

## Scientific Knowledge and the Metaphysics of Experience: The Debate in Early Modern Aristotelianism

### *Abstract*

*Early modern commentary on Aristotle's metaphysics contains a lively debate on whether experience is 'rational', so that it may count as 'proto-knowledge', or whether experience is 'non-rational', so that experience must be regarded as a primarily perceptual process. If experience is just a repetitive apprehension of sensory contents, the connection of terms in a scientific proposition can be known without any experiential input, as the 'non-rational' Scotists state. 'Rational' Thomists believe that all principles of scientific knowledge must rely on experiential data, because experience consists in an apprehension of facts rather than objects. And it is only apprehension of facts that can justify knowledge of principles. In this context, the role of mathematical knowledge is special, because it is self-evident. So Thomists must either show that mathematical principles do rely on experience, or that they do not express knowledge claims.*

In the first chapter of the first book of *Met.*, Aristotle introduces the notion of *empeireia* – a term that is usually translated as 'experience' (or, in Latin, *experientia*). Contemporary readers should be warned that Aristotle's notion of experience is quite alien to us. It apparently consists just in repeated perceptions of the same (kind of) objects.<sup>1</sup> Having such repeated perceptions somehow bridges the gap between non-rational perceptual activities of the mind and rational cognitive activities (in *Met.* I.1 art and science).<sup>2</sup>

It has been noted that how exactly Aristotle conceives this mediating function of experience is not easy to discern in his texts.<sup>3</sup> The intention of what follows is, however, not primarily exegetical, but rather based on the presumption that early modern commentary on the role of experience in *Met.* I.1 is relevant in its own right regardless of the question how well it matches with Aristotle's writings. The different readings developed by Thomists (Javellus, Cajetan, Fonseca) and Scotists (Antonius Andreas, Suárez) highlight an important philosophical distinction and not just a philological difference in how to read *Met.* I.1. Their main disagreement concerns the question whether experience is indispensable for the acquisition of scientific knowledge or whether it is closer to perception in that it is no requirement for the acquisition of such knowledge. Closely related to this is the question whether Thomists are right in asserting that experience can be expressed in a proposition denoting a fact or whether the Scotist view should be preferred that experience is primarily experience of objects rather than facts about objects.<sup>4</sup>

The analysis of the concept of experience within early modern metaphysics is historiographically in a blind spot. Within the history of metaphysics, the primary concern is metaphysical knowledge. Metaphysical knowledge is undisputedly *a priori*, so experience is of lesser relevance. In the history of early modern natural science and natural philosophy, there does exist an intense interest in problems related to the role of experience in emerging natural sciences. But such research focuses on the role of experience in the solution of concrete problems rather than on theoretical aspects: the application of the concept of experience is more relevant than the concept itself.<sup>5</sup>

This paper will demonstrate that, strictly speaking, there is no such thing as a single theory of experience to be found among early modern Aristotelians. They disagreed on how to define experience, on the role it plays in the formation of concepts, the justification of propositions, and the acquisition of scientific knowledge (with an emphasis on mathematical knowledge). These differences can be subsumed under the following four questions:

1. What, if any, are the characteristic differences between perception and experience?
2. How do experience and the intellect cooperate in the formation of concepts and propositions?
3. What is the role of experience in the acquisition of scientific knowledge in general?
4. What is the role of experience in the acquisition of mathematical knowledge in particular?

### *Perception and Experience – Is there a Difference?*

The ‘non-rational’ camp in the early modern debate about the Aristotelian conception of experience is represented by the Scotist Antonius Andreas. Also known as *Doctor dulcifluus* or *Scotellus*, he was born in the Aragonese city of Tauste (cca. 1280) and seems to have died around 1320. He entered the Franciscan Order around 1295, studied first at the *studium generale* in Lérida, later in Paris with Duns Scotus himself.<sup>6</sup> Andreas’ position is included here, because it provides a reference point for early modern debates on the topic of experience.

