact for the rest of Boyle's life.[5] In addition to his prodigious skill as an experimentalist and chemist, Boyle was an accomplished scientific methodologist. Inspired by Roger Bacon, he coined the term "crucial experiment", referring to experiments which decide between competing hypotheses. He detailed his approach to scientific method in the preface of *Defence of the Doctrine Touching the Spring and Weight of Air*: "[I]t was not my chief Design to establish Theories and Principles, but to devise Experiments, and to enrich the History of Nature with Observations faithfully made and deliver'd."(Boyle (1662, Preface))

Here, Boyle is placing himself squarely among the ranks of those who practiced "experimental natural philosophy". Peter Anstey characterizes this school thus: "experimental natural philosophy involves the collection and ordering of observations and experimental reports with a view to the development of explanations of natural phenomena based on these observations and experiments." (Anstey (2005, 215)) This is in contrast to speculative natural philosophy, "the development of explanations of natural phenomena without prior recourse to systematic observation and experiment." (Anstey (2005, 215))

4. For a more detailed examination of this initial meeting and of Spinoza's stay at Rijnsburg, see Nadler (1999, 213-4, Chapter 8).

5. See Buyse (2013a, §1). The entire paper provides a very thorough background to the "correspondence".

Rose-Mary Sargent writes that

> For Boyle, the importance of hydrostatic investigations extended beyond proving that certain regularities obtain in nature to an explanation why they "ought to be so." The first task was largely mathematical. The second was the province of natural philosophy. (Sargent (1995, 66–7))

Boyle's emphasis on experiment, and ingenuity as an experimentalist, made him the ideal foil for Spinoza, who – as I will now go on to argue – held a collection of views which fit the profile of a speculative natural philosopher quite well.[6]

5.4 Ep. 6

5.4.1 Spinoza on Boyle's experiments on niter

The essay in *Certain Physiological Essays* we will treat, *A Physico-Chymical Essay, containing An Experiment with some Considerations touching the different Parts and Redintigration of Salt-Petre* (henceforth *Physico-Chymical Essay*) is devoted to an extensive treatment of some experiments Boyle carried out on "niter" (probably potassium nitrate), "fixed niter" (probably potassium carbonate), and "spirit of niter" (probably nitric acid). Curley describes (C.I.173n15) the experimental procedure as follows:

> Boyle melted niter in a crucible, added a live coal which kindled the niter, and continued adding coals until the kindling stopped. The mixture was then heated further until all 'the volatile part' escaped. The remaining 'fixed niter' was then divided into two parts. Boyle dissolved one part in water, then added drops of 'spirit of niter.' This was continued until the effervescence stopped. The other part was treated similarly, except that the fixed

6. This contrast between Boyle the experimentalist and Spinoza the rational naturalist is also noted in Hall and Hall (1964).

> niter was not first dissolved in water. Each solution was then set to evaporate near an open window. The first solution crystallized in a few hours, yielding niter. The second solution crystallized very slowly, but after water was added and the solution was evaporated, niter crystals were also produced.[7]

Oldenburg reports (in Ep. 11) that according to Boyle, the experiment described in *Physico-Chymical Essay* has two purposes. First, Boyle wanted to demonstrate that "the doctrine of Substantial Forms and Qualities, received in the Schools, rests on a weak foundation." (C.I.197 / G.IV.48) He writes in the preface to *Some Specimens of an Attempt to make Chymical Experiments* (one of the constituent essays of *Certain Physiological Essays*) that he intends to illustrate that the phenomena he is investigating "may be at least plausibly explicated without having recourse to inexplicable forms, real qualities, the four Peripatetick Elements, or so much as the three Chymical Principles". (Boyle (1669, 123))

Second, Boyle wanted to show that "what [the Schools] call the specific differences of things can be referred to the size, motion, rest, and position of the parts." (C.I.197 / G.IV.48-9) In his own words, "his Experiment seems to afford us an instance by which we may discern that Motion, Figure, and Disposition of parts, and such like primary and mechanical Affections (if I may so call them) of Matter, may suffice to produce those more secondary Affections of Bodies which are wont to be called Sensible Qualities." (*Physico-Chymical Essay* §12) Therefore, the experiments show that the mechanical hypothesis is superior to that of the Schools.[8] These are two separate aims, since Boyle could show the inadequacy of the Scholastic account without showing the adequacy of the mechanical one.

The hypothesis that Boyle takes his experiments to support is that salt-petre is produced by the concurrence of two sorts of bodies (one a salt, the other a spirit), neither

7. For a more thorough discussion of the experiment, see Banchetti-Robino (2012).

8. That Robert Boyle was a mechanist is not in much question. Whether Spinoza was one, however, is more controversial. Buyse (2013b, 2020) and Schliesser (2018) say no, while Chalmers (2009, 109), Martin (2018), and Clericuzio (Clericuzio (1990, 574ff); Clericuzio (2000, 129ff)) say yes. Taking a side in this debate is well beyond the scope of this chapter.

of which is inflammable. (*Physico-Chymical Essay* §20) Spinoza takes this to be a thesis about the nature of niter, but he does not think the observations Boyle has made confirm this thesis.

Against Boyle's hypothesis, according to Spinoza all one needs to explain this phenomenon is one kind of body, with different modifications – namely, one group of these bodies is at rest, and the other is in motion. The "fix'd Salt", which Boyle took to be one of the two distinct kinds of bodies constituting the nature of niter, Spinoza proposes to treat merely as an impurity. (C.I.174 / G.IV.17)

In this hypothesis, Spinoza thinks he has an explanation for some of the chief differences between niter and spirit of niter. The phenomena he gives an explanation for in terms of his own hypothesis are: the reconstitution of niter, the difference of taste between spirit of niter and reconstituted niter, and the difference in flammability between niter and spirit of niter.

Spinoza then passes to three experiments which offer some illustration of his explanation. We will not deal with these in great detail, except to note something odd about the language he uses. Earlier on in the letter (C.I.174 / G.IV.17) he announces his intention to give the simplest explanation of the phenomena, and also to "add two or three quite easy experiments which in some way [*aliquo modo*] confirm this explanation".[9] With respect to each of the experiments, Spinoza does *not* say that these experiments show that his hypothesis is correct. He says that these experiments "seem to confirm [*comprobare videntur*] this explanation." (C.I.176 / G.IV.21) In drawing conclusions from the first experiment, he says that "I seem to be able to infer [*videor posse concludere*]" two things, and only with respect to the third conclusion does he say that "from this it follows that [*ex quo concluditur*]", abandoning the "seem" construction. (C.I.177 / G.IV.22) He says

9. Indeed, it might be that these experiments are not experiments properly speaking (in the technical sense used today, or even in the sense of what Boyle carried out), but rather are a part of "daily experience," which further diminishes their epistemic status. Macherey (1995, 749–51) makes essentially this point, and he is certainly right to note that "from Spinoza's point of view, experience ought to be kept in a complementary and purely illustrative role, which subordinates it to the consideration of reasons and causes." (Macherey (1995, 751); translation my own).

of the second experiment that it "seems to show [*ostendere videntur*] that the fixed parts are only impurities in the Niter", and of the third experiment that it "seems to indicate [*indicare videtur*] that, when the particles of the spirit of Niter lose their motion, they are made inflammable." (C.I.177 / G.IV.23)

What are we to make of this coy and hesitant language? What is the function of these experiments, if *not* to prove or demonstrate definitively a preferred hypothesis? I think we find a clue in Ep. 13. By this time, Oldenburg had conveyed Spinoza's criticisms to Boyle, and (in Ep. 11) had conveyed Boyle's responses back to Spinoza. In responding to Boyle, Spinoza writes that he offered these experiments "to confirm my explanation – not absolutely [*non ut absoluto*], but as I expressly said *to some extent*." (C.I.209 / G.IV.66) He continues, after a few lines:

> As I expressly said, I did not offer these experiments that I might confirm absolutely [*prorsus confirmarem*] what I said. It was only that these experiments, which I had said and showed to agree with reason, seemed to confirm those things to some extent [*aliquo modo confirmare viderentur*]. (C.I.210 / G.IV.66)

This, I think, is a clue to what is motivating Spinoza's view of experiment. This view is a bit more clearly demonstrated in Ep. 13. But, before giving a thorough analysis (which we will do in a later section) it will be useful to examine Spinoza's general views about the method and aims of the sciences, as well as his epistemology, at the time of Ep. 6. In other words, as I argued in an earlier section, we should look to TdIE.

5.5 Knowledge, Essence, and Method in TdIE

What sets TdIE apart from other contemporary or near-contemporary texts on method is Spinoza's aim. It is useful to contrast him with one of his predecessors and influences, Thomas Hobbes. Hobbes' account of both the proper aim and method of philosophy is

found in Chapter 1 of *De corpore*. According to him, the proper method of philosophy, depending on the particular topic of inquiry, is either analytical or synthetical. (EW I 66) The analytical method "proceeds from sense to the invention of principles." (EW I 75) It is in this way that the first principles of the sciences are discovered. The synthetical method, on the other hand, moves from principles to the characteristics of individual things – for instance, what the properties of matter are, or whether any particular appearance is a material body or a mere accident.[10]

The general aim of any philosophy we conduct by this method, according to Hobbes, is

> [T]hat we may make use to our benefit of effects formerly seen; or that, by application of bodies to one another, we may produce the like effects of those we conceive in our mind, as far forth as matter, strength, and industry, will permit, for the commodity of human life. (EW I 7)

Or, in slogan form: "The end of all knowledge is power." (EW I 7)

Contrast this with Spinoza's account. According to his system, the proper end of human endeavor (science included) is blessedness: "[L]ove toward the eternal and infinite thing feeds the mind with a joy entirely exempt from sadness. This is greatly to be desired, and to be sought with all our strength." (C.I.9 / G.II.7)

One might well ask whether something like Hobbes' position is true of Spinoza as well. He writes in EIIIp12 (C.I.502 / G.II.150) that "the Mind, as far as it can, strives to imagine those things that increase or aid the Body's power of acting." And at the end

10. Lodewijk Meijer discusses this distinction between analytical and synthetic methods in the preface to *Principles of Cartesian Philosophy*, and he attributes this knowledge to Spinoza. (C.I.226 / G.IV.129) The particulars of the method, however, are likely to be Cartesian rather than Hobbesian, given the direct reference Meijer makes to the Second Objections and Replies. Furthermore, the analytic method referenced in this preface is described to be one which "shows the true way by which the thing was discovered, methodically, and as it were a priori." (C.I.226/ G.IV.129) The synthetic method, on the other hand, "uses a long series of definitions, postulates, axioms, and problems." (C.I.226 / G.IV.129) This does not seem perfectly to track the distinction we see Hobbes making above, where the analytical method moves from sensations to principles. While the differences in method between Descartes and Hobbes are extremely interesting, they are not within the scope of this chapter.

of EIVpref (C.I.545-6/ G.II.208), he tells us that "when I say that someone passes from a lesser to a greater perfection…[I mean that] his power of acting, insofar as it is understood through his nature, is increased or diminished." This is a fair point, but it is not clear that Spinoza has such a doctrine in mind in TdIE. There the highest good is a person's arrival at a human nature "much stronger and more enduring than his own" (C.I.10/ G.II.8); this nature is said to be "the knowledge of the union that the mind has with the whole of nature." (C.I.11 / G.II.8) Certainly there is emphasis on the strength (and hence, one might think, the power) of this nature, but it does not seem that its essential characteristic is its power, as in the *Ethics*. Rather this nature (and hence the perfection and blessedness) is a sort of recognition of the mind's place in the cosmos.

He goes on: "This, then, is the end I aim at: to acquire such a nature, and to strive that many acquire it with me." (C.I.11 / G.II.8) It is this dominant aim that dictates his method and subordinate aims. The ones he enunciates are (C.I.11 / G.II.9):

1. "[T]o understand as much of Nature as suffices for acquiring such a nature."
2. "[T]o form a society of the kind that is desirable, so that as many as possible may attain it as easily and surely as possible."
3. "[To pay attention] to Moral Philosophy and to Instruction concerning the Education of children."
4. "[To work out] the whole of Medicine."
5. "Mechanics is in no way to be despised."

Before this can be done, Spinoza says that "we must devise a way of healing the intellect, and purifying it, as much as we can in the beginning, so that it understands things successfully, without error and as well as possible." (C.I.11/ G.II.9) Because he wishes to

"direct all the sciences toward one end and goal, viz. that we should achieve...the highest human perfection...anything in the sciences which does nothing to advance us towards our goal must be rejected as useless". (C.I.11 / G.II.9)

This point is important for my reading of these texts. Whether or not sense perception (and hence all experience related to sense perception, be it simple experiences or highly structured experiments) has high or low epistemic value, or whether or not we should draw scientific laws from experimental evidence, is ultimately going to be determined by whether or not these methods will contribute towards the blessedness of humanity. And, as we will see, if these are found wanting on this score, they are to be rejected. Consequently, I think properly to understand the conditions Spinoza sets on knowledge in general, and knowledge of essences in particular, one needs to understand the motivation for these restrictions.

5.5.1 Perception and its types

At C.I.12-3 / G.II.10, Spinoza introduces a four-fold distinction amongst types of perception (and the corresponding kind of cognition).[11] These distinctions rest on the modes of perception by which we come to acquire this cognition. I will categorize these modes as follows:

Type One: "Perception we have from report or from some conventional sign."

11. I render "cognitio" as "cognition", rather than "knowledge". I am not unique in doing this. Kisner and Silverthorne's recent translation of the *Ethics* (Spinoza (1677/2018)) renders the relevant passages in EIIp40s using "cognition" instead of "knowledge". And the most recent critical edition of the text of the *Ethics*, Spinoza (1677/2020), translates its occurrences in EIIp40s as "connaissance," rather that "savoir," which emphasizes its distinction from a propositional knowing-that. This is perhaps not overly consequential as regards TdIE, but that will nonetheless be my practice. It is, however, reflective of the fact that the early moderns often meant very different things by *scientia*, *cognitio*, and their cognates than do modern epistemologsts. An important exposition of this view is Carriero (2013). See also Antognazza (2020), which categorizes what we would today call "knowledge" as a mode of cognition importantly different, and indeed different in kind, from belief (especially relevant are pp. 11-2).

Examples: the date of our birth, who our parents were, and other things that under ordinary circumstances we never doubt

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Type Two: "Perception we have from random experience [*experientia vaga*], that is, from experience that is not determined by the intellect."

Examples: that we will die, that oil feeds fire, that water puts it out, that a dog is a barking animal, that man is a rational animal.

Type Three: "Perception that we have when the essence of a thing is inferred from another thing, but not adequately. This happens, either when we infer the cause from some effect, or when something is inferred from some universal, which some property always accompanies."

Examples: when we infer, from the fact that we get sensory experience through only a single body, that the soul is united to one and only one body; when we know the nature of our vision, and in particular that it presents nearer objects as larger and distant objects as farther, we come to know that the real dimensions of the sun differ from its apparent dimensions.

Type Four: "Perception we have when a thing is perceived through its essence alone, or through cognition of its proximate cause."

Examples: that two and three are five, that parallel-ness is transitive, &c.

In general, I will use the locution "**Type One** cognition" to refer to cognition gained through **Type One** perception, and so forth for the others. Whenever I say "experience" unmodified, I will be referring to the type of experience that Spinoza references in his description of **Type Two**. Further, in reference to **Type Two** perception, Spinoza says that it has the name "random experience" because it "presents [itself] by chance, and we have no other experiment which attacks it, and hence it remains in us, as it were, unshaken." (G.II.10)[12] Here I think the use of "other experiment [*aliud...experimentum*]" most naturally suggests that Spinoza thinks that whatever that experiment is, it is of a kind with the initial instance of **Type Two** perception (else why add the qualifier "other"?). As a result, going forward I will take any use of "experiment" to single out, not a perception in a distinct perceptual class from a **Type Two** perception, but an additional **Type Two** perception

What the distinction between **Type Three** and **Type Four** cognition is supposed to be is clear enough, but its importance is not. In two footnotes, Spinoza makes two points which bring this importance out. In the first (C.I.13nf / G.II.10nf), he makes the following point: While **Type Three** perception can let us make true inferences, and can yield ideas of a thing with accurate content, it will not allow us to gain a complete characterization of a thing's essence. In the case of inferring cause from effect, we will only be able to infer as much from the cause as we find in the effect. According to Spinoza, when this happens we are only able to make very broad inferences, such as "therefore there is something which has caused this effect". This tells something about the nature of the thing in question, but it does not suffice to narrow it down: as far as the ordinary course of nature goes, an event may have infinitely many potential causes. (C.I.41 / G.II.36)

In the second footnote, Spinoza remarks that

> Although such a conclusion is certain, it is still not sufficiently safe, unless we take the greatest care. For those who do not take such care will imme-

12. The translation here is my own, because I think that Curley's translation importantly misconstrues the text; it sequesters off the last clause into its own separate sentence, and drops the "tanquam" altogether.

> diately fall into errors. When things are conceived so abstractly, and not through their true essence, they are immediately confused by the imagination. What in itself is one, men imagine to be many. For to the things they conceive abstractly, separately, and confusedly, they give names which they use to signify other more familiar things. Hence they imagine these things in the same way as they are accustomed to imagine the things to which the names were first given. (C.I.14nh / G.II.12nh)

The conclusion that Spinoza is speaking of here is that the soul is united to the body. The ground of this inference is the fact that "we clearly perceive that we feel such a body, and no other". We may infer that there is some sort of union between the body and soul from this sensation, but we will not learn anything about this union from this inference other than what we have learned in the sensation initially. And when this union is conceived of abstractly, it is susceptible of much more confusion by the imagination. from this work of the imagination that fictitious and false ideas arise. (C.I.36-7 / G.II.32)

It may not be clear why all of these types of cognition mightn't contribute something towards the achievement of our goal. But it is important to recognize that Spinoza's views on epistemology are driven by his views on method and the aims of the sciences. He claims that the mode of perception we are to choose is the one which will best aid us in securing the means to the ultimate end of the sciences. These means are, first, exact self-knowledge, and second, as much knowledge of the natures of other things as will let us understand their accidents ("differences, agreements and oppositions"), "conceive rightly what they can undergo and what they cannot", and accurately compare them with our own nature and power. (C.I.15 / G.II.12) Hence, if one of these types of cognition can achieve these goals and the others can't, we should go with the one that can and shed the ones that can't – or, at least, recognize that the achievements of the other kinds of cognition are ultimately parasitic on achievements of the preferred kind.

Spinoza's next conclusion comes as a result of a few separate arguments. First, Spinoza

argues that **Type One** perception, and hence **Type One** cognition, will not let us reach the goals of true science. Since, as I will go on to argue, what we are concerned with here is **Type Two** perception and cognition, I will not go over the argument here; nor will I review the reasons why Spinoza thinks **Type Three** perception cannot yield knowledge of essences. I will simply note that in both cases, Spinoza thinks that the relevant type of perception is not up to the task. He says of **Type One** perception that, through it, "we do not perceive any essence of a thing." (C.I.15 / G.II.12) And of **Type Three** perception, he says that "it will not through itself be the means of our reaching our perfection." (C.I.16 / G.II.13) Since reaching our perfection involves coming to know our nature and the nature of things (see C.I.15 / G.II.12), I infer that **Type Three** perception by itself will not be sufficient for coming to know the essence of things.

Since, as I will argue, **Type Two** perception is more relevant to our topic, I will now examine the argument that Spinoza gives for its inadequacy. This argument goes as follows:

(P2.1) In **Type Two** perception, we only perceive the accidents of a thing.

(P2.2) If we do not know the essence of a thing, we do not understand its accidents clearly.

So (C2) In **Type Two** perception, we do not understand a thing's accidents clearly.

One might wonder, quite reasonably, why Spinoza thinks he is entitled to (P2.1). We are not in a position to answer this question now, but once we have developed enough machinery, we will return to it.

This argument has at least two upshots. The first is that any clear understanding gotten from **Type Two** perception is going to presuppose cognition of an essence, which **Type Two** cannot give us. The second is that, unless we understand a thing's accidents clearly, we won't be able to reach an adequate understanding of what sorts of changes

that thing can undergo and which it can't, or what the differences between that thing and others is.

