

WOLFF AND KANT ON REASONING FROM ESSENCES

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1. Introduction

Wolff and Kant agree that the method of demonstration of the «mathematical method» is, generally speaking, the axiomatic-deductive method of Euclid's *Elements*.¹ This method employs chains of syllogisms in order to prove a general proposition about a geometric figure with apodictic certainty. These chains of syllogisms (or demonstrations), in the mathematical method, are carried out with recourse to an individual geometric figure. For example, in order to prove the general proposition that all internal angles of a triangle are equal to 180 degrees, one need only to draw a triangle and to make convenient additions to it, such as, to add a line at its apex, parallel to its base. On the basis of the drawn triangle and the convenient additions made to it, one can then employ principles like «all internal angles within parallel lines are equal» within the demonstration. By a combination of such principles and references to the drawn triangle within the demonstration, one shows that specific internal angles within parallel lines in the drawn triangle are equal.

1 The mathematical method is, to be sure, broader than the method of demonstration, for Wolff, as it is an order of explanation of the mathematicians, which begins with definitions, and proceeds to principles (*Grundsätze*), theorems (*Lehrsätze*), and problems (*Aufgaben*) (*Kurzer Unterricht* [KU], §1). However, in this paper, I focus on the application of the mathematical method to philosophy. Since Wolff provides a convenient comparison of the mathematical method in action as it is applied to geometry (*German Logic* [GL], chapter 4, § 23) and to natural philosophy (GL, chapter 4, § 25), which highlights the method of demonstration, I focus on the comparison of how this demonstration can be used in both disciplines.

One proceeds in this way until one proves the proposition in question. Although the drawn geometric figure is an individual, it is able to be used to prove propositions which hold for all triangles: it is an individual which represents the universal. While Wolff and Kant agree that, generally speaking, this is the mathematical method, they disagree on the scope of its application.²

For Wolff, one can achieve scientific certainty in all sciences by means of the mathematical method (when I refer to the «mathematical method» from now on, I am referring specifically to its method of demonstration).³ When Wolff applies the mathematical method to natural philosophy, it involves one unique feature, on my interpretation: it treats a thing in nature like a geometric figure.⁴ That is, it treats a thing in nature as an individual which can stand for the universal.⁵ For Kant, by contrast, there is only one

2 Wolff discusses the example taken up in this paragraph of the mathematical method in action in geometry at GL, Ch. 4, § 23 and Kant discusses this example at A716/B744-A717/B745. Although Kant maintains the general steps of the mathematical method, as here described, he deviates significantly in that, on his view, the individual geometrical figure must be constructed *a priori*, as I will discuss when I take up Kant's arguments against Wolff in section 5.

3 KU, § 51.

4 I single out natural philosophy because in the example demonstration, which I focus on in this paper, mentioned in footnote 1, Wolff provides a detailed account of how the mathematical method is applied to natural philosophy.

5 My discussion of Wolff's mathematical method relies on the *Kurzer Unterricht von der mathematischen Methode oder Lehrart (Kurzer Unterricht)* in the *Anfangsgründe aller mathematischen Wissenschaften*, on his *Vernünfftige Gedanken von den Kräften des menschlichen Verstandes und ihrem richtigen Gebrauch in der Erkenntnis der Wahrheit (German Logic)*, and on *Vernünfftige Gedancken von Gott, der Welt und der Seele des Menschen, auch allen Dingen überhaupt (German Metaphysics)* [GM], since these texts seem to present a unified theory with respect to understanding the mathematical method, as it is presented in the example I focus on in the GL. Alberto Vanzo argues that the essence of a composite being is contingent, for Wolff (which runs counter to the view I will present in this paper), VANZO 2015, 247-249. I agree with Vanzo with respect to Wolff's view in the *Ontologia* (see WOLFF 1730, § 789, § 792). However, Vanzo also provides citations from the GM, implying that he believes that Wolff also held that essences of composite beings are contingent in the GM. While I agree that Wolff distinguishes between essences of

type of thing that is an individual which can stand for the universal, namely, a figure constructed from a pure geometric concept. Kant, thus, argues that the mathematical method cannot be employed within philosophy with the same efficacy as it can within mathematics.⁶ On the basis of the distinction he draws between mathematical and philosophical cognition, Kant argues that while a geometric figure is an individual which is able to represent the universal, a thing in nature is not.

In this paper, I aim to explain why Wolff thinks that a thing in nature can be treated in this way. I will argue that Wolff's modal metaphysics presents nature as consisting of rigid essences and causal connections which, on my view, provides the grounds for him to employ a thing in nature like a geometric figure within the mathematical method. In response, I will discuss why Kant's critical philosophy precludes such a modal metaphysics. In order to achieve this goal, I will first sketch the mathematical method, as it is applied to natural philosophy by Wolff. I will only provide enough details to show, on my view, which demands Wolff's application of the mathematical method to philosophy makes on his modal metaphysics. I will, then, present the aspects of Wolff's modal metaphysics which are pertinent to the topic at

simple and composite beings in the GM, the passages Vanzo cites do not support the view that Wolff holds the essences of composite beings to be contingent in the GM. Thus, I restrict my interpretation that essences of composite beings are necessary for Wolff to the three above-mentioned texts. Although I do not have space to delve into this question here, a longer version of this paper would investigate how Wolff's view regarding essences of composite beings changes during his career and what this means for the mathematical method.