For Andreas, there is no relevant difference between the epistemic roles of experience and sensation:

“[...] it is my first conclusion that in order to be aware of principles in a non-complex manner, i. e. to be aware of simple terms, sensitive or [my emphasis, S. H.-W.] experiential cognition is required”.<sup>7</sup>

Accordingly, his discussion of experience contains a lengthy digression on the exact interplay of internal and external senses in the process of knowing in order to explain how knowledge is based on input from them.<sup>8</sup>

Andreas’ Dominican adversary Chrysostomus Javellus argues against this view and embraces the ‘rational’ relevance of experience in the process of acquiring knowledge.<sup>9</sup> For Javellus, the perceptual input required for ‘apprehending’, i. e. grasping the content of concepts cannot be experiential (in this context he refers explicitly to Andreas’ stance):

It is asked [sc. by Scotists] whether the sensitive cognition which is required for the intellectual cognition of non-complex terms, should be called experiential. [...] Scotists, as can be seen in the first conclusion of q. 4 [sc. in] Antonius Andreas, hold that such a [sc. sensitive] cognition can be perceptual or experiential, and they do

not see any difference. However, a non-complex term, insofar as it is non-complex, is cognised by a non-complex cognition. The same is true for a complex term which is cognised by a complex [sc. cognition], so in the first case, there is no experience, properly speaking.<sup>10</sup>

The profound qualitative difference between sensation and experience mirrors the difference between non-complex and complex intellectual cognitions, i. e. the apprehension of simple terms and assent to conjunctions of terms (propositions).

Javellus explains this in some more detail. The input from the senses that is required for the apprehension of (the content of) terms is 'confused'. It conveys an awareness of how to apply a term to objects (awareness of the *quid nominis*), but no insight into essential properties of the objects falling under this term (awareness of the *quid rei*):

[...] non-complex cognition of terms, which is a requirement in order to cognise complex principles, is not a perfect awareness of the essence of the [sc. objects falling under the] terms, but rather a confused awareness that barely exceeds [sc. the kind of] cognition which must be presupposed for correct usage of the term.<sup>11</sup>

In contrast, experience is a form of complex sensitive cognition, because it is the cognition of a complex object:

In our [sc. the Thomist] way of arguing, take note that an experience is a complex sensitive cognition, because it collates many particulars. The philosopher says in the text [sc. Met. I.1] that an experience consists in the cognition that this herb has cured Socrates, and Calias, and many [sc. other] individuals. Therefore, it is manifestly clear that an experience is [sc. a form of] perceptual cognition that serves intellectual cognition insofar as it [sc. experience] is complex, [sc. that is] cognition of principles and conclusions.<sup>12</sup>

Such a complex sense-based cognition is a necessary prerequisite for assent to a given propositional content, because this assent to a propositional content presupposes more than just an awareness of the content of the concepts contained in that proposition.

It is proven that such awareness [sc. experience] is not merely useful, but necessary [sc. for intellectual cognition of propositions]. We must presuppose something that moves and determines the intellect to form [sc. precisely] this general proposition. [...] This something that is capable to move and determine the intellect cannot be non-complex awareness of terms [sc. perception], because its lack of complexity is inapt to determine the intellect to this complex [sc. of terms. i. e. proposition] rather than to another.<sup>13</sup>

In other words, mere awareness of the content of simple terms, even if it is mediated by input from the senses, does not render us capable to give or withhold assent to the connection of these terms in a proposition. For this, we need input from the senses that does not merely relate to the objects of the respective simple terms. It is the relation of these objects that we must be

sensitively aware of. So in order to give or withhold assent to propositions, we must have awareness of the *fact* stated in the proposition, insofar as this awareness is mediated by the senses. This form of sensitive awareness justifies knowledge that objects really are connected in the way the proposition states:

As experience shows, we do not know how to form a complex principle, even when being aware of the terms, unless we perceive that these terms are connected to one another in reality.<sup>14</sup>

Experience, however, is not the only requirement. In order to acquire scientific knowledge, the intellect has to play its role as well. Here again, Andreas' and Javellus' positions are incompatible.