Type Four, by contrast, will definitionally achieve the desired ends. If we have **Type Four** perception of our essence, then we will gain exact cognition of our nature. And if we have **Type Four** perception of the nature of things, then we will clearly be able to infer all the properties necessary to meet Spinoza's desiderata.

So according to Spinoza, we should "chiefly use" **Type Four** perception. (C.I.16 / G.II.13) He does not say that we should not employ the other types of perception in pursuit of our goal, but he has other commitments which ought to push him in this direction. Recall his comment that "anything in the sciences which does nothing to advance us towards our goal must be rejected as useless" (C.I.11 / G.II.9); recall too that our intellect is to be purified, "so that it understands things successfully, without error and as well as possible" (C.I.11 / G.II.9). The first two types of perception do not advance us towards our goal, since they only yield adequate cognition if we already have cognition of the essences of things; they also admit of significant error. **Type Three** might yield some cognition of essences, but it does not guarantee an error-free conclusion, does not understand things successfully, and certainly does not do it as well as possible. I say "does not guarantee an error-free conclusion" because, as noted a few pages earlier, Spinoza thinks that this kind of perception involves a high degree of abstraction. And since any kind of abstraction can be influenced by the imagination, this sort of perception can very easily lead us astray. This kind of perception, according to Spinoza, is very delicate.

But it is **Type Two**, and not **Type Three**, that concerns us in our analysis of Spinoza's response to Boyle. I base this claim on two reasons, one of them textual and one of them substantive. I will treat the substantive reason at length later, but before I examine the textual one, let me first say a bit about how this compares with the analysis of the types of cognition given in KV.

5.5.2 Perception and cognition in KV and TdIE

As mentioned in §1, the counterpart in KV for this introduction of the types of cognition and perception comes at C.I.96 / G.I.54:

> We acquire these perceptions [of ourselves and of those things that are outside us], then, either 1. simply through 'belief' (which comes from experience or from report), or 2. through a true belief, or 3. through a clear and distinct concept. The first is commonly subject to error. The second and third, though they differ from one another, cannot err.

Spinoza then goes on to give the example of the "rule of three," just as in TdIE (which we will discuss momentarily). While this is a threefold rather than fourfold typology, that particular difference is merely cosmetic. A little while later in the same work, at G.I.104 / C.I.61, Spinoza writes that "[w]e have divided perception into four kinds: *report alone, experience, belief, and clear knowledge*."

There is continuity elsewhere. Spinoza insists that "true belief," the KV counterpart of what I have called in TdIE **Type Three** cognition, does not show us the essences of things: "[true belief] shows us, indeed, what belongs to the thing to be, but not truly what it is." (C.I.102 / G.I.59) This parallels what Spinoza says of **Type Three** cognition in TdIE: it does not disclose essences. Spinoza does not, that I can see, directly say that "true knowledge" discloses essences, but elsewhere in KV he does call it "an immediate manifestation of the object itself to the intellect," (C.I.138-9 / G.I.100) which comes to about the same thing given the definition of essence that he gives at C.I.94 / G.I.53:

> That belongs to the nature of a thing without which the thing can neither exist nor be understood: but this is not sufficient; it must be in such a way that the proposition is always convertible, viz. that what is said also can neither be nor be understood without the thing.

The reasoning for this goes as follows. given this definition of essence, if a thing presents itself directly to my intellect, then I must be able to understand it. And, since I cannot do this without understanding the essence (or so it seems to me that the definition given above says), I must at the same time understand the essence of the thing. Hence, the fourth kind of cognition discussed in KV discloses essences.

Furthermore, Spinoza speaks in KV of the relation between "true knowledge" and the proper end of humans. He calls it "the final end we seek, and the most excellent thing we know." (C.I.104 / G.I.61) Our well-being, that is, "our greatest blessedness," is "the Love of God," (C.I.129 / G.I.89) cannot be brought about by the lower kinds of perception. The lowest two are the source of the passions, and "reason...has *no power* [emphasis mine] to bring us to our well-being" (C.I.138 / G.I.100) "Reason" here seems to refer to "true belief"; for instance, in the rule of three example in KV, Spinoza writes that a man has a case of "true belief" when "Reason tells him that because of the property of proportionality in these numbers, this is so, and could not have been, or happened, otherwise." (C.I.98 / G.I.55) Instead, our blessedness can only be brought about by "true knowledge": "so if we come to know God [by "true knowledge"], then we must necessarily unite with him...As we have already said, our blessedness consists only in this union with him." (C.I.139 / G.I.100)

So we have at least three points of continuity between the account in KV and that of TdIE: first, the general typology of kinds of cognition is the same; second, the third kind of cognition (**Type Three** in TdIE and "true belief" in KV), and hence, we might infer, certainly not lower kinds, does not disclose essences; and third, only the fourth and highest (**Type Four** in TdIE and "true knowledge" in KV) can help us achieve blessedness. These are the crucial points that I have argued that TdIE makes above, so I conclude, on this basis, that there is sufficient continuity between KV and TdIE to assume that *with respect to the things I set out in this chapter*, and those alone, the account of the four types of cognition set out in TdIE and that set out in KV are the same.

5.5.3 The case of the "rule of three"

At C.I.14-5 / G.II.11-2, Spinoza gives a concrete example of how we go about obtaining cognition using each of them. He poses a problem: suppose you are given three numbers p, q, and r, and are asked to find a fourth number s such that $\frac{s}{r} = \frac{q}{p}$. Someone using **Type One** perception will rely upon something that a teacher once told them without demonstration, and will proceed to find the fourth number. Others will conduct a series of trials and notice that, in pairs where the proportion is obvious, the numbers follow a set pattern (namely, that $s = \frac{rq}{p}$). From numerous trials, this person will "construct a universal axiom from an experience with simple numbers" (C.I.15 / G.II.12), and this axiom will be derived using **Type Two** perception.

A person using **Type Three** perception, however, will come to find the fourth number because he has grasped the nature of proportion (Spinoza's language, not mine; the Latin is *natura proportionis*), and he because understands a particular property of proportionality. From this property he infers what s is. But this is still not the highest form of perception for Spinoza – that comes when this property is apprehended "not by the force of that Proposition, but intuitively, without going through any procedure." (C.I.15 / G.II.12)

When Spinoza then goes on to give his arguments concerning why **Type Two** perception is not up to the task, he says the following:

> As for the second, again, no one should be said to have the idea of that proportion which he is seeking. Apart from the fact that it is a very uncertain thing, and without end, in this way no one will ever perceive anything in natural things except accidents. But these are never understood clearly unless their essences are known first. So that also is to be excluded. (C.I.16 / G.II.13)

I read "that proportion" as referring to the proportion which was mentioned in the

preceding example. The procedure mentioned by Spinoza in the "rule of three" example that corresponds to **Type Two** perception seems experimental. If one reads these two last passages against each other, it seems clear that Spinoza is targeting experimentalists. This impression is bolstered by a remark he makes in a footnote: "Here I shall discuss experience somewhat more fully, and examine the Method of proceeding of the Empiricists and of the new Philosophers." (C.I.16ni / G.II.13ni) While this does not amount to full-scale textual endorsement of the notion that **Type Two**, and not **Type Three**, perception is what is involved in deriving inductive laws from these experiments, it is the next best thing.

But while textual evidence that Spinoza held a view is interesting and valuable, it does not tell us much about *why* he should have held these views, nor why we should consider whether we should hold them. In the next section, I take up that question, and address the substantive reason that I mentioned above.

5.6 Ep. 13

Recall that Spinoza took Boyle to "[want] to explain the nature of Niter to us, that it is a heterogeneous body, consisting of fixed and volatile parts." (C.I.208 / G.IV.64) His response was intended to show that all the chemical characteristics of niter could be accounted for by the simpler hypothesis that niter is homogeneous, and that the varying properties that Boyle attributed to heterogeneous types of bodies can be explained by differences in motion and rest. He continues:

> [I]t was not my task to show that the fixed salt is an impurity in Niter, but only to suppose it, to see how [Boyle] could show me that the salt is not an impurity but is absolutely necessary to constitute the essence of Niter, *without which Niter could not be conceived* [emphasis mine]. (C.I.208 / G.IV.64)

The view of essence which Spinoza expresses here is important, since it gives him a

strong reason to reject the notion that Boyle has shown him the essence of niter in this experiment. The reasoning goes like this:

1. A thing cannot be (adequately) conceived without its essence.

2. We can (adequately) conceive of Niter without the properties Boyle takes as constituting its essence.

So: (3) The properties that Boyle takes to constitute the essence of niter are not actually the essence of niter.

Spinoza believes (1), and takes himself to have established (2). So if his doctrine of essences is conceded, (3) follows. So far from demonstrating the essence of niter (as Spinoza thinks was the intent), Boyle has offered an hypothesis (that it is of the essence of niter to consist in heterogeneous parts) which *cannot* be right.

This argument has potentially troubling undertones – undertones which become more overt later in the letter. Spinoza writes (in a somewhat lengthy passage which nonetheless bears quoting):

> [Boyle] says, further, that there is a great difference between those experiments (the readily available and doubtful ones I have adduced), where we don't know what Nature contributes and what things intervene, and those regarding which it is established with certainty what things are contributed....I do not know why the Distinguished Gentleman is bold enough to maintain that he knows what Nature contributes in the matter we are speaking of. *By what reasoning, I ask, will he be able to show us that that heat has not arisen from some very fine matter?* Was it perhaps because so little of the original weight was lacking? But even if none was lacking, one could, in my judgment at least, infer nothing. For we see how easily a thing can be imbued with a color from a very small quantity of matter, and not on

> that account become sensibly heavier or lighter. So it is not without reason that I can doubt whether perhaps certain things have concurred which could not have been observed by any sense perception – especially so long as we do not know how all those Variations which the Distinguished Gentleman observed in experimenting could have come about from the bodies mentioned. (C.I.211 / G.IV.67)

Spinoza had criticized Boyle's attempt to show that "all tangible qualities depend only on...mechanical affections". He had claimed that Boyle's experiments with niter were of about as much good as much simpler ones to accomplish that goal, such as rubbing two pieces of wood together. (C.I.179 / G.IV.25)

In response, Boyle had claimed that there is a crucial difference between experiments where we know what sorts of things are taking part in the experiment and ones in which we don't. In the case of the wood rubbing together, we have a very composite body, whereas in the case of the experiments with niter (presumably) we are dealing with simpler bodies, and therefore have a better idea of what we are experimenting on.

It is possible that at this point Boyle and Spinoza are simply talking past each other. At one point (C.I.147 / G.IV.48) Oldenburg chides Spinoza gently on Boyle's behalf concerning the purpose of Boyle's tracts: The intent was to show the weakness of the Scholastic conception of substance and form. So – one might ask – why should we expect Boyle to be moved by Spinoza's criticisms?

For one thing, Spinoza and Boyle seem to have related conceptions of essences. For Spinoza (at least in the *Ethics*; nowhere in TdIE does he give an explicit definition of an essence that I can find), the essence of a thing is that without which the thing can neither be nor be conceived, and which can neither be nor be conceived without that thing. (See *Ethics* part II definition 2, at C.I.447 / G.II.84) According to Boyle, in his work *The Origin of Forms and Qualities According to the Corpuscular Philosophy* (first published in 1666):

> This *Convention of Essential Accidents* being taken (not any of them Apart, but all) *together* for the Specifical Differences that *constitutes* the Body and *discriminates* it from all other sorts of Bodies is by one Name, because consider'd as one *collective* Thing, call'd its Forme...or, if I may so name it, an *Essential Modification*. (Boyle (1666, 102))

These "essential accidents" are said to be a "determinate *manner of existence* of the matter" of which the body is constituted.[13] (Boyle (1666, 102)) This is fairly close to Spinoza's notion, though not couched in the same terminology. Since the essence of a thing is what distinguishes it from all other things, presumably it will be impossible to conceive *this particular* thing adequately without also adequately conceiving of its essence – otherwise, how would we conceive of *this* thing as opposed to some other one?

So, if Boyle and Spinoza share a similar notion of essence, we might expect Spinoza's criticisms to move Boyle. But even if they would not have moved Boyle an inch – say, because Boyle is concerned with the most general affections of matter and not with specific essences of things, or because they have different conceptions about the aim of the sciences and all of human knowledge – I think that understanding Spinoza's philosophical motivations in this correspondence is both illuminating and important. It allows us to see the positions he takes, not simply as islands in conceptual space with no real connection to one another, but as an integrated view, one where seemingly disparate parts cohere together surprisingly well.

5.6.1 Under-determination

Now, we return to Spinoza's response. He speaks of certain things affecting the outcome of experiments which could not have been observed by any possible experience or experiment (though perhaps they may have been discerned by experience which is "determined by the intellect"; we will discuss this briefly in a later section). So how can we ever

13. See Jones (2007) for a comparison of the theory of essences of Boyle and John Locke.

be sure, when conducting an experiment, that we have actually discovered the cause of the macroscopic phenomena? He even goes so far as to say that "I regard it as certain that the heat and effervescence [Boyle] recounts have arisen from foreign matter".[14] (C.I.211 / G.IV.67-8)

Here is a concrete example of the sort of thing I am reading Spinoza as saying.[15] Suppose that we determine experimentally that the gravitational force exerted on mass M_1 by mass M_2 is proportional to both masses and the inverse square of the distance between them:

$$F_{M_1M_2} \propto \frac{M_1M_2}{r^2}$$

Since any body of experimental evidence will have some associated error, the data from which we've induced this law will also be consistent with another law where the force is proportional to both masses and the inverse square-plus-ϵ of the distance, for small-enough ϵ[16]:

$$F_{M_1M_2} \propto \frac{M_1M_2}{r^{2+\epsilon}}$$

It doesn't seem plausible to take the fact that the latter law also fits the data as a serious reason to doubt that gravity follows an inverse square law. But for Spinoza, since any body of experimental evidence will be compatible with both laws for small-enough ϵ, we are

14. This vein in Spinoza's thought has been picked up by some in the secondary literature; for instance, Biasutti (2013) writes that "[w]hen considered as it simply appears to our senses, nature is classifiable in the most diverse ways, without any one of these making itself absolutely preferable to another." As we will see, Spinoza has good systematic reasons for thinking this.

15. The example is inspired by a similar one given in Weinberg (1992, 85).

16. Newton considers something like this in Book 3, proposition 2 of the *Principia Mathematica* (referencing Book 1, proposition 45, corollary 1), and argues that the law governing the force of gravity cannot depart at all from the inverse square. His argument there is that even the slightest departure from the inverse square law would result in "a noticeable motion of the apsides in a single revolution and an immense such motion in many revolutions." (Newton (1687/1999, 802)) This notwithstanding, I think the example can be made to work simply by choosing the ratio of the total angular motion "with which the body returns to the same apsis" to the "angular motion of one revolution" (Newton (1687/1999, 543)) to be $1+\delta$ or $1-\delta$ for δ picked small enough so as to fit all hitherto-observed data. This is jerry-rigged, to be sure, but that does not concern us at the moment.

never justified in this inference when the experimental evidence is all we have to go upon.

Consider just how radical this skepticism is. Spinoza takes Boyle's experiments to be directed at discovering the essences of chemical substances. These essences are things without which we cannot conceive the thing in question. Now, if sense experience can never distinguish between two contrary hypotheses about the essence of a particular thing, then such experience – and hence experiments, since these are only a controlled and highly artificial version of sense experience – can never reveal the essences of the things in question. It should come as no surprise, then, that Spinoza writes, in Ep. 10 (to Simon de Vries), that "experience[17] does not teach any essences of things" (C.I.196 / G.IV.47), and in TdIE that "in [experience] no one will ever perceive anything in natural things except accidents." (C.I.16 / G.II.13) This apparent skepticism is noted in Hall and Hall (1964, 254), who write: "Spinoza's position here seems to be that if two or more equally rational accounts of a phenomenon can be proposed, there is no reason to choose one as true rather than another."

If all Spinoza thinks we have to go on is what we can infer from the sensible phenomena, then the conclusion would be extreme skepticism. But I do not think this is the correct conclusion. Perceptions gained solely from experiment are going to be **Type Two** perceptions, and so any cognition reached on these sorts of perceptions will be **Type Two** cognition. But Spinoza expected this anyway. We should be aiming at **Type Four** cognition, according to the arguments in preceding sections, and therefore should not be surprised if **Type Two** perception fails to reveal essences. Importantly, Spinoza does think cognition of essences is possible, but only with the aid of **Type Four** perception. (C.I.16 / G.IV.13)

So Spinoza is not a skeptic about the possibility of cognition of essences. Rather, I read him as accepting a form of under-determinationism, which flows, ultimately, from his views on the aim of the sciences. On the view I have imputed to him above, there

17. It should be noted that Spinoza does *not* here use the technical term *experientia vaga*, but rather simply *experientia*, which suggests a wider meaning.

is in principle no amount of experimental evidence which will suffice to yield cognition of the essence of any created thing. Spinoza holds both that one of the chief aims of the sciences is to teach us the natures of things, and that no experience generally, and hence no experiment particularly, will suffice to fix the facts about the essence of any particular thing. So, whenever we attempt to discover the nature and essence of any particular thing or class of things by experiment alone, we will be unsuccessful. And, if this is all we have to go on, no such discovery will be possible. But, fortunately for us, Spinoza does not think this is all we have to go on.

I am not imputing to Spinoza what some under-determinationists take to be an important or essential part of that thesis, viz., confirmation holism. This is the doctrine that hypotheses are never tested in isolation, but only against the whole of a scientific theory (or in more extreme cases against the whole of science). This view comes to us from Pierre Duhem by way of Quine (probably most influentially in Quine (1951)), and to impute it to Spinoza would be anachronistic.[18]

But there is another reason why Spinoza definitely did not hold to some variant of the Duhem-Quine thesis. One of the catch-phrases of Quine (1951) is that "[a]ny statement can be held true come what may, if we make drastic enough adjustments elsewhere in the system." (Quine (1951, 40)) Elsewhere he puts it like this: "Any one of the statements [of a scientific theory] can be adhered to in the face of adverse observations, by revising others of the statements." (Quine (1975, 313)) Spinoza would dissent from this. Statements which are supported by **Type Four** perception can be held to be true, come what may. But no statement derived from **Type Two** perception may be. The easiest way to see this is by considering a case where two statements bump up against each other, one of which derives support from a **Type Four** perception and the other from a **Type Two** perception. In a case like this, the **Type Four** perception will always win. Instead, Spinoza's brand of under-determination is much closer to what is sometimes called con-

18. Note that Quine himself cautioned against conflating the two ideas; see Quine (1975, 313)

trastive under-determination. Laudan (1990) puts it this way: "for any theory T, and any given body of evidence supporting T, there is at least one rival (i.e. contrary) to T that is as well supported as T." (Laudan (1990, 271))

Nancy Maull claims that this under-determination presents itself because geometrical demonstrations are the way to show these truths. In speaking of the exchange with Boyle and Oldenburg she writes:

> Spinoza's message, conveyed unmistakably in his pesky insistence throughout the exchange, is that the experiments (because they admit to different interpretations) decide no unique hypothesis and that a mechanical hypothesis about the sizes, shapes, and motions of unseen bodies may only be justified by rigid mathematical proof from higher principles. (Maull (1986, 6))

I think Maull is correct about the under-determination, but wrong about its source, for two reasons. First, what Spinoza thinks Boyle is offering is not just an hypothesis about the "sizes, shapes, and motions of unseen bodies", but also an hypothesis about the essence of a particular thing, whereas Maull seems to take him to be concerned with an hypothesis about particular motion. And that sort of hypothesis simply cannot appeal to experiment for its justification in the first place. Second, I do not think it is correct to read Spinoza as saying that such a hypothesis could be confirmed by a demonstration, either. In the example of the "rule of three", the kind of cognition that Spinoza says we attain by force of a demonstration in Euclid, when we have understood it, is **Type Three** cognition, not **Type Four** cognition. And it is only **Type Four** cognition, according to him, that will reliably disclose truths about the essences of things to us.