6 More specifically, Kant separates mathematical and philosophical cognition completely, which means that there is a distinct method proper to each type of cognition. However, because demonstrations that rely on non-constructed individuals, as we find in Wolff's mathematical method, must also be able to be used in *a posteriori* philosophical cognitions, for Kant, just not with apodictic certainty, I here state that said method "cannot be employed within philosophy with the same efficacy as it can within mathematics."

hand. In the second part of this paper, I will first address Kant's critical arguments which preclude treating a thing in nature like a geometric figure, as I interpret Wolff to do. Finally, I will take up why Kant thinks that the mathematical method cannot be used in natural philosophy with the same efficacy as it can within mathematics.

2. Wolff's Application of the Mathematical Method to Philosophy

On my interpretation, when Wolff applies the mathematical method to natural philosophy, he treats a thing in nature like a geometric figure.⁷ For, Wolff takes himself to be able to draw a universal conclusion from an experience of an individual thing in nature with apodictic certainty. However, Wolff admits that one experience of a thing in nature can only yield individual propositions. How then does Wolff derive a universal conclusion from experience of an individual in nature? On my view, there are several steps involved, and several different ways that Wolff's philosophical system allows him to use the mathematical method; however, I will only focus on two here. The first, as I see it, relies upon an additional principle, which I call the «Generalisation Principle».⁸ The Generalisation Principle states that a proposition about an individual event can be made general by including the condition under which the effect follows in the general proposition; Wolff presupposes, when employing this principle, that under the same conditions, the same

7 There have been a number of excellent discussions of Wolff's mathematical method, see, for example: CORR A. 1972, 324-329; ENGFER 1982, 48-61; DUNLOP 2014, 663-668; GOMEZ TUTOR 2004. Mine sets itself apart by comparing its use in mathematics to philosophy by focusing on the mathematical demonstration, see FRKETICH (unpublished manuscript).

8 FRKETICH (unpublished manuscript).

effect will always follow from the same cause.⁹ The second is that Wolff connects a property to an essence in a demonstration such that it must be a property of all things of that kind. In this section, I will sketch Wolff's example of how he applies the mathematical method to natural philosophy to arrive at apodictically certain conclusions about things in nature.

In both mathematics and natural philosophy, Wolff employs the mathematical method to discover a subset of «the constant» (*das Beständige*) properties, or properties that make up the essence of a thing.¹⁰ Wolff splits the constant properties into two groups: those which are not caused by one another, and those which follow from the first group.¹¹ The first group consists of the properties which are traditionally thought of as essential properties, namely, those properties which are always clearly present in a thing, for example, that a human being is rational. However, Wolff includes the second subset in his definition of an essence because these properties necessarily follow from the first and will always show themselves under the correct circumstances, for example, that a human being is capable of doing philosophy. They are what I will here call «essential dispositional properties». The mathematical method, in the example I will shortly investigate, serves to discover essential dispositional properties of the thing under investigation.¹²

9 See KU § 35; GL, Ch. 3, § 5. Wolff does not explicitly state that what I am calling the Generalisation Principle is that which allows for a thing in nature to be treated like a geometric figure in the mathematical method. Rather, Wolff simply states that the mathematical method uses this principle, as I have described it, without explaining why or how (KU § 35). I have assigned this principle this central role on the basis of the concrete examples discussed in this paper.

10 GL, Ch. 1, § 42.

11 *Ibid.*, § 48.

12 It may seem strange to call a property of a geometric figure, like the property that all internal angles of a triangle are equal to 180 degrees, an «essential dispositional property». Indeed, this description I assign to it may best fit things of nature, but Wolff's technical definition also fits geometric figures. For, properties like being a space en-

How does this work when the mathematical method is applied to philosophy? Wolff provides an example of how he applies the mathematical method to philosophy in his *German Logic*, chapter 4, § 25. In this example, he aims to prove the general proposition «that air has an elastic force».¹³ In order to prove this, he first conducts a scientific experiment with a sample of air sealed in a bladder. He places the air in a controlled environment and removes all of the air surrounding the bladder. In this example, while the individual sample of air fulfills the same role as the drawn triangle in the mathematical example, the scientific experiment fulfills the same role as the addition of convenient lines to the triangle.¹⁴ Once the surrounding air is removed, Wolff notices that the air in the bladder expands. He then employs this intuitive information from the scientific experiment to prove the general proposition that air has an elastic force in a demonstration with apodictic certainty.

Wolff is aware that the experience of the sample of air procures an individual proposition.¹⁵ Nonetheless, he proves a universal proposition, with apodictic certainty, on its basis. On my interpretation, in a first step, he employs the Generalisation Principle to do so. For example, one proposition,

closed by three straight lines comprise the subset of essential properties which are not caused by one another. The property that all internal angles are equal to 180 degrees then follows necessarily from this first subset, but can only be proved under the correct circumstances, that is, when a line is drawn at the apex of the triangle parallel to its base (in order to reveal alternate angles between parallel lines), and when the correct principles are used within the demonstration (such as, the principle that all alternate angles between parallel lines are equal).