### *The Relation of Experience and the Intellect*

For Andreas, the intellect on its own (*propria virtute*) is capable of assenting to the connection of terms in a principle due to its natural light (*lumen naturale*). He bases this claim on the authority of the Philosopher himself who states that principles are known through their terms.<sup>15</sup>

In order to have a complex awareness of principles sensitive or experiential cognition is not necessary per se. [...] For the intellect itself can compose or divide concepts on its own, after it has conceived them. Complex concepts [sc. propositions] can be known to be true, if they are a first principle due to the natural light of the intellect, because we know principles insofar as we know [sc. their] terms. Therefore, sensitive or experiential cognition is not per se necessary in order to acquire such complex cognition of principles.<sup>16</sup>

The natural light is the ability to determine the truth of a given proposition that should serve as a principle based only on the content of the concepts involved. According to the Thomist Cajetan, this is unacceptable. Concepts can be joined in different combinations, we may e. g. assert or deny a connection between terms of a principle. Unless experiential input is available, there is no reason to presume that one of these combinations is preferable to the others:

This is confirmed: it is evident that identical terms can be composed in different ways. There will be no decisive reason why the intellect grasps one complex cognition (which is called a principle) of these terms rather than another, unless experiential cognition determines the intellect accordingly.<sup>17</sup>

So for Thomists, the Scotist doctrine of 'natural light' is vacuous, because it does not explain or justify the truth of the principles we accept. Javellus agrees with his teacher Cajetan. The Scotist Andreas must presume that the intellect is a *potentia absoluta*: It is entirely free in its decision to give or withhold assent to a given propositional content. Such a *potentia absoluta* is not bound by any general rules of operation (then it would be a *potentia ordinata*). But even as a *potentia absoluta*, the intellect still has to be a *potentia determinata*:

[...] I negate that the intellect, having grasped the content of simple terms, is capable on its own to assert or deny a given determinate complex [sc. i. e. a proposition]: It is not true that potencies are free to choose whether to assert or to deny [sc. a determinate complex],

if they have not been determined in such a way that truth is evident for them – i. e. [sc. the intellect] is assisted and determined by repeated complex sensitive cognition that is called experience.<sup>18</sup>

Javellus concedes that the intellect may not be bound by general rules and therefore really be a *potentia absoluta*. But even then there must be a factor determining its activity in particular cases in order to refute the objection of arbitrariness. Therefore, we are bound to assume that principles of a science are known by the cognitive capabilities of the intellect (the natural light) and experiential input.

Fonseca goes one step further. Cajetan's and Javellus' implicit assumption that the intellect on its own may proceed arbitrarily is made explicit in his commentary on Aristotle's *Metaphysics*. For Fonseca, the intellect on its own is generally prone to error:

The [...] reason is that for the certainty of abstractive cognition such as the cognition of universals an examination based on intuitions is required – and such an examination can in this life only be had through the senses.<sup>19</sup>

It should be noted that this rather sweeping statement seems to concern *all* cognition of universals, insofar as it aspires to certainty. This is remarkable, since at the same time Fonseca explicitly denies Cajetan's assumption that experience is a requirement for the cognition of principles:

[...] if Cajetan's statement in 2. Post. ad c. 18 were provable, we would have to say that experience is necessary for the correct connection of terms. [...] It should [sc. rather] be said that the true and essential cause for habits of [sc. knowing] principles is the light of the intellect. By this light we realise that the predicate belongs immediately to the subject and that experience is not required as a true and essential cause of these [sc. habits].<sup>20</sup>

So how does this fit together? For Fonseca, the intellect on its own is capable of finding true relations between terms. But this does not imply that this intellectual intuition is infallible. In other words, Fonseca seems to make an implicit distinction between the causal story of the knowledge of principles and their justification. Even though knowledge of principles does not depend causally on experience, it does so for its justification:

It must be stated that experience is necessary, because nobody assents to principles without risking error, unless he has made some experiences of particulars and has found some constancy [sc. in them].<sup>21</sup>

The conclusion drawn from these reflections is almost Kantian in spirit: Neither the intellect on its own nor experience can justify our beliefs. Both 'sources of knowledge' must cooperate in order to attain the maximum degree of certainty that is accessible to us:

It must be answered that experience fails at times, when it is on its own and the intellect sometimes deceives itself. If both of them agree, they have the highest degree of certainty that is available to us by nature.<sup>22</sup>

In his *Disputationes Metaphysicae*, Suárez reargues the Scotist position against

Fonseca.<sup>23</sup> Experience is only required in order to know the exact content of concepts employed in truly first and immediate principles. Suárez agrees with Andreas that our grasp of the connection between the simple terms of a principle is based on intellectual intuition. Experience may at times be helpful in this process, but our cognitive access to the connection of terms expressed in a principle is fully and exclusively intellectual:

So the only remaining function for experience in the generation of knowledge is this: It instructs our intellect, so that it understands precisely the reasons (*rationes*) of the simple terms. If these reasons have been understood correctly, the intellect sees clearly the immediate connection between these terms due to its natural light. This in turn is the first and only reason to assent to them [sc. the principles].<sup>24</sup>

So true principles are known to be true regardless of experiential data. Suárez uses the principle of non-contradiction as an example:

Among the first [sc. principles] there is one that is very general and very familiar: Whatever is, or is not, cannot be and not be at the same time: [...] <sup>25</sup>

In order to know this principle, experience is not merely superfluous. Confirmation of the principle of non-contradiction through experience is, as Suárez puts it, 'barely possible'. We can perceive that something is e. g. white at a given time, so that, if we do so repeatedly, we acquire a 'positive' experience regarding its whiteness. But in order to confirm the principle of non-contradiction through experience, we would need a distinct experience confirming the absence of non-whiteness, because, else, we would presuppose what we set out to justify, namely the principle of non-contradiction:<sup>26</sup>

In order to know this, experience is not required. The only thing [sc. we need] is apprehension of the terms used in it, [i. e.] comprehension or explication of them. We cannot even justify any appeal of such principles to a given experience. We may experience that some particular exists. But we cannot 'experience positively' (*non possumus positive experiri*) that something does not lack existence in a way that is distinct from the experience that this particular exists. As soon as the terms used have been explained, this [sc. principle] is based on our understanding [sc. of them] (*sola intelligentia id percipitur explicatis terminis*). And this is known so clearly that it does not require any further proof.<sup>27</sup>

So we may conclude that for Andreas, the Scotist, the intellect is capable on its own to assent to the connection of simple terms in a principle. Cajetan and Javellus disagree, because Andreas' model does not really give a valid reason for the truth of intellectual intuitions and runs the risk of arbitrariness. For Thomists, there must be a determinate reason, why the intellect prefers one combination of terms over the other. Fonseca generalises this insight: All cognition of universals is fallible. He seems to attempt to distinguish the causal history of a given mental state from its mode of justification: Even though the state of knowing a principle may come about only due to the intellect, it can only be regarded as justified, if it is confirmed by experience. Suárez reargues Andreas' position: It is a conceptual truth that at least some principles cannot be

confirmed by experience. The principle of non-contradiction cannot draw on experiential insights in order to be known as true.

### *Experience and the Acquisition of Scientific Knowledge*

In spite of the fact that the exact interaction of intellectual and experiential capabilities is a matter of dispute, there is widespread agreement among early modern Aristotelians that experience is not the principal cause of scientific knowledge. This is conceded even by Javellus:

Humans acquire art and science by experience either as inductive [sc. science and art] or as confirmative [sc. science and art]. But experience is not a principle [sc. for science and art], because the intellect rather than sense is the principle of it. Therefore, some explain the statement of the Philosopher [sc. Aristotle] as saying that humans acquire science after they have had an experience, because the experience they have had strengthens the assent of the intellect. The reader should note that concerning these conclusions all commentators, the Scotists and the Thomists, agree.<sup>28</sup>

And since experience is not the principal cause of science, it must be an 'occasional' or 'instrumental' cause, since both classes form a complete disjunction:

[...] causes for knowledge are twofold, some are principal causes on which scientific knowledge is based, others are dispositional or contributing, which some call occasional or instrumental.<sup>29</sup>

Whether experience is a necessary or contingent 'instrument' for the acquisition of scientific knowledge, is, however, a disputed question. Javellus believes that as an instrumental cause, experience is a requirement in all non-perfect forms of science, particularly in 'beginning science' (*scientia initiativa*). For Suárez, the role of experience in the acquisition of scientific knowledge is in all cases purely accidental.