5.7 Why did Spinoza think poorly of Type Two perception?

So far, I have made two arguments. First, Spinoza thought poorly of sense experience as a way of obtaining scientific knowledge. Second, he held to an under-determinationist thesis, on which any body of sense experience is compatible with multiple hypotheses about the essences of the things involved. In this section, we will put these two theses together.

I will argue that, given his under-determinationism, Spinoza had a strong reason to distrust **Type Two** perception, and hence **Type Two** cognition, as a means of disclosing essences. In doing so, I will contrast my analysis of Spinoza's attitude towards experiment with those of McKeon (1928) and Klever (1990). I will argue that these positions are in large part correct, but incomplete: They don't offer a good reason as to *why* Spinoza held the views that he did. I will not go into the details of the view expressed in Gabbey (1995, §6) (mostly for reasons of space) except to note that he basically agrees with McKeon: "for Spinoza *experientia vaga* does not uncover causes or essences." Since he concurs with McKeon but does not (as far as I can tell) give a systematic reason for why this experience does not reveal essences, I will treat my discussion of McKeon as applying to them both.

It should be said, at the outset, that Spinoza's thoughts on the poor epistemic status of **Type Two** perception is somewhat overdetermined. For instance, in TdIE he comments that "false...ideas have their origin in the imagination, i.e., in certain sensations that...do not arise from the very power of the mind, but from external causes." (C.I.36-7 / G.II.32) So – one might reason – shouldn't we already expect Spinoza to think poorly of **Type Two** perception on other grounds, and hence conclude on the above basis alone that it cannot disclose essences to us?

This point is certainly correct as far as it goes. Spinoza does think that all false ideas have their origin in **Type Two** perception. But this does not show, by itself, that *the*

only thing that arises from **Type Two** perception are false ideas. Going only on what Spinoza says in TdIE §84, it might still be the case that *certain* instances of **Type Two** perceptions can indeed produce cognition of essences. In other words: while all false ideas arise from **Type Two** perception, not all ideas arising from **Type Two** perceptions need be false.[19] What I will argue in this section, however, is that no idea arising from **Type Two** perception is a true idea of an essence.

5.7.1 McKeon's reading

In his thorough study of Spinoza's approach to experimental science, Richard McKeon makes an argument similar to mine. On his reading, Spinoza held that

> [t]he ideal of science is rational, and consequently knowledge of the nature of things may be attained by reflection concerning essences; experimentation could reveal nothing essential concerning things. "Only accidental qualities which are never clearly understood unless the essences of things are previously known" can be discovered by methods of observation. (McKeon (1928, 134))

On this reading, **Type Two** perception simply is not up to the job, since it only reveals accidents and not essences. Furthermore, since cognition derived from sense perception is uncertain, it cannot be genuine, scientific knowledge. (McKeon (1928, 152–3))

19. One might say that this is not true in the *Ethics*, and that there, the fact that any idea of the first kind of cognition represent two causes (my body and the external object) is what makes it necessarily confused and inadequate.

While this is true in the *Ethics*, the case in TdIE is somewhat different. In that work Spinoza writes: "all confusion results from the fact that the mind knows only in part a thing that is a whole, or composed of many things, and does not distinguish the known from the unknown (and besides, attends at once, without making any distinction, to the many ideas that are contained in each thing)." (C.I.29 / G.II.25) No mention of an idea arising from multiple causes is made – *all* confusion in ideas arises from the sources mentioned. This is compatible with what is said in the *Ethics* of course, and perhaps what is said there is, upon further argument and reflection, compatible with what is said here. But it is not *obviously* the same doctrine or explanation, and so since my purpose is to read the correspondence against TdIE whenever possible, I will default to that.

But it is fair to ask why this is the case. Why is it, on Spinoza's view, that we only gain cognition of accidents from **Type Two** perception? If this is true simply by stipulation, then we are no closer to understanding why our senses are untrustworthy. McKeon does not provide a satisfactory answer to this question. Given his view, we are no closer to understanding why Spinoza should have taken this view.

I think, however, there is an argument, starting from Spinoza's views on under-determination, which leads to the conclusion that we only perceive accidents in **Type Two** perception. It is this:

1. The properties we perceive in **Type Two** perception never uniquely determine the essence of a thing.

2. If a property does not uniquely determine the essence of a thing, it is an accident.

So: (3) The properties we perceive in **Type Two** perception are accidents.

If my reading is correct, Spinoza is warranted to accept (1) because of his under-determinationism. Recall the hypothesis he offers as a rival to Boyle's in the case of the reconstitution of niter. According to his argument, the phenomena are just as compatible with his hypothesis about the nature of niter as with (what he takes to be) Boyle's hypothesis. He also holds that there are in principle many ways in which (what we would term) the micro-physical structure of the world can be arranged which will reproduce the phenomena we observe. Recall that he says that he can "doubt whether perhaps certain things have concurred which could not have been observed by any sense perception." (C.I.211 / G.IV.67) The upshot of this is that the properties of objects which we encounter in sense perception can be produced by multiple different corresponding micro-physical goings-on, and hence by multiple different essences.

How about (2)? Here Spinoza might argue as follows. An accident is a property which a substance (or in Spinoza's case, a mode) can have (or not) without making a difference to its essence. Now, let us assume that a particular property does not make

a difference to the essence of the thing in which that property is instantiated. Then it follows that that thing can possess that property (or not) without the its essence being affected. And consequently, the property is an accident. Hence, Spinoza is entitled to the conclusion that all we perceive in **Type Two** perception are accidents.

If these properties did make a difference in terms of uniquely identifying the essence in question, then the presence of one or more of these properties would suffice to fix that essence. But, as Spinoza can argue, these properties do not so suffice. Consequently, perception of accidents cannot hope to reveal essences. Since this is all we have in **Type Two** perception, it will never do this either.

Rather than simply having to rely on his fourfold typology of perception, Spinoza has substantive reasons for holding that **Type Two** perception will not yield cognition of essences. He can appeal to his under-determination thesis, as well as his account of essence, to explain why this is. So, on the reading I am offering, the assertion of the insufficiency of **Type Two** perception seems far less arbitrary than it did before. In contrast to McKeon's account, which simply stipulates that Spinoza holds that experience is not worth the trouble here, my account gives a substantive explanation about why this should be.

5.7.2 Klever's reading

Wim Klever, like McKeon, interprets Spinoza as being suspicious of the value of experiment. He writes that "according to Spinoza the senses are not able to demonstrate something against our rational expectations." (Klever (1990, 128)) On his view, Spinoza was an anti-falsificationist. By this, he seems to mean that, for Spinoza, "[v]erification or falsification of ideas can only be performed by other ideas." (Klever (1990, 129)) He sums it up nicely in the following way: "Experiments don't have the power of proving the necessary structure of reality." (Klever (1990, 130))

For Klever, this distrust is explained by the fact that there are infinitely many causes

involved in producing a phenomenon. If this is true, and we can only locate finitely many causes by carrying out experiments, then experiment can never access the true causal nexus responsible for the phenomena we observe. Klever draws this conclusion from the fact that Spinoza writes the following: "For it is by reasoning and calculation that we divide bodies to infinity, and consequently also the Forces to move them. But we can never 'confirm' this by experiments." (C.I.192 / G.IV.29) Klever draws the following moral from this:

> A phenomenon cannot be looked upon as he product of a finite number of causes...Of course this endless quantity can never be grasped or made visible by experiments, which would be, however, necessary to get an adequate proof of the constitutive elements and sufficient causes of a phenomenon. (Klever (1990, 132))

This reading has at least two shortcomings. The first is textual. The passage which Klever cites occurs in Spinoza's criticism of another essay which appears in Boyle (1669), *The History of Fluidity and Firmnesse*. Here is the quote in full context (the italicized text is Curley's translation of the passage from Boyle reproduced in the letter):

> *[I]t would scarce be believed how much the smallness of parts may facilitate their being easily put into motion, and kept in it, if we were not able to confirm it by Chemical experiments.* No one will ever be able to 'confirm' this by Chemical experiments, nor by any others, but only by demonstration and computation. For it is by reasoning and calculation that we divide bodies to infinity, and consequently also the Forces required to move them. But we can never 'confirm' this by experiments. (C.I.192 / G.IV.29)

It is not clear that the point Spinoza is making here concerns experiments generally. His objection is to the idea that we can confirm how the size of the parts of fluids can make it easy for them to be put in motion. The reason Spinoza criticizes this supposed

confirmation, I propose, doesn't have to do with the infinity of causes, but rather with a category mistake. The division of bodies with respect to their size belongs to mathematical demonstration, and hence the computation of the forces required to move them requires demonstration of the same kind. As a result, it is foolish to think that chemical experiments can demonstrate anything about the force required. This would be true whether or not we are dividing forces or bodies to infinity, so it is not clear that the infinitude of causes is doing any argumentative work here.

Second, Klever's view doesn't tell us why we cannot discover essences in experiment. According to the reading of TdIE given above, it is only necessary to know a thing's proximate cause in order to know the causal elements of its essence. Why can experiment not reveal this, on his view? A particular body may be composed of infinitely many other bodies, but it is not necessary to have adequate cognition of each of these bodies in order to know that the body constituted of them is the proximate cause of something.

5.8 Rational naturalism

Spinoza is often classed as a *naturalist*, that is, as someone who holds the view that "everything in the world plays by the same rules". (Della Rocca (2008, 5)) Jonathan Bennett puts it like this: "The whole story about people, [Spinoza] held, can be told with the concepts that are needed, anyway, to describe other parts of Nature." (Bennett (1986, 59)) But if this is taken to have the empiricist connotations which the word has today, this perception is mistaken. Contemporary naturalists hold (roughly) that experimental science is the means of investigating reality. If what I have argued is correct, Spinoza has no truck with this.[20]

Part of the reason for this division is as follows. Modern forms of naturalism often seek to bring philosophical questions and theses more closely in line with the deliverances

20. For a nice overview, and an argument that there is no useful sense in which Spinoza is a naturalist, see Douglas (2015b). Engaging with his argument is, unfortunately, beyond the scope of this chapter.

of the natural sciences. With Spinoza, in a sense the opposite is true. Instead of assimilating philosophical inquiry into empirical science, the sciences should adopt the method of philosophy wholesale. After all (as we saw above) the chief aim of the sciences is to give us a closer knowledge of the union which we as humans have with the whole of nature, and this can only be achieved by strongly aprioristic methods. Empirical and experimental investigation, to the extent it is useful at all, plays a subsidiary role. *True* science is not empirical at all.

One might think that I am illegitimately running together two theses. The first (relatively uncontroversial) thesis is that the lower types of perception do not represent the "gold standard" of perception, and hence should be dispreferred to **Type Four** perception and cognition. The second (and more controversial) thesis is that the lower types of perception and cognition cannot play any role at all in achieving **Type Four** cognition. The objection runs: surely Spinoza believes the former, but this is less evidence for the latter thesis, which is the one I am supposed to be imputing to Spinoza.

I think this objection itself runs together two theses. The first is the claim that the lower types of perception cannot help us achieve **Type Four** perception. The second is that we cannot achieve knowledge of essences through the lower types of perception. While the first thesis may well be true, and may be closely linked to the second, it is not one which concerns me here. I am concerned only with the a weakened version of the latter claim. Since, as we have seen, the true aim of the sciences is to teach us the essences of things, only those modes of perception which can yield knowledge of essences can be included in a true science. But – as I have been at great pains to argue – Spinoza thinks that the lower types of perception do *not* give us knowledge of essences. He states explicitly that **Type One** (see C.I.15 / G.II.12: "from report...we do not perceive any essence of a thing") and **Type Two** (see C.I.16 / G.II.13: "in this way no one will ever perceive anything in natural things except accidents.") perception do not yield knowledge of essences. Here we have it in his own words: "only the fourth mode [of perception] comprehends

the adequate essence of the thing." (C.I.16 / G.II.13) Even if **Type Three** perception is in some sense useful, all I really need for the purposes of this chapter is the claim that **Type Two** perception (which, as we showed earlier, is the type of perception involved in empirical investigation) is "to be excluded" (C.I.16 / G.II.13) from the sciences.

So, on the reading that I advocate, the naturalism that Spinoza holds to is *not* the sort of naturalism which places a high premium on experimental science in discovering truths about the world. Rather, it is a rationalist naturalism, one which sees mankind as occupying a particular but ultimately not all-that-distinctive niche in the universe, governed in the same way as the rest of nature, and one which most emphatically does *not* see experiment and experience more broadly as the means for exploring that niche.[21] On this count I agree with Alison Peterman, who writes that, for Spinoza, "no matter how carefully or systematically you look, no matter how powerful your microscopes or telescopes, you make *no progress* toward knowing about bodies through [experiments like Boyle's]," (Peterman (2014, 216)) as well as with G. H. R. Parkinson, who writes that, for Spinoza, "general laws about what exists are not discovered by induction from particular experiences: the so-called 'laws' which are discovered in this way are not really *known*." (Parkinson (1964, 160))

This interpretation – that true science is not empirical at all – is not completely unproblematic. Schliesser (2018, 158–163) points to other places in Spinoza's writings, such as the *Tractatus Theologico-Politicus* (TTP), where Spinoza speaks of the proper method of interpreting nature as "putting together a history of nature, from which, as from certain data, we infer the definitions of natural things."[22] (C.II.171 / G.III.98) Spinoza also speaks in Ep. 37 (dated 1666) of putting together "a little history of the mind, *or* of percep-

21. Some disagree; see for instance Curley (1990). Parkinson (1964, 159) takes a superficially similar view, on which "experience must occupy a position of great importance in Spinoza's theory of knowledge," though his view on the value of experiment for Spinoza is not far from my own; see Parkinson (1964, 157–62).

22. We should not take this to mean that Schliesser thinks that we can have empirical knowledge of essences; indeed, according to him, for Spinoza knowledge of essence "is purely intellectual knowledge". (Schliesser (2018, 169))

tions". (C.II.33 / G.IV.189a) These passages suggest that the composition of a "history" of the properties of objects, discovered empirically, is crucial to understanding nature. Still more problematically for my view, Spinoza speaks of how we can "infer the definitions of natural things" from this history.

This is a strike against my view, I will admit. But we should not be hasty. First, I have been stressing the importance of reading the correspondence with Boyle against Spinoza's earlier works. From that chronological perspective, the comparison with the TTP seems less apposite. The rationalist naturalism which I see Spinoza as espousing is confined for the most part (at least, for the purposes of this chapter) to the earlier works.

That said, I do bring in later works (viz., the *Ethics*) to aid in interpreting Spinoza's positions in the correspondence with Boyle. So let's concede for the sake of argument that we can overlook developmental concerns and read the TTP and other works back into TdIE and the Boyle correspondence. I still contend that the objection is not decisive. To see why, let's survey some other views Spinoza held in the TTP and contemporaneous works. In both Ep. 37 (C.II.32 / G.IV.188a, dated 1666) and the TTP (C.II.157 / G.III.85) Spinoza holds that clear and distinct ideas can only be produced by other clear and distinct ideas (or from something known through itself). So if we are to have clear and distinct ideas (in other words, adequate cognition) of the definitions of things, and hence their essences, these ideas must be produced by clear and distinct ideas. The upshot is that if we are to have adequate cognition of the essences of things through such a history, the ideas the history comprises must themselves be clear and distinct.

If this is true, however, such ideas cannot be ideas gotten from **Type Two** perception. In TdIE, Spinoza emphasizes that adequate ideas do not come from sense perception. He writes in that work (C.I.38 / G.II.34) that clear and distinct ideas are those "such as have been made from the pure mind, and not from fortuitous motions of the body." And further down he writes that "the clear and distinct ideas that we form seem to follow so from the necessity of our nature alone that they seem to depend absolutely on our power

alone." (C.I.44 / G.II.39) Since clear and distinct ideas depend only on our own power, they cannot be ideas gotten from **Type Two** perception, as this kind of perception is not under our own power. Consequently, whatever the ideas in these histories are, they cannot be derived from **Type Two** perception if they are to produce adequate ideas of the essences of things.

So we appear to be left with an inconsistency. On the one hand, Spinoza seems explicitly to suggest that empirical inquiry into the definitions of things is possible. On the other, he seems to have good systematic reasons for thinking that such empirical inquiry should not be able to yield knowledge of essences. What are we to do with this tension? I do not know. Whether or not Spinoza's rationalist naturalism is coherent may be a topic for further inquiry. But, as I have tried to show, there are deep-running strands in Spinoza's thought which militate against the success of any essentially empirical project.

5.9 What role *does* experience play?

The reader might now be puzzled. If Spinoza really does think so poorly of experiment, then why does he carry out experiments, or speak of them "seeming to show" or "seeming to confirm" certain results? If they cannot discover essences, what confirming or evidentiary role do experiments have? Spinoza is not generous enough to give us a fully worked-out theory of confirmation. He does tell us, in the letters, that confirmation comes in degrees; the experiments he offers confirm his explanation "not absolutely, but...*to some extent*". (C.I.209 / G.IV.66) But what does this confirmation "to some extent" constitute?

I will address this in just a moment, but I first need to make a small lexical digression. I am taking "confirmatio" and "comprobatio" to track the same concept in Spinoza, or at least in the passages in the Boyle correspondence and in the *Ethics* which we will examine. This departs from Curley (see the Index entry at C.I.630), but I believe that there is good reason for this assimilation. At C.I.174 / G.IV.17, Spinoza speaks of some experiments

which "to some extent confirm [*aliquo modo confirmatur*]" his explanatory hypothesis. And later at C.I.176 / G.IV.21, after putting forth his explanation, he says that these experiments "seem to confirm [*comprobare videntur*]" it. The inference I draw from this is that what these experiments are said to be doing in both cases is the same thing, and hence that "confirmare" and "comprobare" are tracking the same action in the Boyle correspondence. This will have import for my proposed solution.

As far as I can tell, Spinoza does not use "confimrare" or "comprobare" (or their cognates) in TdIE at all. He does, however, use "comprobare" in a passage in the *Ethics* which seems relevant. Admittedly, to invoke the *Ethics* to make an interpretive point about the Boyle correspondence goes against what has been my practice in this chapter. But in an instance where there is little help to be gotten from TdIE, perhaps it may be helpful to bring in other interpretive loci.

In EIIIp2, Spinoza writes that "the Body cannot determine the Mind to thinking, and the Mind cannot determine the Body to motion, to rest, or to anything else (if there is anything else)." (C.I.494 / G.II.141) In the scholium to this proposition, he intimates that he has clearly shown the proposition such that "no reason for doubt remains". But, still, he goes on to say that "I hardly believe that men can be *induced* to consider them fairly unless I confirm [*comprovabero*] them by experience." (C.I.494 / G.II.142) This might strike the reader as somewhat odd. If it is the case that no reason for doubt of the proposition remains, why is it that Spinoza thinks that men can only be "induced" to believe these things when confirming them by experience? It seems like experience isn't playing any evidentiary role here.

That is precisely my interpretation. The use of "comprobare" or "confirmare" is not, I think, meant in the same sense which we would use it today. For Spinoza, to say that x confirms y is, in this sense, not to say that x has objective evidentiary bearing on the truth of y. Spinoza continues in that scholium to say that men "are so firmly persuaded" that the mind can induce the body to move, suggesting that the examples of experiences

which he will go on to give are meant to address the firm persuasion. This can be true if the examples are meant to have an evidentiary bearing on the truth of proposition 2, but it can also be true if they are meant simply to undermine the firmness of the belief that men are said to have. If Spinoza is right that there remains no reason for doubting that proposition, the examples from experience become evidentially otiose, which suggests that their function is not evidentiary at all. They may instead play a persuasive or illustrative role. I take no firm position on the positive role that experience (and hence experiment) plays for Spinoza. Instead, my point is simply negative: it does *not* play an evidentiary role.

At least, not by itself. Spinoza speaks in some places of the value of experience that is "determined by the intellect" (C.I.12 / G.II.10), and how once we know the "mechanical principles of philosophy" certain experiments may be useful in investigating the nature of niter. (C.I.210 / G.IV.67) So we are left with two sorts of experience: *experientia vaga*, and experience which is, in some way, determined by the intellect. The former is not going to deliver adequate cognition, whereas the latter might. To explore this distinction is unfortunately far beyond the scope of this chapter. But it is clear from the relevant passage that, whatever this experience that is determined by the intellect is, it *isn't* sense perception – and that is all that is needed for this argument. Put simply: Since ideas gotten from **Type Two** perception are not determined by the intellect, and ideas gotten from sense experience are all instances of **Type Two** cognition, no idea gotten from sense perception will be an "experience determined by the intellect."