13 GL, Ch. 4, § 25.

14 'Convenient lines' here refer to the preparation of the drawn geometric figure. See the first paragraph of this paper, in which I provide the example of the geometrician adding a line at the apex of the triangle, parallel to its base, in order to prove the proposition that all internal angles of a triangle equal 180 degrees.

15 KU § 34.

which I interpret to be universal, and which is included in the demonstration that Wolff uses to prove the above enunciated proposition, is: «air expands the bladder, upon removing the resistance».¹⁶ This proposition is taken from experience of the exhibited sample of air as it behaves in the scientific experiment. On my view, this proposition must be universal because it is used in a syllogism to prove a general proposition. As I understand it, Wolff takes himself to be able to arrive at this universal proposition from an individual experience because this proposition includes the condition, namely «upon removing the resistance», under which the specific effect follows, namely, that «air expands the bladder». In other words, this proposition has been made universal, from an individual proposition gleaned from one experience, by the Generalisation Principle.¹⁷ This proposition, in turn, contributes to proving the minor premise of the next syllogism that I will discuss, namely, the syllogism in which Wolff takes himself to prove the proposition he set out to prove: that air has an elastic force.

The conclusion of the first syllogism of the demonstration Wolff provides, in his example of the mathematical method as it is applied to philosophy, is the general proposition he set out to prove. This syllogism is as follows:

16 For the full demonstration, see GL, Ch. 4, § 25. I will not provide the full demonstration here, since my intention is simply to explain one demand that the mathematical method, as it is applied to natural philosophy, makes on metaphysics, rather than to provide an extensive discussion of the mathematical method itself.

17 Wolff discusses several other «arts» and rules of logic which he employs in the mathematical method, for example, the «art of invention» (GL, Ch. 4, § 24), «figurative knowledge» (GM, § 324), «the art of the combination of signs» (GL, Ch. 4, § 22), enthymemes (GL, Ch. 4, § 17; GL, Ch. 4, § 21), etc. However, I will not discuss these arts, here, as they are not pertinent to the topic at hand.

1. That which begins to expand, on removing the resistance, has an expansive or elastic force
2. Air begins to expand, on removing the resistance¹⁸
3. Therefore, air has an expansive force¹⁹

The major and minor premises are both proved by subsequent syllogisms of the demonstration which I will not discuss in full in this paper. In this syllogism, as I understand it, Wolff connects the property of having an expansive force, or being elastic, to the essence of air; that is, he identifies it as an essential dispositional property of air. In so doing, he takes himself to prove that elasticity is a necessary property of every instance of air.

In this section, I briefly presented Wolff's example of how he uses the mathematical method in natural philosophy. I explained that this example involves the following: (1) the Generalisation Principle, and (2) an essential dispositional property. The questions I seek to answer now are what gives Wolff licence to employ the Generalisation Principle and to identify a necessary property of an essence in a demonstration? As I see it, the answer to both of these questions is that Wolff views nature to exhibit rigid regularities and

18 R. Lanier Anderson appears to reconstruct this syllogism such that its minor premise is singular, and thus concludes that the syllogism is invalid (ANDERSON 2015, 92). On my interpretation, this minor premise is general as I interpret it to be the general conclusion of another syllogism provided by Wolff which, I argue, employs the Generalisation Principle in order to transform the empirical data gleaned from the scientific experience into a general proposition. Anderson likewise recognises that Wolff believes that there is a rule which allows him to arrive at a general proposition from an individual experience, but Anderson does not use this rule to render the syllogism valid, as I do (ANDERSON 2015, 93), see FRKETICH (unpublished manuscript). Anderson and I, however, agree that Wolff's syllogism would not reassure any philosophers convinced by Hume's problem of induction.

19 This syllogism is taken verbatim from Wolff's GL, Ch. 4, § 25. I have added the premise numbers.

that this view of nature is grounded in Wolff's modal metaphysics.

3. Wolff's Modal Metaphysics: the General Characteristics of a Being

On Wolff's view, nature exhibits regularities which are explained by rigid essences and causal connections. This view of nature is grounded in his metaphysical principles. Wolff's general picture of metaphysics, as it pertains to the subject at hand, can be summarised as follows. God thinks the essences of all possible worlds, which consist in possible things and the causal networks between them.²⁰ God creates the best of all possible worlds, our world, by actualising its essence.²¹ Actuality is that which differentiates our world, and all of the things existing therein, from the infinite number of other possible worlds and the possible things that populate them. Thus, the metaphysical principles of all possible worlds (the actual world included) are the same. However, for Wolff, there is an epistemological constraint which prevents finite human beings from knowing any possible things in any possible world other than the actual world.²² Humans can know the metaphysical principles of all possible worlds by doing philosophy, but can only know the actual properties of things in the actual world.

In the principles comprising the first section of his *German Metaphysics*,

20 GM, § 952.

21 *Ibid.*, § 951.