In order to make his point, Javellus discusses first three arguments that have been brought forward against any role for experience in science:<sup>30</sup>

1. Propositions *quia* do not prove propositions *propter quid*, because mere facts cannot be premisses in proofs that convey knowledge of causes: Premises of scientific proofs must always be universal.
2. Experience cannot cause knowledge, because it would then be the less perfect cause of a more perfect effect: Scientific knowledge is more perfect than experiential knowledge.
3. Propositions about a certain number of objects cannot be used for universal proofs. If this were possible, we would always run the risk of committing the 'fallacy of affirming the consequent' when trying to prove the cause from the effect. For scientifically known causes, such a proof is valid, because the premise is true for all instances of a natural kind. Thus we can deduce the existence of the cause from the fact that the effect exists. If such a deduction is only based on experience, we cannot eliminate the possibility that some other cause was responsible for the observed effect.

These three arguments are closely connected, because they all rely on the contrast between scientific proofs, which must be universally valid and true for

all objects of a concept, and ‘experiential proofs’, which do not fulfill this requirement. Hence, a single experiential fact cannot legitimise an induction to all objects of a concept, which would be required for knowledge *propter quid*. And because it is not true of all objects of a concept, experience is a less perfect mental state than scientific knowledge and, therefore, causally ineffective in bringing about scientific knowledge. Finally, proofs based on experience are formally invalid, when reasoning from the effect to the cause, because only scientific proofs allow this form of induction with the required generality.

But, for Javellus, all these arguments lose sight of the fact that experience is only an instrumental and circumstantial cause for knowledge. So these three arguments do not speak against the instrumental necessity of experience for the acquisition of scientific knowledge:<sup>31</sup>

ad 1.: Propositions *quia* in beginning science describe the proper object (*ipsum quid*) of beginning science, which is different from the proper object of perfect science.

ad 2.: If the cause is not the principal cause, it can bring about a more noble effect, because it only contributes to its reality. Instrumental causes are by definition less noble than their effects, but they nevertheless contribute to the existence of the effect.

ad 3. Experiential induction is legitimate, if it is taken to express a merely probable conclusion. Thus the fallacy of affirming the consequent can be avoided, because probable induction from an effect to a cause is not fallacious.

So for Javellus, experience provides us with knowledge that contains insights into a certain kind of objects (namely the objects of beginning science) and it can be a (partial) cause for knowledge, because it is based on, albeit merely probable, inferences.

Again, Suárez disagrees. According to him, experience must be regarded as a compensation for the limitation of our higher cognitive abilities. This is articulated in his discussion of the *inventio* of principles of particular sciences. These principles usually do not rely exclusively on the intellect. This is what distinguishes them from the truly first principles. In order to find such particular principles we need experiential input in order to determine their truth, because our cognitive abilities are limited:

But those who acquire knowledge only on their own need experience for the cognition of these principles, because without it and without the external assistance of a teacher and [sc. his] instruction, these principles cannot be conceived adequately, or the content of the terms cannot be cognised adequately in order to elicit evident assent to them. [...] The reason is that our cognitive capabilities are limited and imperfect, because they depend on sense. Therefore, without sufficient support from the senses they cannot proceed with sufficient certainty and reliability. Thus it often occurs that those who put much faith into [sc. the achievements of] intellect and disregard the senses, may easily err about ‘natural matters’ [sc. the subject matter of natural philosophy], [...] <sup>32</sup>

Suárez assumes that the limitations of our cognitive abilities in finding such principles are purely subjective and ‘psychological’: They can be compensated



for by extraordinary amounts of ingenuity, precision and attention, so that it is not impossible to deduce the truth of such principles from it, because experience can be substituted by other means. For Christ's human nature, one impression of the senses (*phantasma*) sufficed to know many truths and principles without using any of his supernatural abilities.<sup>33</sup>

We can conclude that there is widespread agreement that experience is no principal cause of scientific knowledge – none of the authors discussed here is a proto-Humean. And it is undisputed that experience may play an instrumental role in the acquisition of scientific knowledge. Javellus and Suárez only disagree regarding the question, whether experience is a *necessary* instrument. Javellus answers in the affirmative, because experience provides insights into the proper subject of beginning science, can be a partial cause for perfect scientific knowledge and provides probable inductive knowledge. Yet, he does not show that these factors are a necessary ingredient of beginning science. For this, he might rely on the general arguments for the necessity of experience analysed above. Suárez does not agree, because the limitations of our cognitive capacities which force us to appeal to experience in finding principles of particular sciences are purely contingent, they are not part of our nature. Therefore, we can conceive situations where a knower who is endowed with superior cognitive capabilities may overcome these limitations without an appeal to experience.