But what is "experience determined by the intellect"? To offer and argue for a characterization of this concept goes far beyond the ambit of this chapter, and indeed this dissertation. But here is one possibility. First, note that "experience" is equivocal. It can refer to sense experience in addition to the experience we have of consciousness more generally (though throughout this chapter I have assumed it to reference sense experience). So perhaps one can give a characterization like this: experience which is determined by

the intellect is conscious experience that follows from our intellect alone, and not from sensory input. This derives some small support from a passage in TdIE. There, Spinoza writes that

> For if we should suppose that the intellect had perceived some new being, which has never existed...and that from such a perception it deduced others legitimately, all those thoughts would be true, *and determined by no external object, but would depend on the intellect alone*. (C.I.31-2 / G.II.27)

So here, it seems that Spinoza is contrasting being determined by an external object and being determined by the intellect. My conjecture is that sense experience belongs to the former, while experience "determined by the intellect" (in the above case, the experience of those things deduced from the new being) belongs to the latter. These depend (causally, conceptually, or otherwise), not on an external object, but on the intellect alone.

One final question remains. If confirmation is not an evidentiary notion for Spinoza, then how can it persuade at all? We have seen the "that" already. What is yet to be adumbrated is the how. This question would take a dissertation all to itself, but here is a sketch of an answer.

First, Spinoza says that men can only be "induced" to believe certain things by experience. What does he mean by "induce"? He nowhere gives us a substantive theory of inducement that I can find, but he does use the concept elsewhere in the *Ethics*. In EVp41s, he speaks of persons who are "induced to live according to the rule of the divine law...not only by this hope, but also, and especially, by the fear that they may be punished horribly after death." (C.I.616 / G.II.307) So men are induced to action, at least, by hope and fear, which, for Spinoza, are passions (see EIIp18s2, at C.I.504 / G.II.154), and hence inadequate ideas.

Second, Spinoza elsewhere in the *Ethics* tells us how it is that we can shake ourselves of false imaginings. We do it, he tells us in EIVp1s, by confronting them with stronger

ideas:

> It happens, of course, when we wrongly fear some evil, that the fear disappears on our hearing news of the truth. But on the other hand, it also happens, when we fear an evil that is certain to come, that the fear vanishes on our hearing false news. So imaginations do not disappear through the presence of the true insofar as it is true, but because there occur others, stronger than them, which exclude the present existence of the things we imagine, as we showed in IIP17. (C.I.548 / G.II.212)

What I take Spinoza to be saying here, then, is this. If I have an idea of imagination, then it is not destroyed by a true idea insofar as that idea is true, but insofar as that latter idea is *more powerful* than the former.[23]

I propose, then, the following understanding of "confirmation" at play when Spinoza speaks of confirming things via experiment or experience. The persuasive power of "confirmation by experience" derives from presenting someone with a *more powerful* idea than that which one is seeking to overcome. This is inducement: by providing the listener with a more powerful idea (or by bringing about some change in them such that they have that idea), one induces the listener to adopt the desired belief. So when Spinoza speaks of inducing men to consider fairly things that "are such that no reason for doubt remains" by confirming them by experience, he is saying that, in order to overcome this prejudice, he must create in the reader (in this case) a more powerful idea. And, crucially, this idea *may be one derived from experience*. Recall in the passage quoted above that one can destroy an imagination by use of another imagination. This process, importantly, is not necessarily rational, and hence needn't be a matter of evidentiary weight. Instead, it is simply a matter of one idea being more powerful than another.

So we have an answer to the question: "what confirming role do experience and experiments play in a mature science". As Spinoza's remarks indicate, sometimes one's in-

23. This point is not unique to me. See for instance Della Rocca (2003) and Steinberg (2017).

terlocutors will not be able to consider a position fairly unless they are induced to do so by experience. One can make them do so by carrying out experiments which one communicates to them. The ideas which come from conveying the results of these ideas to one's scientific interlocutors, it is hoped, will be more powerful than the ones which correspond to their previous, mistaken beliefs.

This is of course entirely compatible with experience or ideas gotten by **Type Two** perception playing some additional roles in epistemology or scientific practice more generally. For instance, they might play an important role in our coming to possess the so-called "common notions" of EIIp37-40 (see especially p39). But in this scheme, **Type Two** cognitions play what we might call an inciting role. Such-and-such an idea, gotten by **Type Two** perception, provides the raw material for the "good" abstraction by means of which we attain the common notions. But, on my reading, they play no role at all in providing *evidence* for any hypotheses concerning essences, whether to us or to our scientific peers, or in justifying our beliefs about the common notions. When it comes to that, they are entirely effete.

5.10 Wrap-up

Some interpretations of Spinoza's philosophical project see it as primarily or even only driven by his metaphysical commitments. For instance, Della Rocca argues that "Spinoza's epistemological views...derive, in surprising ways, from his metaphysical commitments, commitments that also underlie his psychology," (Della Rocca (2007, 851)) commitments which ultimately, for Della Rocca, lead Spinoza to the rejection of inexplicable relations and facts. Whether this is what is going on in the *Ethics* is a matter of debate.[24] But be that as it may, in the TdIE, considerations about the *aim* of the sciences are at least as important. Metaphysical doctrines certainly obtrude into this discussion (Spinoza's account of essence and definition, for instance), as do epistemological issues (the four

24. See for instance Garber (2015); Lin (2019, 166–8).

types of perception, for example). But the reason they are employed at all is in examining how we may best achieve the goal of the sciences, or what he calls the highest good, "the knowledge of the union that the mind has with the whole of Nature" (C.I.11 / G.II.8), in addition to "love towards the eternal and infinite thing", which is "to be sought with all our strength." (C.I.9 / G.II.7)

If the arguments I have given in this chapter are correct, then Spinoza was a thoroughgoing under-determinationist, at least at the time of the Oldenburg-Boyle correspondence and the TdIE. What I have tried to draw attention to is that, once Spinoza's under-determinationism is put up against his broader epistemological and methodological commitments, it is well-motivated; this is also true of his view of the role of experience and experiments in the sciences. There is, as one would expect, a method behind Spinoza's madness.

Chapter 6

The adequacy of mathematical concepts

6.1 Introduction

There is a tension in Spinoza concerning mathematics. On the one hand, he considers number and measure to be tools of the imagination. Since he also thinks that ideas that involve inadequate ideas are themselves inadequate, and that ideas of the imagination are inadequate, any ideas involving number and measure will be inadequate. On the other hand, he both engages in applied mathematics and builds mathematical concepts into his metaphysics. He does so in ways that suggest he regards knowledge produced in these contexts as adequate. It is difficult to see how these two parts of his theorizing are compatible.

I want to argue that, although his official account of mathematical concepts as often used makes them ideas of the imagination, there is space in his philosophy for another kind of mathematical concepts, based on common notions, which are themselves adequate. To do so, I will address Spinoza's account of abstraction. I will draw a distinction between two sorts of causal histories which ideas that involve ideas of the imagination might have. The first is simply a causal history that reflects the impressions which exter-

nal bodies make upon our body, and which does indeed produce ideas of the imagination. The second is one that reflects the operation of the intellect upon ideas presented in the imagination, an operation of which we are the total cause. Ideas produced by the latter route, I will argue, can be adequate. If mathematical concepts are derived in the former way, they will be inadequate. If they are derived in the latter way, they can be adequate. Whether or not an abstracted idea is adequate will depend on the causal history of that idea, or (in other words) on the kind of abstraction by which we come to possess them.[1]

6.2 Evidence against

6.2.1 Ep. 12

Some of the best evidence against the applicability of mathematics to the physical world comes from Ep. 12 (C.I.200 / G.IV.52, written 20 April 1664 to Lodewijk Meyer). Here, Spinoza bemoans the fact that we often conceive of things abstracted from how they are in substance; the result is that we conceive of them using the imagination. He writes that:

> [W]e conceive quantity in two ways: either abstractly, or superficially, as we have it in the imagination with the aid of the senses; or as substance, which is done by the intellect alone. So if we attend to quantity as it is in the imagination, which is what we do most often and most easily, we find it to be divisible, finite, composed of parts, and one of many. (C.I.202-3 / G.IV.56)

"Measure", for Spinoza, determines quantity so as to make it easier to imagine. "Number" works in a similar way. We separate modes of substance from it, reducing them to

1. What exactly adequate and inadequate ideas are is a matter of some scholarly debate; see for instance McAllister (2014), which offers a nice compendium of commentators on the subject. Generally, we might say that an idea is adequate exactly when it is caused completely by the mind which has it, and inadequate "so long as [the mind which has it] is determined externally...to regard this or that" (EIIp39s). Here I concur with, e.g., Della Rocca (1996, 54), who holds that "a necessary and sufficient condition for the inadequacy of an idea in the human mind is that the idea is caused by ideas that are not part of the human mind."

classes in such a way as makes them easier to imagine. Consequently, in order to determine these modes, we must employ the concept of Number.

His view in the letter is that "Measure... and number are nothing but Modes of thinking, or rather, of imagining." (C.I.203 / G.IV.57) To conceive of a specific thing (either a mode or substance) using measure or number is to conceive of it using ideas of the imagination. For that reason, any conceiving done using measure or number will be inadequate, since the ideas of the imagination are inadequate. This would seem clearly to militate against an applied mathematics or a mathematical physics that provides adequate knowledge of the natural world. If determination of quantity by number or measure is solely the work of the imagination, then the assignment of a numerical degree of force to two objects in a collision (say) can only produce cognition of the first kind, which is necessarily inadequate for Spinoza.

6.2.2 Cogitata Metaphysica

In *Cogitata Metaphysica* (henceforth CM, published in 1663), the appendix to *Principles of Cartesian Philosophy*, Spinoza gives a characterization of mathematical concepts similar to that found in Ep. 12:

> We also have modes of thinking which serve to explain [*explanandam*] a thing by determining it through comparison to another. The modes of thinking by which we do this are called time, number, and measure, and perhaps there are other besides. Of these, time serves to explain duration, number discrete quantity, and measure continuous quantity. (C.I.300 / G.I.234)

Spinoza is also clear that modes of thinking "which [help] us to more easily *retain, explain, and imagine* the things we have understood" (C.I.300 / G.I.233) are not real beings. Spinoza thinks that there is discrete quantity, which we determine using number, and there is continuous quantity, which we determine using measure. Both of these

modes of imagining are used in our explanations of things. In context, it is not entirely clear what explanation means. Minimally, however, it seems to mean something like: one explains x using y only if one conceives of x using the concept of y.[2]

The upshot here seems to be: Insofar as we conceive of things using number and measure, we are engaging in reasoning concerning beings of reason. These "have no object that exists necessarily, or can exist", and "are not ideas of things". (C.I.300-1 G.I.234) We confuse these with ideas of real beings because the former "'arise from the ideas of real beings so immediately". (C.I.301 / G.I.234)

6.2.3 Conclusion

In both CM and Ep. 12, Spinoza thinks that to explain a thing using numerical concepts is to explain it in a way that separates it from substance. Such an explanation is done through a mode of imagining. And, as in Ep. 12, it seems like such an explanation or conception must be inadequate. Some secondary literature tends to reflect this negative strand in Spinoza's thought. One can find either direct criticisms or allusions to such criticisms (some of which we will meet below) to a pro-mathematization reading of Spinoza in, e.g., Melamed (2000), Peterman (2015), Manning (2016, §6.3), and Schliesser (2018).

Similar opinions are expressed in older scholarship. See for instance McKeon (1928, 153), who writes that "[t]he favorite categories of the scientist, number, time, and measure, are therefore nothing more than modes of thinking or rather modes of imagining." Alexander Matheron writes that "it is certain that numbers, contrary to geometrical entities, are nothing in things themselves. Whereas a square table really has the property of being square, two tables do not really have the property of being two: it is we who bestow this property on them.". (Matheron (1986, 146)) We also find a similar avowal of the poor state of number in Gueroult (1969), who writes that "to affirm the sovereignty of number and of connected notions, is in effect to break Nature." (Gueroult (1969, 517))

2. See for instance Spinoza's linking of explaining a thing through an attribute and conceiving of it under that attribute it in EIIp7s.

Amihud Gilead writes that:

> Most of the mathematical notions, which were recognized by Galileo and Descartes as real and objective elements of the true knowledge of reality *ut in se est*, are not considered by Spinoza as *entia realia* but as *entia rationis*, and sometimes even less than that, as *entia imaginationis*. (Gilead (1985, 74))

It should be said that Bennett thinks that this Spinozistic criticism is ill-founded, as

> I can find no good or Spinozistic reason for holding that 'number is nothing but a mode of imagination', by which Spinoza ought to mean that number concepts are usable only in shallow, impressionistic sorts of talk and not in basic metaphysics or science." (Bennett (1984, 196))[3]

While, as Homan (2018, 455–6) notes, this is not at present the standard reading of Spinoza, it nonetheless represents a powerful strain of criticism of a Spinozistic applied mathematics. One might think (and indeed some do think) that on the basis of these texts, the case is open and shut: Spinoza cannot countenance the applicability of mathematics to the physical world. I shall now try to show that things are not so neat.

6.3 Evidence for

6.3.1 Ep. 36

Spinoza closes this letter (C.II.31 / G.IV.186-7, written June 1666 to Johannes Hudde) with a discussion of the relative merits of convex-concave and convex-plane lenses. To begin, he supposes that the index of refraction of a convex-plane lens is 3 to 2. He then goes on to offer some algebraic calculations concerning the focal length of the lens under consideration. In each case, Spinoza offers explicit numerical calculations to justify

3. See also Bennett (1984, §46)

these optical results. Moreover, he makes explicit use of Descartes' sine law. Since this law involves numerical quantities (specifically, ratios and dimensionless quantities) it is difficult to understand its employment if we do not admit the use of mathematical concepts. So it looks very much as if Spinoza is employing them in the description of modes of `Extension` (lenses and light rays).

6.3.2 Ep. 38

In this letter (C.II.33 / G.IV.190a, written 1 October 1666 to Johannes van der Meer), Spinoza carries on a brief calculation of probabilities. Spinoza says that the problem under discussion (which we seem not to have) rests on the following principle: A person is playing a game fairly if his expectation of winning or losing is equal to that of his opponent. Curley (C.II.34n70) takes "expectation" to be a function of both the probability of winning and the amount of money bet. Spinoza goes on to give an example of a specific situation covered by this principle, using specific chances of winning and losing in a three-player game.

Presumably, given his background commitments, the chances involved are subjective probabilities; for Spinoza, everything happens according to an absolute necessity of nature. Still, it shows that there is *something* in the world which he thinks numerical values properly describe.

6.3.3 Ep. 41

In this letter (C.II.40 / G.IV.202b, written 5 September 1669 to Jarig Jelles), Spinoza carries out an experiment to determine whether water will fill a vertical pipe more or less slowly depending on whether the pipe is placed closer or further away from the water source. He concludes that

> The difference the length of the tube can make is relevant only at the beginning – that is, when the water is beginning to flow – but when the water

> has flowed for a short time, it will flow with as much force through a very long tube as it does through a short one. (C.II.41 / G.IV.205b-6b)

The exact details of the experiment don't concern us much here. What does concern us is the following. Spinoza speaks, at the end, of the explanation of this experimental conclusion, he speaks of the water as having numerical degrees of *speed*:

> For it's certain that if in the first moment the water in tube G confers on the water in tube M one degree of speed, in the second moment, if it retains its earlier force, as is supposed, it will communicate four degrees of speed to the same water, and so, in turn, until the water in the longer tube, M, has received exactly as much force as the gravitational force of the higher water contained in tube G can give it. (C.II.41 / G.IV.206b)

Here we have Spinoza yet again applying mathematical notions to nature. In fact, they are being applied to speed, one of the properties which in EIIp13 are said to distinguish the simplest bodies (this will become important later).

6.3.4 KV and the *Ethics*

In both the KV (done at least by spring 1662[4]) and the *Ethics*, Spinoza describes individuation conditions for a certain kind of mode of `Extension` which he refers to as an "individual" (at least in the *Ethics*).

6.3.4.1 KV

At C.I.95 / G.I.52, Spinoza writes that "each and every particular thing that comes to exist becomes such through motion and rest. The same is true of all modes in the substantial extension we call body." Furthermore, "[t]he differences between [one body and

4. There is some dispute about when the KV as we have it was finished. I do not wish to take a stand on the exact dating. All I will assume is that, in conformity with Spinoza's comments in Ep. 6 (C.I.188 / G.IV.36/8, written April 1662) that he had by the time of its writing composed what appears to be both the *Treatise on the Emendation of the Intellect* and the KV. See C.I.188n53 and C.I.3-4 for some further details.

another] arise only from the different proportions of motion and rest, by which this one is so, and not so, is this and not that." (C.I.95 / G.I.52) Whenever a body's proportion of motion and rest changes, it ceases to exist. (C.I.96 / G.I.53) As an example, he asks us to consider a particular finite body whose proportion of motion to rest is 1 to 3. While such a body retains that proportion, it remains the same body. But "if other bodies act on ours with such force that the proportion of motion [to rest] cannot remain, that is death". (C.I.96 / G.I.53) What is crucial here is that Spinoza uses a mathematical concept (the ratio of 1 to 3) to identify a body through change.

6.3.4.2 The *Ethics*

The similar passages in the *Ethics* come at EIIp13def. I quote the definition in its entirety:

> When a number of bodies, whether of the same or of different size, are so constrained by other bodies that they lie upon one another, or if they so move, whether with the same degree or different degrees of speed, that they communicate their motions to each other in a certain fixed manner, we shall say that those bodies are united with one another and that they all together compose one body or Individual, which is distinguished from the others by this union of bodies.

In lemmas 4-7 (C.I.461 / G.II.101-2), we are told that a body remains the same body through change so long as the component bodies preserve some ratio of motion and rest. While Spinoza does not use an explicit numerical example, the implication seems clear. A ratio is a mathematical concept. This concept is being made the criterion of identity of a body through change. So it looks like Spinoza is using mathematical concepts as a way to explain nature as it is in itself.[5]

5. There is some controversy in the secondary literature as to what this ratio or proportion consists in. Gueroult (1974, Chatper 6) holds that this ratio is a simple one of motion to rest, as apparently does Lachterman (1977, 84–5). Matheron (1969, 40) rejects this interpretation as overly simple, and proposes that the ratio is instead between the sum of the quantities of motion and rest of the parts of the individ-

Given the discontinuities between the *Ethics* and KV, one might legitimately ask whether the doctrine of the ratio of motion and rest in the *Ethics* does not reflect a substantive revision of the doctrine into a non-quantitative, non mathematical one, of the sort endorsed in, for instance, Adler (1989, 1996). Any argument for or against this position must be inferential; Spinoza gives us no concrete textual basis for either view. But I think there are at least two lines of textual evidence which count against a supposed discontinuity.

First, there is an argument from views that Spinoza seems to have held at roughly the same time. According to Ep. 28 (C.I.395 / G.IV.162, written June 1665), Spinoza had finished composing the first three parts of the *Ethics* by summer of 1665 (see C.I.396n25). In November of 1665, Spinoza wrote a letter to Henry Oldenburg (Ep. 32). There, as Gabbey (1995, 168–9) points out, he speaks of the same ratio of motion *to* rest [*motus ad quietem*] rather than a ratio of motion *and* rest [*motus et quietis*]. The phrasing of a ratio of motion to rest is itself used in Oldenburg's reply to this letter (Ep. 33). The use of the preposition has a more straightforwardly mathematical reading than the use of the conjunction. Since this letter is roughly contemporaneous with a time at which we believe the relevant part of the *Ethics* to have been completed, it is natural to infer that Spinoza meant roughly the same thing by "ratio of motion and rest" as by "ratio of motion to rest".