22 For Wolff, a human knower cannot invent a concept of a possible thing *a priori*, for example, the concept of a unicorn. For, a human knower can only be sure that the concept of a thing is possible by experiencing the thing in reality (or proving it in a demonstration on the basis of that which follows from it). This has to do with the fact that a possible thing must fit into the causal network of its possible world, and the finite reason of a human knower is incapable of establishing whether this is the case. Since knowing the possible causal networks of a possible world is beyond the abilities of a finite mind, Wolff restricts human knowledge of any possible thing to knowing things of the actual world. See DUNLOP 2013, 467.

Wolff employs modal language to describe what a thing in general is. His «modal metaphysics», as they pertain to the topic at hand, can be reconstructed from these principles. For the purpose of explaining the metaphysical foundation Wolff needs in order to justify his use of the mathematical method in natural philosophy, I will focus on Wolff's principles about the following: the possible, a thing, an essence, and the necessary. Because I focus on Wolff's modal metaphysics insofar as it supports my interpretation of his mathematical method, I build the abovementioned epistemological constraint into the principles as I develop them.²³ This will become evident in my discussion of the principle of sufficient reason (PSR) and of the definition of essence.

It is important to note that Wolff's metaphysical principles regarding an essence and the necessary follow upon the PSR in Wolff's deduction of the GM. While Wolff defines «essence» and the «necessary» in terms of the principle of non-contradiction (POC), it is integral to the mathematical method as it is used in philosophy to identify the sufficient reason of a property in the thing (thus identifying the property as forming a part of its essence). For example, in the two steps, as discussed above, one identifies the ground, or cause, of an effect. While the Generalisation Principle involves identifying a ground external to the thing in question,²⁴ connecting a property to its essence in the demonstration involves connecting a property with the ground internal to the thing in question. I will not provide a complete reconstruction of Wolff's modal metaphysics, but rather one that focuses on explaining why Wolff is able to employ these two steps when he applies the mathematical

²³ For a discussion of metaphysical possibility in itself, see STANG 2016, 15.

²⁴ At least this is the case in the example I have discussed of air expanding, when the resistance is removed in a scientific experiment. However, the principle would also work with a ground that is internal to the thing in question, see KU, § 35.

method to philosophy. I will conclude that although Wolff is generally committed to an S5 modal logic, these two steps involve modal propositions which are even stronger than the characteristic S5-formula ($\Diamond p \rightarrow \Box \Diamond p$). It is precisely these instances which, on my view, allow Wolff to arrive at necessary propositions about things in nature from the experience of one thing.

I stated above that the mathematical method is used to draw out essential dispositional properties of the object of investigation. In order to understand what an essence is, for Wolff, one first has to understand what «a possible» and «a thing» are. In the following passage, Wolff explains the possible by way of the impossible, on the basis of the POC:

Because nothing can be and not be at the same time, one knows that something is impossible, if it contradicts that of which we already know that it is or can be. [...] From which one sees that the possible is that which does not contain anything contradictory in itself.²⁵

According to the POC, nothing can both be and not be at the same time, as Wolff states in this passage. Wolff continues to explain that something is impossible if it contradicts something we already know to be the case or something that we experience is the case. We know, for example, on the basis of previous scientific investigations, that cats are self-moving. Therefore, to say that «a cat is not self-moving» is impossible because it contradicts our knowledge of the species «cat». I know, from experience, that a student wearing a blue T-shirt is sitting in the courtyard at this moment. Therefore, on the basis of the POC, I know that a proposition which predicates an opposing accident-

²⁵ GM, § 12. All translations of quotations from texts which have not been translated are mine.

al attribute of a subject at the same time, as for example, the proposition that this same student wearing the blue T-shirt is located in a classroom at this moment, is impossible.²⁶ Thus, the possible, is a concept containing properties which do not contradict one another.

Wolff's definition of a thing is: «everything that can be, whether actual or not».²⁷ This definition refers to possibility in that it contains the phrase «everything that can be». That which «can be» is the possible, namely, a concept comprised of a set of properties which do not contradict one another. In fact, being possible is the only criterion for the concept of a thing. For, Wolff explicitly states that something does not have to be actual, that is, exist in our world, in order to be a thing.²⁸ Accordingly, the definition of a thing is merely that it be possible.

While the above principles were derived solely from the POC, the following also follow upon the PSR. Wolff enunciates the PSR as follows:

Everything that is must (*muß*) have its sufficient reason (*zureichenden Grund*) as to why it is.²⁹

What constitutes a «sufficient reason» of a thing? A «reason» is that through which one can understand why a thing is.³⁰ As Wolff explains, if thing A con-

²⁶ An anonymous reviewer of *Noctua* asks what the status of a concept whose properties contradict each other, but do not contradict anything known or experienced by a human knower thus far might be. I agree with the reviewer's diagnosis, that such a concept is, by definition, impossible. However, it is simply not yet known to be impossible by any human knower.

²⁷ GM, § 16.

²⁸ For Wolff, only God knows all possible things (many of which do not exist in the actual world) (GM, § 953). A human knower can neither confirm nor deny the possibility of things in possible worlds which are not connected to the actual world, see footnote 21.