#### *Mathematics and Experience: Javellus and Fonseca*

If experience is regarded as a requirement for knowledge, a consistent explanation of mathematical knowledge poses special problems. This does not primarily concern the question whether mathematical truths can be known a priori, but rather their peculiar justificational status. Early modern Aristotelians acknowledge that mathematical truths are self-evident: They can be understood 'at a glance'. And mathematical objects are abstractions: we do not need (and may never have) an experience of 'a length without breadth or depth'. Nevertheless, we are ready to accept this as the definition of a mathematical line without hesitation.

Javellus discusses the self-evidence of mathematical truths in the context of an objection that states the incompatibility of Javellus' thesis that experience is always a necessary instrument for knowledge with the special status of mathematical truths. This is a difficult question, because knowledge of mathematical objects may be based on a single perception, while experience seems to require multiple perceptions of the same (nexus of) object(s).

Under the premise that art and science are acquired through invention, it is necessary that they are always acquired by experience. It seems that this is not the case: if someone saw only once, in which way the three angles of a triangle are equal to two right angles, or how to construe an equilateral triangle on a given line, he would cognise with certainty that this is always the case. Therefore, he would have knowledge about the conclusion 'a triangle has three equal ...'. This knowledge is not caused by experience, because it [sc. experience] is not caused by one sensation or only one representation in memory, but by many, as the

philosopher [sc. Aristotle] says in the text.<sup>34</sup> Javellus replies that we do require experience for mathematical knowledge, because the objection does not take into account that there are two forms of experience: 'virtual' and 'formal' experience. Formal experience (not the experience of forms, but experience in the strict sense of the word) consists in multiple perceptions. Virtual experience is a state that requires only one perception, but its efficacy (*virtus*) equals that of formal experience: Whether I perceive an immutable object only once or whether I perceive it several times does not change my apprehension of this object. Perceptions of mathematical objects belong to this class.

I reply that experience is always required. But the reader may note that it [sc. the concept of experience] is ambiguous, because it means either formal or virtual experience. Formal experience results from several perceptions of the same thing or many representations of it in memory. Virtual experience results from only one perception or one representation in memory. But even though it is in itself only one [sc. representation], it is equivalent to many [sc. representations]. Some things are to such an extent unchangeable that having seen once how they behave is [sc. the same] as having always seen them, others are quite variable so that unless perceptions of them regarding the effects of the same thing are multiplied, we have only marginal certainty regarding them or no certainty at all. Such are the essences of inferior [sc. sublunar] things. For the first [sc. kind of objects] virtual experience is sufficient. Regarding the second [sc. kind of objects] formal experience is required. And since mathematical objects belong to the first class, for them virtual experience is sufficient. For natural things formal experience is required.<sup>35</sup>

So Javellus sees a significant difference between objects of natural philosophy and objects of mathematics: The immutability of mathematical objects allows for a different mode of experiencing them than the mutability of sublunar nature. Nevertheless, all knowledge concerning mathematical or natural objects is based on experience.

The objection discussed by Fonseca points to a slightly different direction: Here, geometrical *definitions* are introduced as being self-evident. Since they must be regarded as principles, there are principles that do not require experiential confirmation (contrary to what Fonseca himself asserts).

Besides that, geometrical definitions, which are proposed before any theorems, e. g. what is a line, what is a triangle, are in some sense principles. They do not, however, require experience, because if they are articulated, everyone will assent to them instantaneously.

Therefore, not all principles require properly experience.<sup>36</sup>

Fonseca denies that it makes sense to regard mathematical definitions as principles in the strict sense of the word. They clarify the meaning of mathematical terms (what Javellus would call the *quid nominis*), not a purported *quid rei*. So they are just a didactic ploy: It would be feasible, though impractical, to insert these explanations into the process of mathematical deduction without invalidating it.