Second, there is an argument from other continuities in the doctrine. In the KV, Spinoza writes that the criterion of identity of bodies, as well as the criterion of individuation of bodies, is this proportion of motion and rest. This is also the case in the *Ethics*, as we saw above. Further, in KV the destruction of the ratio of motion and rest of the body is identified with death (the destruction of the body). (C.I.96 / G.I.53) This is also true in the *Ethics*. In EIVp39schol, Spinoza writes that "I understand the Body to die when its

ual. Matson (1990, 89) suggests that we think of this proportion as something along the lines of atomic numbers. Garrett (2018b, 306–7) rejects ratio views, preferring instead to interpret Spinoza as holding that "the manner in which the motion and rest of these parts [of an individual] is interrelated must conform to some enduring pattern".

parts are so disposed that they acquire a different proportion of motion and rest to one another." While the doctrine is somewhat more sophisticated in the *Ethics*, the changes seem to amount to enlargements rather than revisions.

For the purposes of space I will not go into great detail about the argument given in Adler (1989, §§2-3) for such a discontinuity. His primary point is that in the KV the *telos* of the body is defined by this ratio, whereas in the *Ethics* it is defined in terms of the conatus. I am not sure about this claim with respect to the KV (and as indicated in previous chapters, I doubt Spinoza's commitment to teleology in the *Ethics* more generally), but there are places in the *Ethics* (e.g. EIVp38-9) where Spinoza calls those things which bring about the preservation of the proportion of motion and rest of the body "good", and those which destroy it "evil". Further, since this proportion is said to be the "form" of the body (EIVp39dem), those things which preserve the ratio of motion and rest are those that bring about the continued existence of the body, which – of course – the body strives for, by EIIp6. But this is of necessity very brief.

6.4 The problem so far

We have seen at this point that Spinoza employs mathematics in his study of nature. If number and measure really are simply modes of imagining, then all the cognition gained in this study ought to be of the first kind only. According to EIIp35, falsity consists in having an inadequate idea, or an idea that is mutilated and confused. Further, in EIIp41d we have it that "to cognition of the first kind pertain all those ideas that are inadequate and confused". As a result, all the cognition gained by Spinoza in these cases would seem to be inadequate. So what does Spinoza think there is to be gained by applying mathematics to nature? He clearly thinks there is *some* profit in it, else he wouldn't engage in it. But what?

This problem runs deeper. Spinoza's definition of an individual in EIIp13s, which we saw earlier, is used in many of the propositions between EIIp14 and EIIp27. This defini-

tion involves the notion of a ratio of motion and rest.[6] Since mathematical concepts are simply modes of imagining, anything which is explained through them will be explained inadequately. If this is true, and a ratio contains reference to mathematical concepts, then the notion of an individual is explained inadequately. Hence, anything which is in turn explained through it (such as, for instance, the human body) will be explained inadequately. This extends to other parts of the *Ethics* as well. Spinoza's characterization of good things as those which bring about the preservation of the ratio of motion and rest of a human body in EIVp39 is just one example.

If we are to have adequate ideas of any of the propositions proved in EII or beyond, we must have an adequate idea of an individual. Suppose we had an inadequate idea of an individual. Then any ideas which involve that idea as an essential component must themselves be inadequate. But insofar as we have an idea of an individual which involves number or measure, we have only an inadequate idea of that individual. Hence, if Spinoza wants to understand the definition of an individual in terms of a ratio of motion and rest (which he does), then any such idea will be inadequate.

There's yet another layer to this problem. As we saw above, in Ep. 41 Spinoza holds that we can assign numerical values to an object's degree of speed. This is one of the properties of objects in EIIp13s which he thinks serve as the basic individuators of the "simplest bodies", along with motion, rest, and slowness. (EIIp13a2") A surface reading of these two texts would suggest that the speed in both is adequately conceived, as there is no reference to inadequacies of the imagination. So we can draw the inference that speed, in this sense, is adequately conceived. It is therefore difficult to understand just

6. Some scholars regard this requirement as absolutely essential to Spinoza's account. See for instance Gabbey (1995, 168):

> To talk of bodies maintaining among themselves "the same proportion of motion and rest," or communicating motion to each other "in a certain fixed proportion," is to say nothing effective, unless a mathematical account is provided of those proportions and of the measures of motion and rest from which they are formed, and unless there is some account of the laws that ensure the claimed invariance in proportionalities.

what on Earth Spinoza is doing here. Either he thinks that we can adequately conceive of speed while determining it according to mathematical concepts, or else he is using "speed" equivocally between the correspondence and the *Ethics*, and what he thinks we can conceive of using mathematical concepts in the letters is something distinct from speed in the *Ethics*.

So something strange is going on. If the reading of Spinoza as skeptical of applying mathematics to nature is right, he runs into several difficult and possibly intractable problems. Not only is his practice of mathematics mysterious, but his signature work is ridden with inadequate cognition. What are we, as interpreters, to do?

6.5 Common notions

I believe a solution to these problems lies in Spinoza's doctrine of common notions. To lay out this solution, I need to discuss this doctrine a little. I will not give a thorough characterization of what these notions are (as does, e.g., Schliesser (2011, 2018)), discuss whether they are innate (as held by, e.g., Marshall (2008) and Nadler (2006, 175), and possibly Allison (1987, 114)) or acquired (as held by, e.g., Flostad (1973); Peterman (2014, 218) seems to suggest she thinks so as well), or examine the broader role they play in our reasoning according to Spinoza (as in, for instance, Schoen (1977)). Instead, in this section I want to pay attention to why these ideas are adequate. In subsequent sections, I will have more to say about what some examples of common notions are, and the use to which we can put them. But for now, let's focus on adequacy.

In EIIp37, Spinoza writes that "[w]hat is common to all things (on this, see L2 above) and is equally in the part and in the whole, does not constitute the essence of any singular thing." In the statement of EIIp37, Spinoza refers us back to Lemma 2 of the Physical Digression in EIIp13s, presumably to give an example of these notions that are "common to all things". Lemma 2 states that "All bodies agree in certain things". Spinoza argues for this as follows. All bodies agree at least in involving the concept of the attribute of

extension, and that constitutes some sort of agreement: They're all extended bodies. Furthermore, they agree in that they can all "move now more slowly, now more quickly, and absolutely, that they now [can] move, now [they can be] at rest." So in addition to including the property of being extended, the common notions include both motion and rest, speed, and slowness.

Let us now turn our attention to EIIp38:

> Those things which are common to all, and which are equally in the part and in the whole, can only be conceived adequately.

I will refer to the property of being "equally present in the part and the whole" as the property of being mereologically pervasive. The demonstration begins from the idea that God has an adequate idea of some property *A* which is common to all bodies and is mereologically pervasive. It proceeds to infer that God has the idea of *A* insofar as he has the idea of the human body and its affections. Since each of these involve the nature of their respective bodies, God's idea of *A* will be adequate in God "insofar as he constitutes the human Mind, or insofar as he has ideas that are in the human Mind." And, since for a human mind to perceive something is just for God to have an idea "insofar as he constitutes the essence of the human Mind," (EIIp11c) the human Mind has an adequate idea of *A*.

It is not entirely clear why Spinoza is entitled to the premise that God has an adequate idea of *A*. In support of this premise, he cites EIIp7c:

> God's actual power of thinking is equal to his actual power of acting. I.e., whatever follows formally from God's infinite nature follows objectively in God from his idea in the same order and with the same connection.

There is little question that Spinoza means for this to be evidence that God has some adequate idea or other. In addition to the passage we are examining, he uses EIIp7c in

EIIp36dem as evidence that God has some adequate idea or other. But what is going on? A clue comes at EIIp32:

> All ideas, insofar as they are related to God, are true.

The demonstration is short and sweet: "For all ideas which are in God agree entirely with their objects (by P7C), and so (by IA6) they are all true, q.e.d." So from the premise that "whatever follows formally from God's nature follows objectively in God from his idea in the same order and with the same connection", it is supposed to follow that all ideas in God agree entirely with their object.

Let us recall EIId4:

> By adequate idea I understand an idea which, insofar as it is considered in itself, without relation to an object, has all the properties, *or* intrinsic denominations of a true idea.[7]

This is in explicit contrast with true ideas, which agree with their objects (EIa6). Agreement with an object is an extrinsic denomination, and so cannot be used to distinguish an adequate idea from an inadequate one. So we will not immediately just be able to substitute terms into EIIp32 to get that all God's ideas are adequate. But I believe that with some intermediate reasoning, we can still get there.

I take EIId4 to mean something like the following. A true idea has both intrinsic and extrinsic denominations. What makes it a true idea is agreement with its object, but what makes it an idea of a particular sort *intrinsically* is not this, but some other cluster of properties. An adequate idea is an idea which shares all the intrinsic denominations of a true idea, and hence a true idea is automatically an adequate idea. This has the upshot

7. What are these intrinsic denominations? Spinoza is obscure on this count. At least, it is meant to exclude the accurate representation of the idea's object (EIId4). Spinoza makes some very cryptic remarks at TdIE §69 which seem to suggest that the intrinsic denominations of a true idea include a kind of orderliness. But there are complications, as in TdIE §73 he identifies true and adequate ideas. Morrison (2015, 85) suggests that the true (and hence adequate) ideas are those which represent their object's essence and nothing else, as well as being contained in our innate idea of our own essence. For our purposes, we will let the term mean something like "intrinsic properties", though I have very little commitment to this view.

that, if I have a true idea, I automatically have an adequate idea (since every true idea will have the intrinsic denominations of a true idea).

This is where EIIp7c comes in. From it we learn (a) that whatever follows from God insofar as he is extended has an exact correspondent insofar as he is thinking, and these all have the same order and connection. The doctrine of parallelism holds, after all, that `Thought` and `Extension` are isomorphic. And since modes of `Extension` and mode of `Thought` match up, as do their causal order, God's ideas will precisely match their objects. So they are true, and hence adequate. This last bit of reasoning is endorsed in EIIp32dem, where Spinoza directly invokes EIIp7c to show that God's ideas match their objects, and are therefore true. I simply make the obvious inference from true to adequate, given the relationship between adequate ideas and true ideas which I adumbrated above.

With this line of reasoning, we can shore up the gap in Spinoza's demonstration of EIIp38 – he is, indeed, entitled to claim that God has an adequate idea of *A*. Because God's idea of *A* is true, it is therefore adequate.

So why does the fact that a property is mereologically pervasive and common to all bodies matter to its adequacy? Here is a supplementary line of reasoning. To say that we have a confused idea of the affections of our bodies is to say that we have an idea that involves the nature of our bodies, its parts, and of external bodies, according to EIIp28dem. Spinoza also writes, in EIIp29s that

> the Mind has, not an adequate, but only a confused [NS: and mutilated] knowledge, of itself, of its own Body, and of external bodies, so long as it perceives things from the common order of nature, i.e., so long as it is determined externally, from fortuitous encounters with things, to regard this or that, and not so long as it is determined internally, from the fact that it regards a number of things at once, to understand their agreements, differences, and oppositions. For so often as it is disposed internally, in this or

another way, then it regards things clearly and distinctly.

So it seems like Spinoza is saying that we may be disposed internally, as a result of regarding a number of things at once, to understand the agreements of things. It seems plausible that properties which are mereologically pervasive and common to all bodies are properties in which all bodies will agree. Hence, when we conceive of these properties, we are doing so based on an internal determination of the mind, which assures that the ideas formed as a result are adequate, and not confused.

6.6 What is the context?

Now I want to turn to an examination of the meanings of some of the key terms Spinoza uses, "number" and "measure". My basic contention in this section is that his talk about mathematical concepts is best understood against the backdrop of Euclid's *Elements*. Specifically, I will argue that when he refers to number and measure, Spinoza is invoking these in the sense in which they are used in the *Elements*, and that his concerns are mereological. Specifically, he thinks that the misuse of measure implies positions about the divisibility of quantity which are absurd.

6.6.1 Measure vs. measurement

Spinoza is sometimes taken to be making a criticism of the use of units of measurement in studying nature. Any such assignment would represent an arbitrary partitioning of nature, which must be a product of the imagination. Matthew Homan, for instance, writes:

> Spinoza's notion of how measure explains continuous quantity is best understood by analogy with his notion of how time explains duration: just as we explain duration by dividing it up into units of time—seconds, minutes, hours—so we explain continuous quantity by dividing it up into units of

> measure—inches, feet, miles. It is easy to see that such standards of measurement are arbitrary and exist merely as beings of reason.[8]

But I am not sure the textual evidence shows that this kind of measurement – fixing a physical unit of measurement by convention and then comparing other quantities to it – is what Spinoza has in mind. In his discussions of measure, he does not speak about such units at all. He speaks (in CM) of measure being the result of a comparison of one quantity with another, an action not restricted to making physical measurements. As I read things, his is not a problem of assigning empirical content to a mathematical formalism.

The placement of the discussion of measure in Ep. 12 is suggestive. There is no reference to units of measurement at all. Spinoza's target seems instead to be the difference between divisible and indivisible quantity; the former is conceived of using the imagination, the latter using the intellect. (C.I.202-3 / G.IV.57) Immediately after this, Spinoza mentions number and measure for the first time. He speaks of these arising from us determining quantity "as we please". So the problem with measure is that its use implies that the measured quantity can be divided. So his concerns seem to be, not conventionalist primarily (though as the use of "as we please" indicates, this might be a problem as well), but mereological. His concern, that is, is about divisibility.[9]

What is the substance of this concern? Turning to the *Ethics* might help us answer this. EIp12 reads: "No attribute of a substance can be truly conceived from which it follows that the substance can be divided." So it follows that if we are imagining `Extension` in such a way that it can be divided, we are not conceiving of it truly.

The demonstration of EIp12 runs as follows. Suppose for reductio that substance can be divided. Then the parts of substance will either retain its nature or they won't. If they do, then each part have to be infinite (this follows from EIp8) and the cause of

8. Homan (2018, 459)

9. I should note that there are some dissenting voices on measure's relation to divisibility. Fowler (1983, 61), for example, writes that the meaning of measure "seems more closely related to subtraction than division".

itself (this follows from EIp7). It also follows that each part will have to have a distinct attribute (this follows from EIp5). From this it follows that one substance can produce multiple others. This contradicts EIp6, which states "one substance cannot be produced by another substance". So the parts of substance can't retain its nature. If they don't retain its nature, it follows that by dividing a substance, a substance would cease to exist. This contradicts EIp7, which states that "it pertains to the nature of a substance to exist". Hence, it follows that no attribute of a substance can entail that a substance is divisible.

This, I claim, is why Spinoza is so worried about measure. It is not because any units of measurement are conventional and arbitrary. His worries precede any empirical specification of length or magnitude. Rather, it is that in employing measure, we are importing a mereology that entails absurd results. The identification of measure with measurement, then, seems off. This is not a point about a distinction made by Spinoza which interpreters fail to track. Rather, I am introducing a distinction between measure and measurement, and arguing that Spinoza is tracking the former.

Here a distinction between senses of measure made by Isaac Barrow may be helpful.[10] In his work, "The Usefulness of Mathematical Learning" (published in Latin in 1685; I quote from the English translation, Barrow (1734)), Barrow distinguishes between six senses of the word "measure". The fourth sense of measure is

> that...which is assumed to render something more known and determinate to us than it was before, and is expounded with this design, that other quantities coming into consideration may, as to quantity, be compared with it, or with one another by means of it.[11]

Units of measurement, such as feet, quarts, and bushels "are measuring magnitudes, because their quantity is commonly supposed known and determined by compact."[12] This kind of measurement is done for the purposes of exhibiting magnitudes in such a

10. My presentation of this distinction is greatly indebted to Dunlop (2012, §2)
11. Barrow (1734, 259)
12. Barrow (1734, 259)

way as to make them intelligible, and is set conventionally. It may be estimated in different ways, "by numbers, or by some equation, or by a sensible computation from the same terms immediately, or from other analogical [ways] exposed to sense."[13]

On the other hand, Barrow's fifth sense of measure is the one I intend to impute to Spinoza. It the sense in which measure is "always understood in the *Elements*".[14] In this sense, a measure is

> a magnitude, which some number of times taken does constitute and compose another magnitude, or which being some number of times taken from another magnitude leaves no remainder, but entirely exhausts it.[15]

So this is the sense of measure that, according to Barrow, is operative in Euclid, and (I will argue) Spinoza. Let me set out why.

6.6.2 Euclid and Spinoza

In Henricus Regius' *Physiologia, sive cognitio sanitatis* (reproduced in Bos (2002)), measure is defined thus: "[B]y *measure*, we understand any quantity, whether continuous or discrete, or [*sive*] magnitude and number".[16] It is clear that this militates against the view upon which "measure" meant "measurement" to Spinoza's contemporaries. However, as I shall argue, it is not clear that this is the sense of "measure" that Spinoza uses. This can be inferred from the distinction Spinoza draws between number and measure: Since Spinoza thinks of these as distinct, and Regius does not, it seems clear that they are not using the word to mean the same thing. How, then, should we interpret Spinoza on measure and number? I want to suggest that we take them to mean what they mean in Euclid's *Elements*. There are at least two reasons for this.

13. Barrow (1734, 260)
14. Barrow (1734, 262).
15. Barrow (1734, 261)
16. Bos (2002, 202). Translation my own. The equation of number and measure appears to reach back at least to Aristotle, in Metaphysics I; see for instance: "For measure is that by which quantity is known; and quantity qua quantity is known either by a 'one' or by a number." (1052b31-1662, in Aristotle (1984))

First, it would make sense for Spinoza to be employing terms that would be understood to refer to a well-known treatment of mathematical concepts.[17] Nothing about Letter 12 suggests that he is referring to units of measurement employed in natural philosophy specifically. Instead, the context suggests a more general discussion. Consequently, one would expect him to use terms which his interlocutors would have a good expectation of grasping. This too is not decisive evidence for my interpretation, as we can see by Regius' definition of measure seen above, as well as the distinct senses noted by Barrow. Clearly the term had other meanings in use at the time.

Second, however, this use of "measure" tracks the use of the word of other mathematicians of the era, including some of those to be found in Spinoza's own library. For instance, van Rooijen (1889, 152) notes that Spinoza owned an edition of Descartes' *De Geometria* with accompanying commentary by Leiden mathematician Frans van Schooten.[18] In the commentary, van Schooten speaks of how certain ratios "are able to be measured [*mensurari*] by the ratio which obtains between lines A5 ad A6".[19] This is in line with Barrow's fifth sense of "measure" – the relation is said to hold between two homogeneous (in this case, geometrical) magnitudes.

But while this is evidence that Spinoza would have been familiar with that sense of measure, it does not yet show that this is the sense of "measurement" in play. Indeed, in *Geometria* Descartes equivocates on the sense of measurement at play. In one place he writes that "we consider geometry the science which teaches the general knowledge of the measures of all bodies."[20] This does not seem to be Barrow's fifth sense of "measure". Elsewhere, however, he writes of how angles of incidence or refraction are able to

17. We do not know precisely what edition of Euclid's *Elements* Spinoza had, only that he had one. The entry in the notary's sheet recording Spinoza's library (which list is reproduced in van Rooijen (1889)) reads simply "Euclides". For slightly more details concerning which editions were possible see Krop (2013, 30).

18. I here quote from the second edition, printed in 1659; Spinoza had the 1649 edition. I do not know whether the commentary changed substantially from the first to the second edition, but it seems unlikely. The original French version can be found at AT VI.367-485.

19. Descartes (1659, 271). Translation my own.

20. Descartes (1659, 18). Translation my own.

be measured by certain ratios of lines to one another.[21] (This immediately precedes the portion of text which the commentary by van Schooten quoted above takes up.) And this *does* seem to line up with the sense which Barrow discusses above. So in order to argue that the sense of "measure" that Spinoza is using is that found in Euclid, contextual considerations are not sufficient. We must look to the texts.

This brings me to my third line of evidence: the way in which Euclid characterizes measure and defines number fit the characterizations that Spinoza gives of each of these. In particular, they track the mereological concerns which we examined above. Let me explain how.