²⁹ *Ibid.*, § 30.

³⁰ *Ibid.*, § 29.

tains something in itself, from which one can understand why B is (where B can either be something in A or external to A), then A is the reason as to why B is.³¹ In this relation, thing A is the actual «cause» of B. The explanation as to why something in A causes B is the «reason». Accordingly, it seems that while «cause» refers to an actual thing in the world, a «reason» pertains to knowledge claims about the relation between cause and effect. The goal of philosophising is to identify the reason as to why something is.³²

Although many would not accept that the proposition «if A (where A is the sufficient condition of B), then B» follows directly from the PSR, it seems to me that Wolff must.³³ For, Wolff accepts the Generalisation Principle, as we have seen, and the Generalisation Principle allows one to make an individual proposition general so long as one includes the condition, or sufficient cause, of the effect expressed in the proposition. Such a proposition is nothing more than a hypothetical proposition. Thus, on my view, Wolff can only take this principle to work because it connects an effect to its sufficient cause in a proposition; and so long as this is the case, then the proposition is necessary, it will always hold.

Wolff's concept of an essence is the sufficient reason as to why a thing has the properties it has; it is the cause of the thing's having the properties it has.³⁴ Therefore, if one wants to explain why a thing has the properties it has in a philosophical investigation, one need only connect them to its essence in a demonstration. Along with the essence of a thing being the ground for why

31 *Ibid.*

32 WOLFF 1963, § 31.

33 Note that the «sufficient condition» cannot be «rain» alone, that is, it does not necessarily follow from the antecedent «rain» that the rock will become wet. Rather, the condition that the rock is sitting in the rain (unprotected from the rain by any impediments) must be contained within the antecedent for it to be a sufficient condition.

34 GM, § 33.

it has the properties it has, an essence is necessary, as Wolff explains in the following:

Since the possible is necessary in itself, and the essence of a thing consists therein that it is possible in a specific way, then the essence is necessary.³⁵

In this passage, Wolff clearly states that the essence of a thing is necessary.³⁶ For, an essence is the «in itself» of the possible; it consists in the essential and non-contradictory properties of a thing. An essence is necessary, as Wolff states in this passage, because the «in itself» of the possible is «necessary». This is the case because its opposite contains a contradiction; its opposite is impossible.³⁷ Recall that the first class of essential attributes (those that are not derived from one another) are the necessary cause of the second class of essential attributes, the essential dispositional properties, because the latter follow necessarily from the former. Once God actualises our world, all essential properties of every actualised thing are also actualised, and thus, exist in the actual world.³⁸ The inessential properties which can be attributed to the thing are limited by the thing's essence (and the POC); a thing can only take on cer-

35 *Ibid.*, § 38.

36 «Necessity» today is commonly used to refer to something that is the case in all possible worlds. Even if Wolff held this interpretation of necessity, on my interpretation, human knowers cannot be said to gain necessary knowledge, under this description of 'necessity', by way of a demonstration in the Wolff's version of the mathematical method. For, due to the epistemological constraint Wolff places on human knowers, the only possible worlds that a human knower can speak of within modal metaphysics are the possible worlds that one has access to by way of the actual world.

37 This shows that the definition of an essence, including its necessity, is derived from the POC. See STANG 2016, 18. Thus, while the properties comprising an essence are derived from the POC, the fact that the essence is the reason as to why a thing in the world has the properties it has, for Wolff, is derived from the PSR, on my understanding.

38 Although God did not have to create our world, and thus, the actuality of our world is contingent, the essences are still necessary because they are determined on the basis of the POC.

tain inessential properties that do not contradict the essential properties. However, a thing will not take on all of its inessential properties. For example, I may never become sunburnt, although being sunburnt is a possible inessential property that I could take on. Thus, while all essential properties, including essential dispositional properties, follow necessarily from the essence of the thing, inessential properties follow contingently from the essence of the thing.

From what has been said, thus far, a clear picture of Wolff's modal metaphysics, as it pertains to the topic at hand, can be reconstructed. For our purposes, the following propositions determine the language of Wolff's modal metaphysics:

$$p \rightarrow \diamond p$$

$$\diamond p \rightarrow \square \diamond p$$

\square [for some property m and some sufficient cause of m , namely, c , p expresses that if c then $m' \rightarrow (\diamond p \rightarrow \square p)$]

\square [for some object o and some essential attribute α , p expresses that o has $\alpha' \rightarrow (\diamond p \rightarrow \square p)$]

The first proposition states that if p is the case, then p is possible. For example, from my experience that grass is green, the proposition «grass is green» is likewise possible. The second proposition states that if p is possible, then p is necessarily possible. This is the proposition which distinguishes an S5 modal system from weaker modal systems. The final two propositions, which follow upon the PSR, yield an even stronger rule for Wolff's modal

system, on my view. The third proposition provides the underpinning for the Generalisation Principle and expresses the following: for any proposition which states that if the sufficient cause of m is the case, then m is also the case, that if that proposition is possible, then it is also necessary. For example, because I know that it is possible from experience that if a rock is sitting outside and if it rains, then the rock will become wet, then I also know that this proposition is necessary. The final proposition combines Wolff's account of an essence with the PSR. It states that it is necessarily the case that for any proposition which states that a thing has a certain essential attribute, that if that proposition is possible, then that proposition is also necessary. For example, because I already know (from experience) that it is possible that a human being is rational, and that being rational is an essential attribute of a human being, I can conclude that it is necessary that a human being is rational. On my view, these four propositions form the foundation for treating a thing in nature like a geometric figure, as Wolff does when he applies the mathematical method to philosophy.