Regarding the third [sc. objection] that pertains to principles of

particular sciences it must be said that our conclusion should not be understood as stating that it includes those particular principles that are just constructions. That means that they only allow the explication of names which are used in demonstrations, such as the definitions standing at the beginning of geometry. They are not mentioned in advance in order to explain the essences of things. Rather they are used so that the recipient of a demonstration may understand what the geometrician wants to express by using the words “line”, “triangle” etc. and the person conducting the proof need not explain it in the process of proving itself.<sup>37</sup>

Since mathematical definitions only clarify the use of mathematical language and have merely an expository function, they must be regarded as linguistic conventions. Since linguistic conventions seem to be arbitrary, they do not tell us anything about how the world is. Experience does. Hence mathematical principles cannot be based on experience – and they need not be, because they have no epistemic value beyond the confines of mathematics proper.

Nevertheless the geometrician does prove his theorems, even though the definitions which he assumes do not explain the essences of things. He only settles by them what the words mean they [sc. the geometricians] use among themselves. For this reason, I would call these definitions mere constructions, because they are like conventions of those who talk [sc. about geometry] and they just mean ‘let’s assume that the word ‘line’ signifies a length without breadth or depth, the word ‘triangle’ a plane figure contained by three lines, etc.’. Because these principles are purely conventional, it is easily seen that we need no experience in order to assent to them.<sup>38</sup>

So Fonseca is a conventionalist about mathematics: Definitions of mathematical terms are mere linguistic clarifications of their use. They have no ontological import. Mathematical objects are constructions. Constructions cannot and need not be experienced in order to be used in proofs.

According to Javellus, mathematics is no exception from the rule that experience is required for knowledge, because there is a form of experience that can take into account the self-evidence of mathematical knowledge: A one-time-perception of a mathematical object is epistemically equivalent to multiple perceptions of a changeable object – one-time-perceptions of mathematical objects are ‘virtual experiences’.

### *Conclusion*

We have seen how in early modern Aristotelianism two different interpretations of the epistemic role of experience evolved: Whereas for ‘non-rationalists’ there is no significant difference in the epistemic roles of sensation and experience, ‘rationalists’ specify experience as sensitive awareness of matters of fact. Correspondingly, ‘non-rationalists’ hold that knowledge of principles can be based on both perception and experience. ‘Rationalists’ believe that knowledge of principles can only rely on experience: ‘complex terms’ (propositions) are in need of ‘complex sensitive awareness’ (experience) for their confirmation.

On both sides of the debate, theories of experience and theories of the intellect are closely related. ‘Non-rationalist’ Aristotelians can be tolerant about what input from the senses may serve as an instrument for knowledge, because they hold that it is the intellect that properly cognises the content of principles without *requiring* any input from the senses. Their ‘rationalist’ opponents criticise this view, because it may involve arbitrariness: The intellect on its own is prone to error. However, the evidence at least for some principles cannot be experiential, as Suárez seeks to prove with regard to the principle of non-contradiction – there is no distinct ‘positive experience’ of non-being, when we experience something as being.

The role of experience in the process of acquiring knowledge is undisputed. Experience is only an instrumental cause of knowledge. The implications of this, however, are controversial: For the ‘rationalist’, experience is a necessary requirement for scientific knowledge. The ‘non-rationalist’ holds that it is not necessary per se. It is supposed to compensate for contingent limitations of our cognitive capabilities.

Mathematical knowledge is a special case, because it poses problems for the ‘rationalist’ due to the self-evidence of mathematical truths, which suggests that experience is irrelevant for mathematical knowledge. The ‘rationalists’ find different solutions. Fonseca agrees to this objection, but in turn he relativises the epistemic value of mathematics: mathematical definitions are only conventions, so mathematical truths do not depict states of the world as it is. Javellus introduces a special form of experience that takes the self-evidence of mathematical truths into account.