The first appearance of "measure" in the *Elements* comes in Book V Definition 1: "A magnitude is a *part* of a(nother) magnitude, the lesser of the greater, when it measures the greater."[22] Euclid does not actually give us a definition of measure.[23] But he does relate it to mereological considerations, since it appears in the definition of parthood.[24]

This matches Spinoza's use of the term in EIp15s. In this scholium, he is intent to argue against those who argue that "corporeal substance, insofar as it is substance, consists of parts", and who therefore deny that God can be corporeal. He gives an example of a reductio ad absurdum they give:

> [I]f an infinite quantity is measured [*mensuratur*] by parts [each] equal to a foot, it will consist of infinitely many such parts, as it will also, if it is measured [*mensuretur*] by parts [each] equal to an inch. And therefore, one

21. Descartes (1659, 55–6)

22. I quote throughout from Heath (1908).

23. Mueller (1981, 61) calls it "perhaps the fundamental undefined notion in Euclid's arithmetic"; he goes on to say that "intuitively, one positive integer measures another when it divides the second evenly." (Mueller (1981, 61)) Barrow too notes that "no definition of *measure* is to be found there, which seems a wonder to some." (Barrow (1734, 260))

24. Incidentally, this militates against the idea that Euclid (and hence, by my reading, Spinoza) anticipated more modern theories of measurement. We find Russell (2010, 176), for instances, writing that "measurement of magnitudes is...any method by which a unique and reciprocal correspondence is established between all or some of the magnitudes of a kind and all or some of the numbers." On my reading of Euclid and Spinoza, this would not be the case. Since the concept of measure appears before the definition of number in Book VII, and hence applies to magnitudes independent of whether we can assign numerical quantities to them, it cannot be restricted merely to the assignment of magnitudes to properties. This goes for other such modern theories of measurement (see Tal (2015, §3) for an overview).

> infinite number will be twelve times greater than another [NS: which is no less absurd].

Later on in EIp15s, Spinoza writes:

> [A]nyone who wishes to consider the matter rightly will see that all those absurdities...from which they wish to infer that extended substance is finite, do not follow at all from the fact that an infinite quantity is supposed, but from the fact that they suppose an infinite quantity to be measurable [*mensurabilis*] and composed of finite parts.

Further on down (C.I.423-4 / G.II.59), Spinoza writes that these problems arise because we are accustomed to conceiving quantity in two different ways: abstractly, as it is in the imagination, and as substance, as it is in the intellect. It is only in the imagination that we find that quantity is divisible. This is the exact same criticism that Spinoza makes when he speaks of the two ways of imagining quantity in Ep. 12. This lends support to the idea that the "measure" of Ep. 12 is the "measure" of EIp15s, which is itself plausibly the measure of Book V Definition 1 of the *Elements*.

There is also some evidence that number applies to discrete quantity in Book VII, Definitions 1-3:

> Definition 1: A *unit* is that by virtue of which each of the things that exist is called one.
>
> Definition 2: A *number* is a multitude composed of units.
>
> Definition 3: A number is a *part* of a number, the less of the greater, when it measures the greater.

We can see Definitions 1 and 2 as providing a criterion for discrete quantity: it is composed of units, which are the ultimate things which determine when a particular thing is called "one". In his commentary on Definition 1, Heath writes:

> The etymological signification of the word *μονάς*, is supposed by Theon of Smyrna (p. 19, 7-13) to be either (1) that it remains unaltered if it be multiplied by itself any number of times, or (2) that it is separated and *isolated* (*μεμονῶσθαι*) from the rest of the multitude of numbers.[25]

If this is not a characterization of discrete quantity, it is hard to know what would be.

The inference I draw is the following. For Euclid, number is used to conceive of discrete quantity, and measure is used to conceive of continuous quantity. Further, both of these involve mereological considerations, which we have seen is one of Spinoza's concerns with the abstract conception of quantity. He, like Euclid, thinks of number and measure as connected with parthood. From these pieces of evidence, I think we can draw a case that the sense of number and measure being employed by Spinoza is at least a derivative of that used by Euclid.[26] It is in my estimation likely that it is similar to the fifth sense of measure discussed by Barrow.

What does a case for this position look like? We've been considering it in a roundabout way for a while now, so let me make it explicit. Consider the case of measure. The concept of "measure" employed by Spinoza does much the same conceptual work as the concept of "measure" used by Euclid and discussed by Barrow. In both senses, to say that one magnitude measures another is to say that the one is a part of another, without remainder. In both senses, the concern with measurement precedes any empirical considerations (we presumably do not have empirical knowledge of extensively infinite physical magnitudes, even if such in fact exist). It is not concerned with the relation between

25. Heath (1908, 279)

26. This is bolstered, in some measure, by the secondary literature. For instance, Sutherland (2004, 172) writes that in the Greek theory of measurement, "measuring requires that we be able to compose multiples equal some magnitude taken as a unit and that we be able to make comparative judgments between the measure and the measured."

certain numbers and certain physical magnitudes. Instead it concerns the comparison between two (abstract, perhaps) magnitudes of the same kind. From these similarities, I think we have at least a reasonably strong circumstantial case that these two concepts of "measure" are at least similar, if not the same.

6.6.3 Measure vs. measurement, round 2

To close this section, let me be a little more explicit about the difference between measure as measurement (for convenience call this M_1) and measure as I am reading it (call this M_2).

First of all, both M_1 and M_2 are conceived of as dyadic relations (let's call these relations $M_1(x, y)$ and $M_2(x, y)$). $M_1(x, y)$ is a certain kind of relation between magnitudes and numbers. The relation I have in mind is something like what Anat Schechtman writes of, in an analysis of Locke's conception of measure: "a quantity's measure is specified by means of number."[27] The relation looks something like the following: a certain conventional correspondence is set up between a unit and a particular physical magnitude. That done, one can sensibly talk about the measure of other magnitudes. For a statement like $M_1(x, y)$ to be true, one would need to resort to the initial correspondence between the unit of measurement (1 foot, say) and a particular physical magnitude. This correspondence is conventionally set.

There are at least four points where M_2 is different. First, the relation $M_2(x, y)$ does not hold between a physical magnitude and a number, but between two homogeneous magnitudes (magnitude which when combined yield a magnitude of the same kind). Second, on M_2 it makes sense to reverse the relation. On M_1, it does not make sense to ask whether the measure of 10 feet is a particular quantity, say. That is to get the relation between quantities and numbers exactly backwards. On M_2, this absolutely makes sense.

27. Schechtman (2019, 1121). Schechtman gives a formal explication of this account at Schechtman (2019, 1139). We should note that Locke here does not appear to be making the distinction I am between "measure" and "measurement".

If $M_2(q, r)$ is true, then $M_2(r, q)$ may be true or false, but not senseless, as it is on M_1. For instance, if q is a line segment twice as long as r, then $M_2(q, r)$ is true, while $M_2(r, q)$ is false, but not senseless. Third, when $M_2(q, r)$ is true, it follows that q is a part of r. This is not the case with M_1, since arguably no physical quantity is part of a number, or vice versa. Fourth, whether or not $M_2(q, r)$ is true is independent of any conventional decision on the part of a community of inquiry. In order for $M_1(q, r)$ to be true, there first has to be a decision to fix a unit of measurement, so that the proposed comparison can take place. Not so with $M_2(q, r)$. The truth of this depends solely on the relations between the magnitudes in question.

I do not mean to dispute M_1 as an interpretation of other figures in the early modern period. As an interpretation of Locke, say, or Newton, it seems to me perfectly adequate.[28] My claim, however, is that M_1 is not what Spinoza has in mind. What he has in mind, instead, is M_2, which (I take it) is roughly the same as the fifth sense of measure discussed by Barrow.

6.7 Can the tension be resolved?

With the status of common notions as adequate ideas in place, and the background of Spinoza's conception of number and measure established, I need to motivate my contention that number and measure may not be ideas of the imagination.

A suggestive line of textual evidence comes from the example of the rule of 3 offered in several of Spinoza's works, most notably in EIIp40s2. Here, Spinoza claims that we can have cognition of the second kind (which produces only adequate ideas) of certain properties of numbers. Suppose we're given three numbers, a, b, and c, and we are asked to find a fourth number d such that the relationship $a/b = c/d$ holds. Then, Spinoza says, we can arrive at the fourth number by cognition of the second kind via a common property of proportionals.

28. For Newton on measurement, see for instance Dunlop (2012).

We should note that proportionality, as defined in Book VII Definition 20 of the *Elements*, it is a property which involves concepts like ratios and multiplication – and hence, by Book VII Definition 5, measure. If number and measure mean to Spinoza roughly what they mean in Euclid (and I have argued that they do), and are here simply tools of the imagination, then any idea which involves mathematical concepts is itself an idea of the imagination, and is hence inadequate. But we know from Spinoza's example that we can in fact have common notions, and hence adequate ideas, which contain or involve ideas of number or measure. This gives us some motivation to doubt whether mathematical concepts must be ideas of the imagination.

But there is more. Spinoza has a powerful argument, from various of his positions, to the thesis that number and measure are *not* simply ideas of the imagination:

1. If number and measure are simply ideas of the imagination, then any idea which involves mathematical concepts is itself an idea of the imagination. (Premise, suggested by EIIp40 and EIIp40dem)
2. Ideas of the imagination are inadequate. (Premise)
3. If number and measure are simply ideas of the imagination, then any idea which contains mathematical concepts is inadequate. (from (1) and (2))
4. Proportionality is a common notion. (from EIIp40s2)
5. Proportionality can be conceived adequately (from (4) and EIIp38)
6. Proportionality is not an idea of the imagination (from (2) and (5))
7. Proportionality involves mathematical concepts. (*Elements* Book VII Definition 20)
8. Number and measure are not simply ideas of the imagination. (from (1) and (7))

This argument appears valid. Which premise can plausibly be denied? (1) looks like the most promising candidate. On this denial, it simply does not follow that if an idea involves number and measure it is an idea of the imagination. If this is conceded, then there is not a blanket prohibition on conceiving of natural things using mathematical concepts. And this amounts to saying that there is nothing *in principle* wrong with employing them in studying nature.

On the other hand, perhaps one can deny (7). Perhaps Spinoza is using "proportionality" to mean some other property, one which does not involve mathematical concepts. That way, number and measure continue to be ideas of the imagination, but proportionality, both in the case of the fourth proportional and the case of the ratio of motion and rest, is not. I have, however, spent a good deal of time arguing that the sense in which Spinoza is employing number and measure in his works is the same as that which appears in Euclid. If that is the case, then (7) falls out right away, and number and measure continue to be mathematical concepts, though not ideas of the imagination.

So we have here a strong motivation to regard mathematical concepts as not being ideas of the imagination. But what are these concepts, if not that? I propose that they are determinations of discrete and continuous quantity, which need not be imaginative ideas. This is similar to the position taken by Homan (2018, 456), who argues that geometrical figures are determinations of finite bodies. My account in effect expands on his. It applies to the use of geometry, algebra, number theory, or any branch of mathematics which relies on number and measure.

Quantity is a good candidate for a common notion.[29] In EIp15s1, Spinoza gives a characterization of "body": "by body we understand any quantity, with length, breadth, and depth, limited by some certain figure." So the concept of a body involves the concept of quantity, which fulfills the first requirement for a common notion. The concept

29. What follows is an elaboration of a line of thinking found in Matheron (1986, 147), who writes that "mathematical entities are precisely *not* real physical entities; they *are* common properties." I am indebted to Matheron for this point, as well as for the discussion of number in reference to the *Elements*.

of quantity is also mereologically pervasive. The concepts of the parts of any composite body will involve quantity, as will the concept of the composite body. Hence it follows, from EIIp38, that quantity is a common notion. Further, it follows that quantity can only be conceived adequately. And by EIIp40 it follows that whatever ideas follow from the concept of quantity are themselves adequate. So if ideas involving mathematical concepts follow from the nature of quantity then they themselves will be adequate.

In this way, Spinoza can preserve his definition of an individual without making it captive to ideas of the imagination. He can hold on to the idea, expressed in Ep. 38, that speed can be assigned a numerical quantity. And he can, in general, account for the applicability of mathematical concepts to nature, provided that the application is careful.

6.8 Some complications

There is a potential problem with this line of reasoning, relating to two ways of conceiving quantity. In EIp15s Spinoza writes the following:

> [W]e conceive quantity in two ways: abstractly, *or* superficially, as we [NS: commonly] imagine it, or as substance, which is done by the intellect alone [NS: without the help of the imagination]. So if we attend to quantity as it is in the imagination,...it will be found to be finite, divisible, and composed of parts; but if we attend to it as it is in the intellect, and conceive it insofar as it is a substance, which happens [NS: seldom and] with great difficulty, then...it will be found to be infinite, unique, and indivisible.

From this passage, one might reason thus. Insofar as we conceive of quantity as finite, we are conceiving of it using the imagination. Insofar as we are conceiving of the quantity involved in finite bodies, we are conceiving of finite quantity. Therefore, when we conceive of finite quantity, we are conceiving of it using the imagination. This would seem to undercut the idea that finite quantity can be a common notion.

This line of reasoning may break down in the following way. Even if finite quantities are presented in the imagination, it does not necessarily follow that the idea formed by noticing the property of finite quantity is itself presented in the imagination.[30] This move is suggested by the case of motion. Insofar as we conceive of finite modes of `Extension` as having finite degrees of motion, we are conceiving of them using the imagination. But it does not follow from this that the idea of motion (finite or otherwise) is itself an idea of the imagination – indeed, it can only be adequate, according to EIIp38. We might think of this as a "good" kind of abstraction, in opposition to the abstraction against which Spinoza usually rails. Instead of being an operation of the imagination, it is an operation of reason. We will have much more to say about this abstraction in a later section. A similar point is made by Primus (2017, 170–1), who writes, on the subject of common notions, that "although [the cognizer] must start from confused ideas...*reflection* on confused representations of things can deliver adequate representations of features of things," provided those features are mereologically pervasive.

Another line of support comes from EIIp39: "If something is common to, and peculiar to, the human body and certain external bodies by which the human Body is usually affected, and is equally in the part and in the whole of each of them, its idea will also be adequate in the mind." Since both the human body and any external bodies by which it is

30. Here I am departing from the position taken by such interpreters as Marshall (2008), according to whom common notions are ideas of properties that "are found in their entirety in every mode of an attribute," including the infinite ones. Clearly, the idea of finite quantity is not found in any of the infinite modes of `Extension`!

But I think my interpretation is better supported by the text, especially the demonstration of EIIp38. There, as we have seen, Spinoza focuses on some property which is common to *all bodies*, which are defined in EId1 as "a mode that in a certain and determinate way expresses God's essence insofar as he is considered as an extended thing.", and characterized in EIp15s1 as "any quantity, with length, breadth, and depth, limited by some certain figure." From EIp25 we know that modes that express God's essence in a certain and determinate way are particular things, Spinoza writes in EIp31c that "all particular things are contingent and corruptible". Since, according to EId2 the infinite modes cannot be limited by another of the same nature, it is hard to see how they could be corruptible. The upshot, I take it, is that infinite modes are not bodies, and so insofar as Spinoza is talking about common properties of bodies in EIIp38, he is talking about common properties of finite modes. Hence, "finite quantity" qualifies as such a common notion.

In this sense, my interpretation is similar to that taken by Malinkowski-Charles (2003, 148), who writes: "If one wants to avoid making the Ethics' knowledge by common notions into a nothingness of knowledge, that is, into a purely abstract knowledge, one must assume that this knowledge corresponds to the understanding of that which is common to everything *among finitely existing things*."

affected are finite modes of `Extension`, they have quantity – specifically, finite quantity – in common. Whether this quantity is continuous or discrete does not matter for us at this point. What matters is that we can plausibly infer that such an idea of finite quantity is a common notion, or something like it, since it satisfies the antecedent of EIIp39.

EIIp39 also adds evidence for my primary line of reasoning. The ideas which figure in the antecedent of EIIp39 (certain affections of the body which have their source in external things) are certainly ideas of the imagination. But EIIp39 offers strong evidence that we can nevertheless extract adequate ideas from these ideas. This helps rebut the objection that my interpretation is merely ad hoc, a simple patch inserted to help Spinoza. Instead, I am using principles and positions which he employs elsewhere to solve this particular problem.[31]

But there is another piece of evidence against my view elsewhere. Spinoza writes, in Ep. 50 to Jarig Jelles, that "we don't conceive things under number unless they have first been brought under a common genus". (C.II.406 / G.IV.239b) This suggests that to conceive of things under number is similar to conceiving of things under a universal term. If this is true, then mathematical concepts are subject to the etiology of universals that Spinoza offers in EIIp40s1:

> Those notions they call Universal, like Man, Horse, Dog, etc., have arisen from similar causes, viz. because so many images (e.g., of men) are formed at one time in the human Body that they surpass the power of imagining.

Here, it seems that universal concepts are formed as a result of the affections of the body. Hence, if one conceives of things under mathematical concepts only if one has first

31. I have, above, made the inference from "x is a genus" to "x is a universal". This is following Spinoza. In CM, he writes that species and genus are modes of thinking "which help us to *retain* things more firmly and easily, and when we wish, to recall them to mind." (C.I.300 / G.I.234) And in EIIp40s1, Spinoza explicitly links universal notions to memory. He writes that "these notions are not formed by all in the same way, but vary from one to another, in accordance with what the body has more often been affected by, and what the Mind imagines or recollects more easily". I take this to be evidence that Spinoza regards genera as being universals.

conceived of them under a genus (henceforth I will use the term "class concept"), it seems like mathematical concepts have their genesis in the imagination.

There is another line of evidence in Ep. 50 that tells against my argument. When speaking of body, Spinoza writes that:

> For whoever says that he conceives a shape indicates nothing by this except that he conceives a determinate thing, and how it is determinate. So this determination does not pertain to the thing according to its being, but on the contrary, it is its non-being. Therefore, because the shape is nothing but a determination, and a determination is a negation, as they say, it can't be anything but a negation. (C.II.406-7 / G.IV.240b)

The reasoning from this passage goes as follows. If determinations are negations, then all conceiving of things under mathematical concepts will involve negation. And since negation is a mode of imagining, to conceive of things under these concepts is to conceive of them under a mode of imagining.[32] This line of argument provides strong reason to think that subsuming things under mathematical concepts means subjecting them to the imagination. And if this is true, then Spinoza is back in the bind he was in before.

But perhaps we can invoke a line of reasoning similar to the one given above concerning quantity. The fact that negations are ideas presented in the imagination does not by itself imply that ideas which result from some reasoning based on these ideas are themselves presented in the imagination. The comparison of ideas of the imagination may itself be an operation which depends wholly on the mind (specifically, on reason). This "good" abstraction is an operation of reason, rather than the imagination. I will now present my positive view.

32. This idea had a fruitful afterlife in 19th century German idealism. For some details see Melamed (2012) and Stern (2016).

6.9 The positive solution

Let's recap. In the last section I argued that quantity – specifically, finite discrete and continuous quantity – is a common notion. If this is true, then any ideas which in some way follow from it will themselves be adequate. I also argued that even if an idea originates in the imagination, it does not follow that ideas produced by an operation of the mind on that idea are themselves ideas of the imagination. If this is true, then it's at least plausible that mathematical concepts can themselves be adequate ideas.

6.9.1 "Bad" abstraction

But now we're up against another problem. Spinoza gives specific etiologies of mathematical concepts, ones that seem squarely to place them among ideas of the imagination. In Ep. 12 abstraction is an operation of the imagination. When we conceive of quantity as it is presented in the senses, we conceive of it abstractly. This abstraction allows quantity to be "divisible, finite, composed of parts, and one of many". Similarly, when we separate out modes of substance from substance using the imagination and the senses, we categorize these modes using number.

We can combine this with what is said in Ep. 50 and what is said in EIIp40s1 to try and extract the causal history of number as a model for those of "bad" mathematical concepts more generally. According to EIIp40s1, we form ideas of universals in the following manner. Our body has an affection which produces many images in the brain. So many of these images are produced in the brain that they cannot all be imagined in detail. What is common to all the different sources of the affections will be what affects the mind most forcefully. As a result, the mind imagines distinctly only that property which they all agree on. What the mind perceives as being in common to all the images varies from person to person. For instance, one person can understand the universal "man" to mean "upright animal", whereas another can understand it to mean "risible animal," or "ratio-

nal animal", and so forth. Which of these one chooses will depend on what the mind attends to when forming the idea: "each will form universal images of things according to the disposition of his body."