On my interpretation, Wolff's application of the mathematical method to natural philosophy depends on his modal metaphysics in the following manner. On my view, the Generalisation Principle is used to form general propositions to be used as premises in a scientific demonstration about information gleaned from the experience of one thing in nature. In the example I discussed, this step involves connecting an event with its sufficient cause external to it. The ultimate goal of the mathematical method, as Wolff applies it to philosophy, is to show that the ground of a property is contained within the thing in question. Take, for example, the first syllogism of Wolff's example in which he applies the mathematical method to natural philosophy

(which relies on subsequent syllogisms in order to prove its premises), and which runs as follows:

4. That which begins to expand, on removing the resistance, has an expansive or elastic force
5. Air begins to expand, on removing the resistance
6. Therefore, air has an expansive force³⁹

In this syllogism, Wolff connects the property of having an elastic force to the concept of air. Ultimately, as I see it, with this syllogism, Wolff takes himself to have proved that elasticity is a property belonging to the essence of air, that is, that elasticity is an essential dispositional property of air, and, therefore, elasticity is a property of every instance of air. On the basis of Wolff's modal metaphysics, as I have reconstructed it, as soon as one connects an individual property to the essence of a thing, one has shown that it is a part of the necessary cause of all things of that kind. Since an essence is necessary, as discussed, the properties which make up its essence are also necessary. This also holds for essential dispositional properties, which are a subset of the constant, or essential, properties for Wolff. Thus, to summarise, on my interpretation, the goal of the demonstration of the mathematical method, as applied to natural philosophy, is to demonstrate the origin of the property. Once the demonstration has shown that the property has its source in the thing, it has proved, as per Wolff's modal metaphysics, that said property is necessarily the case for all things of that type. Thus, in the mathematical

³⁹ This syllogism is taken verbatim from Wolff's GL, Ch. 4, § 25. I have added the premise numbers.

method, as Wolff applies it to natural philosophy, an individual thing in the world can stand for the universal on the basis of his modal metaphysics.

4. Kant's Arguments against Accessing the Essence of a Thing in Experience

As we saw above, Wolff claims that one can learn what the essence of a thing is by means of experience. An «essence», for Wolff, is something ontologically distinct from human experience. In his *Transcendental Aesthetic*, by contrast, Kant argues that experience never provides insight into the so-called thing in itself (namely, that which is ontologically distinct from human experience). Kant's arguments on this score preclude Wolff's application of the mathematical method to natural philosophy within critical philosophy.

In the following passage, Kant criticises Leibniz and Wolff for thinking that we can know the constitution of things in themselves, albeit indistinctly, through sensibility:

The Leibnizian-Wolffian philosophy has therefore directed all investigations of the nature and origin of our cognitions to an entirely unjust point of view in considering the distinction between sensibility and the intellectual as merely logical, since it is obviously transcendental, and does not concern merely the form of distinctness or indistinctness, but its origin and content, so that through sensibility we do not cognize the constitution [*Beschaffenheit*] of things in themselves merely indistinctly, but rather not at all.⁴⁰

Kant claims that to Leibniz and Wolff, the difference between sensible images and the constitution of a thing in itself is a difference of degree, rather than a difference of kind. In this passage, by contrast, Kant argues that the difference

40 A44/B61-62.

is rather transcendental. That is, it pertains to two distinct modes of cognition: sensible and intellectual. While the sensible pertains to experience, the intellectual pertains to *a priori* cognition. As distinct modes of cognition, they cannot come to be known in the same way, for Kant. Sensible cognition can only be known by experience and intellectual cognition (the constitution of things in themselves) can only be known *a priori*.

I interpret «the constitution of things in themselves», in the above passage, to pertain to any *a priori* thing in itself which can only be known by way of the intellect. Thus, it could refer to an essence or any other *a priori* thing, for example, God, monads, the soul, etc. Because an essence, on Wolff's terms, is a thing, the properties of which we can intuit, and which we can come to have *a priori* knowledge of by way of the intellect, I interpret this passage to apply to Wolff's concept of essences.

As I see it, Kant's argument in the above quoted passage amounts to the claim that there is an equivocation in such concepts as, for example, Wolff's concept of essence. On the one hand, «essence» refers to something external to spatial-temporal appearances in that, for Wolff, it is the *a priori* concept of a thing. On the other hand, «essence» refers to the sum total of properties that human beings always experience (or can come to experience, in the case of essential dispositional properties) in a particular type of thing. The equivocation Kant seems to refer to is that the former is what Heidemann calls a «non-empirical thing in itself» and the latter is an «empirical thing in itself».⁴¹ That is, the former does not stand under the subjective conditions of sensibility, namely, space and time; the latter, by contrast, does. Kant's point seems to be that while a non-empirical thing in itself is not knowable by way of experi-

41 HEIDEMANN 2011, 199.

ence, an empirical thing in itself is. As we saw above, Wolff thinks that both aspects of essences or both types of «things in themselves» are knowable by way of experience (albeit the former only by way of applying reason to experiential data). Thus, Kant's criticism applied to Wolff's concept of essence amounts to Wolff's slipping into what Kant views to be an unknowable description of an essence from a knowable one.

Wolff's application of the mathematical method to natural philosophy presupposes the view that there are rigid universal essences of things in nature that one can, in principle, come to know. These essences are both the *a priori* ground as to why things in nature have the constant properties they have and consist in a specific set of essential properties gleaned from experience. The mathematical method combines experience of things in nature (sensibility) with demonstrations (reason) such that one proves that a property experienced has its ground in the thing in question. Kant's view of what can be known by experience, by contrast, already precludes the claim that there are universal essences, which are the grounds of things in nature, and to which a human knower can have access in experience. Accordingly, it comes as no surprise that he argues that one cannot employ the mathematical method within philosophy, as I will now discuss.

5. Kant's Arguments against the Use of the Mathematical Method in Philosophy

Kant argues against the use of the mathematical method within philosophy on the grounds that doing philosophy and doing mathematics involve two distinct types of cognition. The method suitable to a type of cognition follows

from the explanation of what each type of cognition consists in, for Kant.⁴² Since the types of cognition are distinct and since the method follows from the type of cognition, the methods suitable to each are also distinct. I will now work through Kant's arguments against applying the mathematical method to natural philosophy in more detail.

For Kant, mathematical cognition is «rational cognition from the construction of concepts».⁴³ To construct a concept is to exhibit it in *a priori* intuition, according to Kant, for example, to exhibit a triangle (as is done in the mathematical method). Construction abstracts from particular qualities of the individual triangle, for example, being an equilateral or a right angle triangle, and focuses merely on its form: being a space enclosed by three straight lines.⁴⁴ The exhibited concept can only pertain to the *a priori* forms of space and time, for the concept must be capable of being exhibited in *a priori* intuition. Since only concepts of quantity can be represented in *a priori* intuition,⁴⁵ according to Kant, the exhibited concept must pertain to quantity. The result of construction is a geometric figure in *a priori* intuition. Since this figure is an individual which is exhibited according to its form contained in its concept, it is an individual which perfectly represents its concept. Accordingly, for Kant, the concept can be considered in the particular and the exhibited figure is a particular which represents the universal.⁴⁶

Philosophical cognition, by contrast, is «rational cognition from con-

42 A726/B754-A727/B755.

43 A713/B741.

44 See SHABEL 2003, 93. There are, of course, cases where one might investigate particular types of triangles, for example, equilateral or right angled triangles. In this case, one would not abstract from all particular qualities, but would maintain the qualities pertaining to the species in question.

45 A714/B742.

46 *Ibid.*

cepts». ⁴⁷ That is, philosophical cognition is discursive; it must be mediated by concepts. In contrast to mathematical cognition, which considers the universal in the particular, the discursive nature of philosophical cognition means that it «considers the particular only in the universal». ⁴⁸ *A posteriori* philosophical cognition is bound to *a posteriori* intuition, for Kant. Accordingly, it investigates qualities because qualities are bound to reality given in experience. ⁴⁹ With this claim, Kant already precludes the use of an *a priori* demonstration to prove any *a posteriori* property of a thing to be the case of any instance of its kind, as Wolff does in his example of the elasticity of air. For, in order for the property of a thing to be proved of all instances of its kind in an *a priori* demonstration, the concept of the thing would have to be constructible, as was seen with mathematical cognition.

Kant illustrates the methods proper to mathematical and philosophical cognition respectively when he compares how a philosopher and a mathematician would proceed if they were asked to prove that the sum of the internal angles of a triangle is equal to 180 degrees. ⁵⁰ While the mathematician would construct a perfect model of a triangle, adding lines to it such that, for example, alternate internal angles between parallel lines would be visible, as

47 A713/B741.

48 A714/B742. On Kant's view, philosophical cognition refers either to *a posteriori* intuition (A714-715/B742-743), in which case, the cognition is *a posteriori*, or to an object in possible intuition, in which case, the cognition is *a priori* (A719/B747). If a philosophical cognition is *a priori*, as Kant briefly explains in this section, then the transcendental conditions of an object in possible intuition are investigated. An important part of this investigation involves delineating the *a priori* concepts that do not contain an *a priori* intuition (that is, concepts that cannot be constructed), but rather only contain a rule of synthesis of possible intuitions (namely, the categories) (A719/B747). Kant employs *a priori* philosophical cognition in, for example, the Transcendental Deduction, in order to ground the necessity of the categories *a priori*. In this paper, however, I focus on *a posteriori* philosophical cognition.