According to Spinoza, recall, we "don't conceive things under numbers unless they have first been brought under a common genus". (C.II.406 / G.IV.239b) He also writes that "nothing is called one or unique unless another thing has been conceived which agrees with it". (C.II.406 / G.IV.239b) In order to conceive of there being *two* apples, according to Spinoza, we have to unite the two objects under the common concept of "apple".[33] This concept is formed as the result of a particular sort of sense experience, one in which multiple images are formed in a confused and mutilated way. Moreover, as we learn in EIIp40s1, the content of the concept is determined, not by the objects themselves, but by the constitution of our own bodies. Thus, the content will be entirely determined by what images were left in the brain most forcefully, and hence by what the mind perceives most vividly.

What I take Ep. 50 to say is that in order to think of numbers we have to think of distinct things which are ranked under a common class concept. We do not think of the number 2 by itself. We only think of, say, two apples, or two pennies. So any ideas of numbers involve some universal notions. Hence, we might infer, insofar as the latter are confused or inadequate, so too will be the former; the causal history of the mathematical concepts implicates the causal history of the universal notions in an essential way. And insofar as we are only the partial cause of the latter, we are only the partial cause of the former.

Let's consider a toy history of an idea of number. Suppose I have an idea which I think represents two apples. According to Spinoza, because we subsume it under a universal idea, the idea will be inadequate. The etiology I am suggesting for such an idea goes

33. Something like view, notes Sutherland (2006, 543), was common in the early modern period: "It was also not uncommon to hold that there was a cognitive requirement for counting: the things counted must be thought of as of the same kind, and hence as falling under the same counting-concept."

something like this:

1. I have the sensory input idea. The idea at this stage is more-or-less undifferentiated.

2. I subsume the input idea under the class idea "apple". The output idea after this stage is "multiple apples".

3. I subsume the output idea of (2) under the idea "two". The output idea after this stage is "two apples".

At this stage, the origin of the numerical idea under which we subsume the idea produced from step (2) does not matter. Since the output idea involves a universal idea, it is inadequate.

This picture of "bad" mathematical concepts can help us understand where the abstraction goes wrong. The causal history of these ideas implicates external bodies which affect us in certain ways. And recall that (per EIIp28) any ideas of these affections will not be clear and distinct, but confused. As a result, ideas which involve these ideas as an essential component will themselves not be clear and distinct. All our "bad" mathematical concepts are like this. They involve the ideas of universals, and hence will be confused. So we have gotten to the important joint: *if* we can remove these inadequate ideas from the causal history of a mathematical concept, we can remove the component that renders it inadequate.

I should be clear here. I do not mean that we can simply factor out that one part of the causal history in order to make the idea adequate. Rather, I mean that in order to get a "good" mathematical concept, we would need a completely new causal history, and hence an *entirely new concept* – one which did not involve the bad sort of abstraction at all. I will now turn to this.

6.9.2 "Good" abstraction

It is clear, from Spinoza's discussion of common notions, that ideas formed by mental operations upon ideas of the imagination can be adequate. This is the case for the ideas of motion, extension, and, I have argued, finite quantity. According to EIIp38, these ideas are automatically adequate. My proposal here is that we can have adequate idea of number insofar as we rank certain things under a class concept which corresponds to one of these common notions. Return to our previous example. The revised etiology would look like this:

1. I have the sensory input idea. The idea at this stage is more-or-less undifferentiated.

2. I subsume the input idea under the class idea "finite quantity". The output idea after this stage is "multiple finite quantities".

3. I subsume the output idea of (2) under the idea "two". The output idea after this stage is "two finite quantities".

This differs from the "bad" causal history significantly. Instead of being subsumed under a class idea that is inadequate, the input idea is subsumed under a class idea that is adequate, that of finite quantity. So instead of having as an essential component an idea that causally depends on something other than our mind, it has as an essential component one that depends entirely on the activity of the mind. And since it depends on this kind of idea, it cannot help but be adequate.

Why is this? First, EIIIp3 says that the actions of the mind arise from adequate ideas alone. The mind is said to act when there is an event of which we are the adequate cause (by EIIIdef2). I will assume that these events are ideas. EIIp40 says that whatever ideas follow from adequate ideas are themselves adequate. So insofar as we are the adequate cause of one of our ideas, that idea follows from an adequate idea. And, hence, that idea will itself be adequate. So whenever we are the adequate cause of an idea, that idea is

adequate. This is what we wanted to show. This is also supported by EIIp29s, where Spinoza writes that "so often as [the mind] is disposed internally…then it regards things clearly and distinctly."

To be clear, these "good" mathematical concepts are not abstractions from the "bad" ones. They are concepts with entirely different causal histories. It is this difference which explains why the one can be adequate and the other can't. The causal history of the "bad" mathematical concepts involve abstractions which are ideas of the imagination (universals), while the "good" concepts involve ones which are ideas of reason.

Here is how the causal history of a "good" idea of number might look. First, we have ideas of the imagination of certain bodies. We notice that they all agree with respect to certain properties, and these properties are mereologically pervasive. Hence, they meet the criterion for common notions. Because of this, they are also adequate. Now, suppose we rank multiple bodies under this common notion, say finite quantity. Now we can have the number concept "two finite quantities". But the class concept under which we have ranked these objects is one of which we cannot help but have an adequate idea, because it is a common notion. As a result, the ideas of number formed follow from ideas adequate ideas, and are themselves adequate.

Sam Newlands has raised a problem related to Spinoza's account of common notions. His main concern is that Spinoza seems to make a distinction between "good" and "bad" universals in a way that looks unprincipled. While Spinoza inveighs against universals and abstractions with one breath, he seems to use them in the next, via common notions:

> [Spinoza] seems to admit that progress can be made via the use of some abstractions from bodily impressions, contra his earlier blanket warnings against inferring anything from "abstractions and universals." In fact, Spinoza opens his attack on universals in EIIp40s by saying that he will examine "which notions are more useful than others, and which are of hardly any use at all" (G 2:120.18– 19). Is Spinoza now conceding that reasoning via

some abstractions can be useful and appropriate, after all?[34]

I have adopted the strategy that Newlands uses, dividing up the "good" universal notions (those acquired by reason) from the "bad" ones (those acquired by the imagination).[35] But he questions the idea that Spinoza simply claiming this distinction means he is entitled to it:

> Why should we accept Spinoza's claim, for instance, that abstracted ideas like "being" can be acquired only via the imagination and bodily impressions? Why accept his groupings of "good" and "bad" universals in the first place? More generally, why accept Spinoza's account of the different sources of universal notions and the corresponding representational clarity or confusion he attaches to them?[36]

Fair enough. Simply introducing a distinction does not mean one is entitled to it. In order for Spinoza to claim a sharp distinction between sorts of universal notions, he needs to provide a principled way of distinguishing between them. Otherwise, he risks allowing that they're all as good as any other. And if this is true, then the story I've told about the formation of "good" mathematical concepts versus the formation of "bad" ones falls apart. The distinction between the two depends on the distinction between their causal histories, and that distinction in turn rests on the distinction between "good" universal notions and "bad" universal notions. So we need some story to tell about the distinction.

Fortunately, we have one on offer. In our analysis of EIIp38, we saw that in order for something to be a common property, it must be both common to all things and mereologically pervasive. The trouble with universals is that they fail both tests. Not everything falls under any particular universal term, so it fails the first test. And this term is not in the parts as well as the whole, so it fails the second as well. As a result, the reasoning in

34. Newlands (2017, 83–4)
35. Newlands (2017, 84)
36. Newlands (2017, 85)

EIIp38 doesn't apply, and Spinoza has a principled distinction between the two. With this distinction secure, the causal story I have told about "good" and "bad" mathematical concepts is back in business. In this way, I both agree with and go beyond Newlands' view. I agree that Spinoza holds that there are "good" and "bad" universals, but further argue that he is entitled to this distinction because of the peculiarities of his doctrine of common notions.

6.9.3 Harmonization

How does my view harmonize with the texts in which Spinoza expresses his skepticism about the use of number and measure in studying the world? The idea behind this is fairly simple. On my reading, Spinoza can still make precisely the same criticisms that he made before. He can also claim that there are other ways of "mathematizing" nature or natural laws that are free from the bad aspects he criticized.

I have already adverted to this general strategy above, by invoking the distinction between ideas that are presented in the imagination and ideas formed by operations on ideas of the imagination. With this distinction in play, Spinoza can have his cake and eat it too. He can say both that, as he is commonly thought to have held, mathematical concepts are ideas of the imagination and that there are other ones which are not. What matters, in each case, is the causal history.

My reading coheres with the passages from Ep. 12. All Spinoza has to do is hold that mathematical concepts *as ordinarily used* are ideas of the imagination. We reflexively form these in an imaginative way, and they turn out to be useful. There are, however, other mathematical concepts which do not suffer from this deficiency. It also coheres with the passages from the CM. Spinoza can perfectly well hold that there are certain modes of `Thought` which explain certain things better than others; the "good" mathematical concepts would be this latter.

But there is another view upon which Spinoza cannot endorse the application of

mathematical concepts to nature, a view which I take to mount a very powerful objection to my position.[37] According to this view, in order to make any application of mathematical concepts to nature, we must attend to one among infinitely many modes. In determining a particular thing with respect to measure, we are making a choice about how to carve up the world. But we are not epistemically situated in a way that would allow us adequately to understand these modes. This is gleaned from a remark that Spinoza makes in Ep. 32:

> I don't know how [the parts of nature] really cohere and how each part agrees with its whole. To know that would require knowing the whole of Nature and all of its parts. (C.II.18 / G.IV.170a)

Arguably, very few humans have such cognitive access. Consequently, very few humans have cognitive access to the way that each part of nature agrees with the whole thing.

Suppose we decide to measure the motion of some body according to some chosen magnitude. I mean this in the sense I have been talking about it: roughly, comparing the motion to the magnitude as whole to part. This selection of a particular motion to measure removes that motion from its context in the vast causal web of nature. It is a limitation of nature, one which we could only be in a good epistemic position to do if we have knowledge of nature as a whole. In Spinoza's parlance, we are only entitled to have an adequate idea of that part of nature if we are entitled to have an adequate idea of the whole of nature. Consequently, any ideas of the magnitudes being compared must themselves be inadequate.

I think, however, that we have some reason to think that Spinoza shouldn't hold the principle this view ascribes to him, that to know any part of nature adequately we must know the whole thing. Consider his doctrine of the three kinds of cognition, spelled out in EIIp40s2. The highest form of cognition is said to run from "an adequate idea

37. A similar objection is, I believe, discussed in Schliesser (2018, 174), but the precise elaboration and structure of the objection I will present here is my own.

of the formal essences of certain attributes of God to the adequate cognition of the [NS: formal] essence of things." Though there is much mystery surrounding how this kind of cognition is supposed to work, it at least involves an inference from one adequate idea (of the essence of an attribute of God) to another such idea (the essence of a particular thing).

Consider what would be true if we need to know all of nature adequately in order to know one mode adequately. We could not simply infer things about the formal essence of a particular extended mode from the essence of `Extension`. We would need an adequate idea of the entirety of extended nature to obtain an adequate idea of the particular mode. But Spinoza explicitly says that it suffices that we have an adequate idea of the formal essence of the relevant attribute. This seems to cut against the idea that to have an adequate idea of a particular mode, we must have an adequate idea of the whole of nature.

Consider also EVp4: "There is no affection of the Body of which we cannot form a clear and distinct concept ". The demonstration of EVp4 reasons that, because we have common notions, and these are adequate, we can form clear and distinct concepts (i.e., have an adequate idea of) the affections of the body. This suggests that all we need to do to have adequate ideas of the affections of our bodies is to understand them using the common notions. If it were instead true that to understand one affection of the body, we need to understand the whole of nature, then this would not be possible. But since Spinoza thinks it is possible, we should perhaps infer that he does not hold the principle attributed to him.

What reading should we then give to the passage from Oldenburg? I propose that we should read it as making a limited claim about coherence, a technical notion which Spinoza defines this way: "by coherence of the parts, then, I understand nothing but that the laws *or* the nature of the one part adapts itself to the laws *or* nature of the other part so that they are opposed to each other as little as possible." So when Spinoza says that,

in order to know how the parts of nature cohere, he would have to know the whole of nature, he is *not* saying that to have an adequate idea of a particular mode one needs to have an adequate idea of the whole of nature. Rather he is saying that to know how each part of nature interacts with the others in a certain way ("so that they are opposed to each other as little as possible"), we would have to know the whole of nature and each of its parts. This is still a strong claim, but not as strong as the one which fuels the objection above.

6.10 Conclusion

In this chapter, I have tried to do (at least) three things. First, I have examined the problems that Spinoza's "official" view about mathematical entities generate when one looks at his writings as a whole. As we saw, his theory of metaphysical individuation would, if a certain interpretation of his thoughts on mathematical entities is correct, suffer greatly.

Second, I have striven to understand a little better what precisely Spinoza means, in these contexts by "number" and "measure". As we saw above, I think that the most plausible interpretation is that he gave these terms the meaning that thy had in Euclid's *Elements*, at least implicitly. They play much the same theoretical role, having to do with divisibility and parthood.

Third, and perhaps most importantly, I have explored whether we can find a solution to the problems generated by this interpretation of Spinoza's philosophy of mathematics. I argued that, with a suitable understanding of Spinoza's thought on abstraction and common notions, a solution is available, one which (I think) would not be uncongenial to Spinoza.

The reader may have gotten the impression that this is all so much eisegesis. "Aren't you just trying to make consistent views which are plainly contradictory?" Perhaps the views Spinoza holds are ultimately contradictory. But I do not think that we need to conclude this so quickly. If we can find a path to a solution which both harmonizes the

extant texts and makes use of tools that Spinoza himself developed and would have had access to, I think we can charitably assume that his views are not contradictory – instead, their harmonization was merely latent all along.

Bibliography

Primary Sources

Aquinas, Thomas. 1947. *Summa Theologiae.* Translated by Fathers of the English Dominican Province. Benzinger Bros.

———. 1956. *Summa Contra Gentiles.* Translated by Vernon J Bourke. New York: Image Books.

———. 2006. "De Principiis Naturae." In Bobik 2006.

Aristotle. 1984. *The Complete Works of Aristotle: The Revised Oxford Translation.* Vol. 2. Princeton, New Jersey: Princeton University Press.

A Sancto Paulo, Eustachio. 1647. *Summa philosophiae quadripartita.* Geneva: Iacobi Stoer.

Barrow, Isaac. 1734. *The usefulness of mathematical learning explained and demonstrated: Being mathematical lectures read in the public schools of Cambridge.* Translated by John Kirkby. London: Stephen Austin.

Bobik, Joseph. 2006. *Aquinas on Matter and Form and the Elements: A Translation and Interpretataion of the* De Principiis Naturae *and the* De Mixtione Elementorum *of St. Thomas Aquinas.* South Bend: University of Notre Dame Press.

Bos, Erik-Jan, ed. 2002. *The Correspondence between Descartes and Henricus Regius.* Utrecht: ZENO.

Boyle, Robert. 1662. *A Defence Of the Doctrine touching the Spring and Weight Of the Air.* Oxon: Thomas Robinson.

———. 1666. *The Origine of Formes and Qualities.* Oxford: H. Hall.

———. 1669. *Certain Physiological Essays and other tracts.* 2nd ed. London: Henry Harringman.

Burgersdijk, Franco. 1640. *Institutionum Metaphysicae.* Hieronymum de Vogel.

De Fermat, Pierre. 1891-1896. *Oeuvres de Fermat.* Edited by Paul Tannery and Charles Henry. Paris: Gauthier-Villars et fils.

Descartes, René. 1659. *Geometria.* Amsterdam: Ludovicum & Danielem Elzevirios.

———. 1984a. *The Philosophical Writings of Descartes.* Translated by John Cottingham, Robert Stoothoff, and Dugald Murdoch. Vol. 1. Cambridge: Cambridge University Press.

———. 1984b. *The Philosophical Writings of Descartes.* Translated by John Cottingham, Robert Stoothoff, and Dugald Murdoch. Vol. 2. Cambridge: Cambridge University Press.

———. 1991. *The Philosophical Writings of Descartes.* Translated by John Cottingham, Robert Stoothoff, Dugald Murdoch, and Anthony Kenny. Vol. 3. Cambridge: Cambridge University Press.

———. 1996. *Oeuvres de Descartes.* Edited by Charles Adam and Paul Tannery. 11 vols. Paris: J. Vrin.

———. 2004. *The World and Other Writings.* Edited and translated by Stephen Gaukroger. Cambridge: UK: Cambridge University Press.

Doyle, Sir Arthur Conan. 1970. *The Complete Sherlock Holmes.* Edited by Christopher Morely. New York: Doubleday & Co.

Heath, Thomas L. 1908. *The Thirteen Books of The Elements.* Vol. 2. Cambridge: Cambridge University Press.

Heereboord, Adriaan. 1665. *Meletemata Philosophica.* Amsterdam: Joannem Ravestenium.

Hobbes, Thomas. 1839-1845. *The English Works of Thomas Hobbes.* Edited and translated by William Molesworth. 11 vols. London: John Bohn.

Leibniz, G. W. 1965. *Die philosophischen Schriften.* Edited by C. I. Gerhardt. 7 vols. Hildesheim: Georg Olms.

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

———. 2016. *The Leibniz-Stahl Controversy.* Translated by Francois Duchesneau and Justin E. H. Smith. New Haven: Yale University Press.

———. 1849-63. *Mathematische Schriften von Gottfried Wilhelm Leibniz.* Edited by C. I. Gerhardt. 6 vols. Berlin: Halle.

Newton, Isaac. 1687/1999. *Mathematical Principles of Natural Philosophy.* Los Angeles, CA: University of California Press.

Spinoza, Benedict. 1925. *Opera Omnia.* Edited by Carl Gebhardt. 4 vols. Heidelberg: Carl Winter.

———. 1985. *The Collected Works of Spinoza.* Edited and translated by Edwin Curley. Vol. 1. Princeton: Princeton University Press.

———. 2016. *The Collected Works of Spinoza.* Edited and translated by Edwin Curley. Vol. 2. Princeton: Princeton University Press.

Spinoza, Benedict. 1677/2018. *Ethics, Proved in Geometrical Order.* Edited by Matthew J. Kisner. Translated by Matthew J. Kisner and Michael Silverthorne. Cambridge: Cambridge University Press.

———. 1677/2020. *Oeuvres vol. IV: Ethica.* Translated by Pierre-Francois Moreau. Paris: PUF.

Suarez, Francisco. 1856-1878. *Opera Omnia.* Edited by M. André and C. Berton. 28 vols. Paris: Ludovicus Vivès.

van Rooijen, A. J. Servaas, ed. 1889. *Inventaire Des Livres Formant La Biblioteque De Benedict Spinoza.* The Hague: Martinus Nijhoff.

Secondary Sources

Achinstein, Peter. 1978. "Teleology and Mentalism." *The Journal of Philosophy* 75 (10): 551–3.

———. 1985. *The Nature of Explanation.* Oxford: Oxford University Press.

———. 2010. *Evidence, Explanation, and Realism: Essays in the Philosophy of Science.* Oxford: Oxford University Press.

Adler, Jacob. 1989. "The Development of Three Concepts in Spinoza." *Southwest Philosophy Review* 5 (1): 23–32.

———. 1996. "Spinoza's Physical Philosophy." *Archiv für Gsichte der Philosophie* 78 (3): 253–276.

Allison, Henry. 1987. *Benedict de Spinoza: An Introduction, Revised Edition.* New Haven: Yale University Press.

Anstey, Peter. 2005. "Experimental versus Speculative Natural Philosophy." In Schuster 2005, chap. 8.

Antognazza, Maria Rosa. 2020. "The Distinction in Kind between Knowledge and Belief." *Proceedings of the Aristotelian Society* 120 (3): 277–308.

Banchetti-Robino, Marina Paola. 2012. "The ontological reduction of first-order and second-order corpuscles in the chemical philosophy of Robert Boyle: the redintegration of potassium nitrate." *Foundations of Chemistry* 14:221–234.

Bedau, Mark. 1992. "Where's the Good in Teleology?" *Philosophy and Phenomenological Research* 52 (4): 781–806.

Bellucci, Francesco. 2016. "Charles S. Peirce and the Medieval Doctrine of *consequentiae*." *History and Philosophy of Logic* 37 (3): 244–268.

Bennett, Jonathan. 1984. *A Study of Spinoza's Ethics.* Indianapolis, Indiana: Hackett Publishing Company.

———. 1986. "Spinoza on Error." *Philosophical Papers* 5 (1): 59–73.

Biasutti, Franco. 2013. "Galileo and Spinoza: Historical and Theoretical Perspectives." *Intellectual History Review* 23 (1): 3–23.

Bledin, Justin, and Yitzhak Melamed. 2020. "Spinozan Model Theory." *Advances in Modal Logic* 13:133–147.

Brown, Deborah J. 2012. "Cartesian Functional Analysis." *Australasian Journal of Philosophy* 90 (1): 75–92.

Buyse, Filip A. A. 2013a. "Boyle, Spinoza and the Hartlib Circle: the correspondence which never took place." *Society and Politics* 7:34–53.

———. 2013b. "Spinoza, Boyle, Galileo: Was Spinoza a Strict Mechanical Philosopher?" *Intellectual History Review* 23 (1): 45–64.

———. 2020. "Boyle, Spinoza and Glauber: on the *philosophical redintegration* of saltpeter – a reply to Antonio Clericuzio." *Foundations of Chemistry* 22:59–76.

Carriero, John. 2004. "Final Causality in Spinoza." In Garber and Nadler 2004, chap. 4.

———. 2013. "Epistemology Past and Present." *Proceedings of the Aristotelian Society* CXIII:175–200.

Chalmers, Alan. 2009. *The Scientist's Atom and the Philosopher's Stone: How Science Succeeded and Philosophy Failed to Gain Knowledge of Atoms.* Dordrecht: Springer.

Clarke, Desmond. 1982. *Descartes' Philosophy of Science.* Manchester: Manchester University Press.

Clericuzio, Antonio. 1990. "A redefinition of Boyle's chemistry and corpuscular philosophy." *Annals of Science* 47 (6): 561–589.

———. 2000. *Elements, Principles and Corpuscles: A Study of Atomism and Chemistry in the Seventeenth Century.* Dordrecht: Springer.

Curley, Edwin. 1969. *Spinoza's Metaphysics.* Cambridge, MA: Harvard University Press.

———. 1988. *Behind the Geometrical Method.* Princeton: Princeton University Press.

———. 1990. "Experience in Spinoza's Theory of Knowledge." In Curley and Moreau 1990.

Curley, Edwin, and Pierre-Francois Moreau, eds. 1990. *Spinoza: Issues and Directions.* Leiden: E. J. Brill.

Davies, Brian. 2016. *Thomas Aquinas's* Summa Contra Gentiles*: A Guide and Commentary.* Oxford: Oxford University Press.

Della Rocca, Michael. 1996. *Representation and the Mind-Body Problem in Spinoza.* Oxford: Oxford University Press.

———. 2003. "The Power of an Idea: Spinoza's Critique of Pure Will." *Noûs* 37 (2): 200–231.

Della Rocca, Michael. 2007. "Spinoza and the Metaphysics of Scepticism." *Mind* 116 (464): 851–874.

———. 2008. *Spinoza.* New York: Routledge.

———, ed. 2018. *The Oxford Handbook of Spinoza.* New York: Oxford University Press.

Dellsén, Finnur. 2017. "Certainty and Explanation in Descartes' Philosophy of Science." *HOPOS* 7:303–327.

Des Chene, Dennis. 1996. *Physiologia: Natural Philosophy in Late Aristotelian and Cartesian Thought.* Ithaca: Cornell University Press.

———. 2001. *Spirits and Clocks: Machine and Organism in Descartes.* Ithaca: Cornell University Press.

di Bella, Stefano, and Tad Schmaltz, eds. 2017. *The Problem of Universals in Early Modern Philosophy.* Oxford: Oxford University Press.

Douglas, Alexander. 2015a. *Spinoza and Dutch Cartesianism.* Oxford: Oxford University Press.

———. 2015b. "Was Spinoza a Naturalist?" *Pacific Philosophical Quarterly* 96:77–99.

Dugas, René. 1988. *A History of Mechanics.* Translated by J. R. Maddox. New York: Dover.

Dunlop, Katherine. 2012. "The mathematical form of measurement and the argument for Proposition I in Newton's Principia." *Synthese* 186 (1): 191–229.

Flostad, Guttorm. 1973. "Spinoza's Theory of Knowledge in the Ethics." In Grene 1973, chap. 5.

Fowler, D. H. 1983. "Review: Investigating Euclid's Elements." *British Journal for the Philosophy of Science* 34 (1): 57–70.

Gabbey, Alan. 1995. "Spinoza's natural science and methodology." In Garrett 1995, chap. 4.

Garber, Daniel. 2015. "Superheroes in the History of Philosophy: Spinoza, Super-Rationalist." *Journal of the History of Philosophy* 53 (3): 507–521.

Garber, Daniel, and Steven Nadler, eds. 2003. *Oxford Studies in Early Modern Philosophy.* Vol. 1. Oxford: Oxford University Press.

———, eds. 2004. *Oxford Studies in Early Modern Philosophy.* Vol. 2. Oxford: Oxford University Press.

———, eds. 2008. *Oxford Studies in Early Modern Philosophy.* Vol. 4. Oxford: Oxford University Press.

Garrett, Don, ed. 1995. *The Cambridge Companion to Spinoza.* Cambridge: Cambridge University Press.

———. 2002. "Teleology in Spinoza and Early Modern Rationalism." Chap. 15 in *New Essays on the Rationalists,* edited by Rocco J. Gennaro and Charles Huenemann, 310–335. Oxford, UK: Oxford University Press.

———. 2018a. *Nature and Necessity in Spinoza's Philosophy.* Oxford: Oxford University Press.

———. 2018b. "Spinoza's Theory of Metaphysical Individuation." In Garrett 2018a, chap. 11.

Gilead, Amihud. 1985. ""The Order and connection of Things": Are They Constructed Mathematically-Deductively According to Spinoza?" *Kant-Studien* 76 (1): 72–78.

Green-Pederson, N. J. 1983. "Early British Treatises on Consequences." In P. Osmund Lewry 1983, chap. 11.

Grene, Marjorie, ed. 1973. *Spinoza: a collection of critical essays.* Garden City, NY: Anchor Press/Doubleday.

Gueroult, Martial. 1969. *Spinoza.* Vol. 1. Paris: Georg Olms.

Gueroult, Martial. 1974. *Spinoza.* Vol. 2. Paris: Georg Olms.

Hall, A Rupert, and M. Boas Hall. 1964. "Philosophy and Natural Philosophy: Boyle and Spinoza." In Taton and Braudel 1964.

Heesen, Remco, and Liam Kofi Bright. 2020. "Is Peer Review A Good Idea?" *British Journal for the Philosophy of Science,* 1–31.

Hempel, Carl. 1965. *Aspects of Scientific Explanation and Other Essays in the Philosophy of Science.* New York: The Free Press.

———. 1966. *Philosophy of Natural Science.* New Jersey: Prentice Hall.

Hempel, Carl, and Paul Oppenheim. 1948. "Studies in the Logic of Explanation." *Philosophy of Science* 15 (2): 135–175.

Hoffman, Paul. 2009a. "Cartesian Passions and Cartesian Dualism." In Hoffman 2009c, chap. 8.

———. 2009b. "Does Efficient Causation Presuppose Final Causation?" In Newlands and Jorgenson 2009, chap. 9.

———. 2009c. *Essays on Descartes.* Oxford: Oxford University Press.

———. 2011. "Final Causation in Spinoza." *Logical Analysis and History of Philosophy* 14:40–50.

Homan, Matthew. 2018. "Geometrical Figures in Spinoza's Book of Nature." *Journal of the History of Philosophy* 56 (3): 455–476.

Hübner, Karolina. 2015. "Spinoza on Essences, Universals, and Beings of Reason." *History of Philosophy Quarterly* 96 (2): 58–88.

Kitcher, Philip. 1981. "Explanatory Unification." *Philosophy of Science* 48 (4): 507–531.

Klever, Wim. 1990. "Anti-falsificationism: Spinoza's Theory of Experience and Experiments." In Curley and Moreau 1990, chap. 12.

Kovacs, David Mark. 2020. "Metaphysically Explanatory Unification." *Philosophical Studies* 177 (3): 150–177.

Krop, Henri. 2013. "Spinoza's Library: The Mathematical and Scientific Works." *Intellectual History Review* 23 (1): 25–43.

Lachterman, David R. 1977. "The Physics of Spinoza's ETHICS." *The Southwest Journal of Philosophy* 8 (3): 71–111.

Laudan, Larry. 1990. "Demystifying Underdetermination." In Savage 1990, 267–297.

Lin, Martin. 2006. "Teleology and Human Action in Spinoza." *The Philosophical Review* 115 (3): 317–354.

———. 2018. "The Principle of Sufficient Reason in Spinoza." Chap. 7 in *The Oxford Handbook of Spinoza,* edited by Michael Della Rocca. New York: Oxford University Press.

———. 2019. *Being and Reason: An Essay on Spinoza's Metaphysics.* Oxford: Oxford University Press.

Lin, Martin, and Yitzhak Melamed. 2016. "Principle of Sufficient Reason." In *The Stanford Encyclopedia of Philosophy,* Spring 2018, edited by Edward N. Zalta. https://plato.stanford.edu/entries/sufficient-reason/.

Machamer, Peter K. 1976. "Causality and Explanation in Descartes' Natural Philosophy." In Machamer and Turnbull 1976, chap. 7.

Machamer, Peter K., and Robert G. Turnbull, eds. 1976. *Motion and Time, Space and Matter: Interrelations in the History of Philosophy and Science.* Columbus: Ohio State University Press.

Macherey, Pierre. 1995. "Spinoza lecteur et critique de Boyle." *Revue du Nord* 77 (312): 733–774.

Malinkowski-Charles, Syliane. 2003. "The Circle of Adequate Knowledge: Notes on Reason and Intuition in Spinoza." In Garber and Nadler 2003, chap. 6.

Manning, Richard. 2016. "Spinoza's Physical Theory." In *The Stanford Encyclopedia of Philosophy,* Spring 2018, edited by Edward N. Zalta. https://plato.stanford.edu/entries/spinoza-physics/.

Marshall, Eugene. 2008. "Adequacy and Innateness in Spinoza." In Garber and Nadler 2008, chap. 2.

Martin, Christopher. 2018. "Spinoza's Formal Mechanism." *Pacific Philosophical Quarterly* 99 (1): 151–181.

Matheron, Alexander. 1969. *Individu et communauté chez Spinoza.* Paris: Minuit.

———. 1986. "Spinoza and Euclidean Arithmetic." In Nails 1986, chap. 5.

Matson, Wallace. 1990. "Body Essence and Mind Eternity in Spinoza." In Curley and Moreau 1990.

Maull, Nancy. 1986. "Spinoza in the Century of Science." In Nails 1986, chap. 1.

McAllister, Blake. 2014. "Adequate and Inadequate Ideas in Spinoza." *History of Philosophy Quarterly* 31 (2): 119–136.

McDonough, Jeffrey K. 2008. "Leibniz's Two Realms Revisited." *Nous* 42 (4): 673–696.

———. 2011. "The Heyday of Teleology and Early Modern Philosophy." *Midwest Studies in Philosophy* XXXV:179–204.

———, ed. 2020. *Teleology: a history.* Oxford: Oxford University Press.

McKeon, Richard. 1928. *The Philosophy of Spinoza: the unity of his thought.* New York: Longmans, Green / Co.

Melamed, Yitzhak. 2000. "On the Exact Science of Nonbeings: Spinoza's View of Mathematics." *Iyyun* 46:3–22.

———. 2012. ""Omnis determinatio est negatio": determination, negation, and self-negation in Spinoza, Kant, and Hegel." In Melamed and Förster 2012, chap. 10.

———. 2013. *Spinoza's Metaphysics: Substance and Thought.* New York: Oxford University Press.

———, ed. 2015. *The Young Spinoza: A Metaphysician in the Making.* Oxford: Oxford University Press.

———, ed. 2017. *Spinoza's 'Ethics': A Critical Guide.* Cambridge: Cambridge University Press.

———. 2020. "Teleology in Jewish Philosophy: early Talmudists to Spinoza." In McDonough 2020.

———, ed. 2021. *A Companion to Spinoza.* New Jersey: Wiley Blackwell.

Melamed, Yitzhak, and Eckhart Förster, eds. 2012. *Spinoza and German Idealism.* Cambridge: Cambridge University Press.

Mignini, Filippo. 1979. "Per la datazione e l'interpretazione del *Tractatus de Intellectus Emendatione* di B. Spinoza." *La Cultura* 17:87–160.

———. 1987. "Données et problèmes de la chronologie spinozienne entre 1656 et 1665." *Revue des Sciences philosophiques et théologiques* 71 (1): 9–21.

Morrison, John. 2015. "Truth in the *Emendation*." In Melamed 2015, chap. 4.

Mueller, Ian. 1981. *Philosophy of Mathematics and Deductive Structure in Euclid's* Elements. Cambridge, MA: The MIT Press.

Nadler, Steven. 1999. *Spinoza: a life.* New York: Cambridge University Press.

———. 2006. *Spinoza's Ethics: An Introduction.* Cambridge: Cambridge University Press.

Nagel, Ernest. 1961. *The Structure of Science: Problems in the Logic of Scientific Explanation.* New York: Harcourt.

Nails, Marjorie Grene and Debra, ed. 1986. *Spinoza and the Sciences.* Boston: D. Reidel.

Newlands, Samuel. 2017. "Spinoza on Universals." In di Bella and Schmaltz 2017.

———. 2018. *Reconoceiving Spinoza.* Oxford: Oxford University Press.

Osler, Margaret J. 1996. "From Immanent Natures to Nature as Artifice: The Reinterpretation of Final Causes in Seventeenth-Century Natural Philosophy." *The Monist* 79 (3): 388–407.

P. Osmund Lewry, O.P., ed. 1983. *The Rise of British Logic.* Pontifical Institute of Mediaeval Studies.

Parkinson, G. H. R. 1964. *Spinoza's Theory of Knowledge.* Oxford: Oxford University Press.

———. 1977. "Spinoza on Miracles and Natural Law." *Revue Internationale de Philosophie* 31 (119/120): 145–157.

Penner, Sydney. 2013. "Suarez on the Reduction of Categorical Relations." *Philosopher's Imprint* 13 (2).

Peterman, Alison. 2014. "Spinoza on Physical Science." *Philosophy Compass* 9 (3): 214–223.

———. 2015. "Spinoza on Extension." *Philosopher's Imprint* 15 (14).

Primus, Kristin. 2017. "*Scientia Intuitiva* in the *Ethics*." In Melamed 2017, chap. 8.

Quine, Willard V. O. 1951. "Two Dogmas of Empiricism." *Philosophical Review* 60 (1): 20–43.

———. 1975. "On Empirically Equivalent Systems of the World." *Erkenntnis* 9:313–328.

Railton, Peter. 1978. "A Deductive-Nomological Model of Probabilistic Explanation." *Philosophy of Science* 45 (2): 206–226.

———. 1981. "Probability, Explanation, and Information." *Synthese* 48:233–256.

Ruestow, Edward G. 1973. *Physics at Seventeenth and Eighteenth Century Leiden: Philosophy and the New Science in the University.* The Hague: Martinus Mijhoff.

Russell, Bertrand. 2010. *Principles of Mathematics.* Oxford: Routledge.

Salmon, Wesley. 1971. "Statistical Explanation." In *Statistical Explanation and Statistical Relevance,* edited by Wesley Salmon, 29–87. Pittsburgh: University of Pittsburgh Press.

———. 1984. *Scientific Explanation and the Causal Structure of the World.* Princeton: Princeton University Press.

———. 1990. *Four Decades of Scientific Explanation.* Minneapolis: University of Minnesota Press.

Sangiacomo, Andrea. 2016. "Aristotle, Heereboord, and the Polemical Target of Spinoza's Critique of Final Causes." *Journal of the History of Philosophy* 54 (3): 395–420.

Sargent, Rose-Mary. 1995. *The Diffident Naturalist: Robert Boyle and the Philosophy of Experiment.* Chicago: The University of Chicago Press.

Savage, C. Wade, ed. 1990. *Scientific Theories.* University of Minnesota.

Schechtman, Anat. 2019. "Three Infinities in Early Modern Philosophy." *Mind* 128:1117–1147.

Schliesser, Eric. 2011. "Angels and Philosophers: with a New Interpretation of Spinoza's Common Notions." *Proceedings of the Aristotelian Society* CXI:497–518.

———. 2018. "Spinoza and the Philosophy of Science: Mathematics, Motion, and Being." In Della Rocca 2018, chap. 8.

Schmid, Stephan. 2011. "Teleology and the Dispositional Theory of Causation in Thomas Aquinas." *Logical Analysis and History of Philosophy* 14:21–39.

Schoen, Edward L. 1977. "The Role of Common Notions in Spinoza's Ethics." *The Southern Journal of Philosophy* 15 (4): 537–550.

Schuster, Peter Anstey and John, ed. 2005. *The Science of Nature in the Seventeenth Century.* Dordrecht: Netherlands: Springer.

Sehon, Scott R. 1997. "Deviant Causal Chains and the Irreducibility of Teleological Explanation." *Pacific Philosophical Quarterly* 78:195–213.

Shoemaker, Sydney. 1998. "Causal and Metaphysical Necessity." *Pacific Philosophical Quarterly* 79:59–77.

Simmons, Alison J. 2001. "Sensible Ends: Latent Teleology in Descartes' Account of Sensation." *Journal of the History of Philosophy* 39 (1): 49–75.

Skinner, Quentin. 1969. "Meaning and Understanding in the History of Ideas." *History and Theory* 8 (1): 3–53.

Skow, Bradford. 2016. *Reasons Why.* Oxford: Oxford University Press.

Steenbakkers, Piet. 2021. "Spinoza's Philology." In Melamed 2021, chap. 2.

Steinberg, Justin. 2017. "Two Puzzles Concerning Spinoza's Conception of Belief." *European Journal of Philosophy* 26 (1): 261–282.

Stern, Robert. 2016. "'Determination is Negation': The Adventures of a Doctrine From Spinoza to Hegel to the British Idealists." *Hegel Bulletin* 37 (1): 29–52.

Sutherland, Daniel. 2004. "Kant's Philosophy of Mathematics and the Greek Mathematical Tradition." *Philosophical Review* 113 (2): 157–201.

———. 2006. "Kant on Arithmetic, Algebra, and the Theory of Proportions." *Journal of the History of Philosophy* 44 (4): 533–558.

Tal, Eran. 2015. "Measurement in Science." In *The Stanford Encyclopedia of Philosophy,* edited by Edward N. Zalta. Metaphysics Research Lab, Stanford University.

Taton, R., and F. Braudel, eds. 1964. *L'aventure de l'esprit: melanges Alexandre Koyre.* Paris: Hermann.

Taylor, Charles. 1970. "Explaining action." *Inquiry* 13 (1-4): 54–89.

van Fraassen, Bas. 1977. "The Pragmatics of Explanation." *American Philosophical Quarterly* 14 (2): 143–150.

———. 1987. *The Scientific Image.* Oxford: Oxford University Press.

Ward, Thomas. 2011. "Spinoza on the Essence of Modes." *British Journal for the History of Philosophy* 19 (1): 19–46.

Weinberg, Steven. 1992. *Dreams of a Final Theory.* New York: Pantheon Books.

Wilsch, Tobias. 2016. "The Deductive-Nomological Account of Metaphysical Explanation." *Australasian Journal of Philosophy* 94 (1): 1–23.

Wright, Larry. 1976. *Teleological Explanations.* Berkeley: University of California Press.