49 A714-715/B742-743.

50 A716/B744.

discussed above, the philosopher (who is, in Kant's example, only able to employ philosophical cognition) would only be able to analyse the concept of a triangle. In this way, the mathematician would be able to prove the proposition in question in the mathematical method, with recourse to the individual triangle, as described above. The philosopher, by contrast, would only arrive at more distinct concepts of straight line, angle, and enclosing a space. Kant's illustration tells us that the mathematician is able to add new properties to the concept in question, *a priori*. By contrast, the philosopher is only able to analyse the concept in question, *a priori*. Accordingly, in the *a priori* methods suitable to both types of cognition, only the mathematician is able to draw out properties which follow necessarily from the definition of the thing in question. The philosopher, by contrast, cannot do so *a priori* and, therefore, cannot do so with apodictic certainty.⁵¹

Kant further argues that the mathematical method involves definitions, axioms, and demonstrations, all of which depend upon the constructability of mathematical cognition. I will here just briefly address what Kant says about definitions and demonstrations, since they are most relevant to the topic at

⁵¹ On my interpretation of this example, in contrasting what Kant takes to be the *a priori* methods proper to mathematical and philosophical cognition, he shows that while the mathematical method is able to add new properties not previously contained in the concept of the thing under investigation, the method proper to philosophy is not able to do so. With this example, Kant shows that because a philosophical cognition cannot be constructed, the philosopher cannot achieve what the mathematician can. How does this discussion fit with my interpretation of Kant's criticisms of Wolff? On my view, it implicitly shows that, by Kant's lights, Wolff actually uses the method of the mathematician in philosophy, that is, Wolff takes himself to exhibit or construct a thing in nature by way of a scientific experiment in the same way as the mathematician constructs a mathematical cognition. Thus, I do not take Kant to insinuate that Wolff uses analysis when he does natural philosophy. Rather, I take him to provide us with the grounds to see that, on Kant's view, Wolff actually illicitly uses the method proper to mathematics, in natural philosophy, but that this is not actually a method available to the philosopher.

hand. First, Kant argues against using the order of explanation of the mathematicians when he argues that a philosopher cannot imitate mathematicians by beginning with definitions.⁵² Definitions, for Wolff, refer either to nominal or real definitions, the latter of which pertains to the essence of a real thing, as per the example of air being elastic discussed above.⁵³ Regarding definitions of empirical concepts, Kant argues that they cannot be proved, for otherwise they would not be able to stand at the beginning of a demonstration.⁵⁴ However, as we saw, Wolff takes himself to prove that elasticity is an essential property of air. Further, Kant argues that empirical definitions cannot be exhaustive, for it is impossible to know the exhaustive concept of a thing given in experience.⁵⁵ Since essential properties also include essential dispositional properties, which only reveal themselves under certain circumstances, for Wolff, it is impossible to ensure that all essential properties have been discovered. Finally, Kant argues that one cannot be sure that one has maintained the definition within its boundaries, that is, that one has included only the necessary properties in one's concept.⁵⁶ For, Kant argues that while one person will include certain properties in the concept, like the malleability of gold, others will not. Kant concludes from these arguments that empirical concepts cannot be defined, in the strict sense of being self-evident, exhaustive, and within proper boundaries, but rather can only be explicated, in the sense of having definitions of words suitable for picking out their correct instances.⁵⁷

Kant expands on his claim that demonstrations rely on mathematical

52 A730/B758.

53 KU § 2.

54 A727/B755.

55 *Ibid.*

56 *Ibid.*

57 A730/B758.

cognition by elaborating on the only type of experience a philosophical cognition can offer to a demonstration. In this context, Kant states that «experience may well teach us what is, but not that it could not be otherwise».⁵⁸ As I understand this passage, Kant is saying that nature only show us facts by way of the senses; it does not give us any sort of guarantee that it exhibits regularities or that any thing in nature is the way it is with necessity. Accordingly, as Kant puts it, it does not show us that it could not be otherwise. Or, to apply this to the discussion about essences at hand, experience does not provide us with material from which to adduce the non-empirical thing in itself.

6. Conclusion

As I have argued, Wolff employs information from one thing in nature to arrive at universal and apodictically certain conclusions in the mathematical method. In this paper, I have presented Wolff's modal metaphysics which provide a foundation for Wolff's view that essences and causal connections in nature are rigid, and which, in turn, allows for him to have a thing in nature stand for the universal within the mathematical method.

Against this view, as I have discussed, Kant argues that a human knower cannot access an essence under the description of a thing independent of the human forms of space and time by way of experience. For Kant, such an essence amounts to some X which is external to all possible experience, a non-empirical thing in itself about which we can know nothing. Accordingly, for Kant, such a description of an essence cannot be relied upon in order to be able to employ the mathematical method in natural philosophy with apodictic certainty. Furthermore, Kant argues that experience cannot teach us that it

⁵⁸ A734/B762.

could not be otherwise, that it cannot give us guarantees. With this claim, as well as his sharp distinction between mathematical and philosophical cognition, Kant argues against Wolff's metaphysical principles which allow for Wolff to demonstrate rigid essences and causal connections in nature on the basis of one experience.⁵⁹

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