### References

- Andreas, Antonius, *Quaestiones super duodecim libros Metaphysicae Aristotelis*. Leipzig: Stöckel, approx. 1494
- Dear, Peter, “The Meanings of Experience.” In: *The Cambridge History of Science vol. 3: Early modern science*, edited by Katharine Park and Lorraine Daston, 106-131. Cambridge: Cambridge University Press, 2006.
- Fonseca, Pedro, *Commentariorvm Petri Fonsecae Lvsitani, Doctoris Theologi Societatis Iesv, In Libros Metaphysicorum Aristotelis Stagiritae*. Frankfurt: Schonvvetterus, 1599.
- Gensler, M., “The making of a Doctor Dulcifluus: Antonius Andreae’s contribution to the formation of Scotism.” *Anuari de la Societat Catalana de Filosofia* 1996: 57-67.
- Gregorić, Pavel and Filip Grgić, “Aristotle’s Notion of Experience.” *Archiv für Geschichte der Philosophie* 88 (2006): 1-30.
- Javellus, Chrysostomus, *In omnibus metaphysicae libris quaesita testualia metaphysicali modo determinata*, Venice: Bonellus, 1583
- Schmitt, Charles B., “Experience and Experiment: A Comparison of Zabarella’s View with Galileo’s in De Motu.” *Studies in the Renaissance* 16 (1969): 80-138.
- Schmutz, Jacob, “Réalistes, nihilistes, et incompatibilistes: le débat sur les negative truthmakers dans la scolastique jésuite espagnole”, Cahiers de

Philosophie de l'Université de Caen 43 (2007): 131-178

Suárez, Francisco, *Metaphysicarum disputationum [...] tomus prior*. Salmanticae: Renaut, 1597.

Vio Cajetan, Thomas de, *In Praedicabilia Porphyrii, Praedicamenta, Postpraedicamenta, & libros posteriorum analyticorum Aristotelis ... commentaria*. Lugduni: Beraud, 1578.

- 1 Cf. *Met. I.1* 980b28 (ed. Ross): “γίγνεται δ’ ἐκ τῆς μνήμης ἐμπειρία τοῖς ἀνθρώποις: [...]” (“Now from memory experience is produced in men; [...]” transl. Ross).
- 2 Cf. *Met. I.1* 981a1ff: “[...] καὶ δοκεῖ σχεδὸν ἐπιστήμη καὶ τέχνη ὅμοιον εἶναι καὶ ἐμπειρία, ἀποβαίνει δ’ ἐπιστήμη καὶ τέχνη διὰ τῆς ἐμπειρίας τοῖς ἀνθρώποις: [...]” (“And experience seems pretty much like science and art, but really science and art come to men through experience.”)
- 3 Cf. Pavel Gregorić and Filip Grgić, “Aristotle’s Notion of Experience”, *Archiv für Geschichte der Philosophie* 88 (2006).
- 4 Gregorić and Grgić (loc. Cit., 11) believe that for Aristotle himself this distinction was inexistent. If this diagnosis is right, it indicates how early modern Aristotelians transcended the original text in order to arrive at a coherent vision of its philosophical content.
- 5 Cf. e. g. Peter Dear, “The Meanings of Experience,” in: *The Cambridge History of Science vol. 3: Early modern science*, ed. Katharine Park and Lorraine Daston, (Cambridge: Cambridge University Press, 2006), 106ff, Charles B. Schmitt, “Experience and Experiment: A Comparison of Zabarella’s View with Galileo’s in *De Motu*,” *Studies in the Renaissance*, 16 (1969): 89ff.
- 6 More detailed biografical information can be found in M. Gensler, “The making of a Doctor Dulcifluus: Antonius Andreae’s contribution to the formation of Scotism,” *Anuari de la Societat Catalana de Filosofia* 1996, 57ff.
- 7 Antonius Andreas, *Quaestiones super duodecim libros Metaphysicae Aristotelis* (Leipzig: Stöckel, approx. 1494), fol. 11v: “[...] et sit ista prima conclusio quod ad habendam noticiam incomplexam de principiis quae est de terminis simplicibus necessaria est cognitio sensitiva seu experimentalis.”
- 8 Cf. Andreas, *Quaestiones*, fol. 11r ff.
- 9 Javellus was born in the Italian city of Casale at c. 1470, and died in Bologna at around 1538. He graduated as bachelor of theology in 1513 and as master in 1515. A student of Cajetan, he gained some notoriety for his controversy with Pomponazzi concerning the status of the rational soul. Cf. *Scholasticon* (ed. Jacob Schmutz), s.v. “Javelli (Javelli), Crisostomo”, <http://www.scholasticon.fr> [retrieved on December 30<sup>th</sup> 2011] and *Biografisch-Bibliografisches Kirchenlexikon*, s.v. “Javelli, Chrysostomos”.
- 10 Chrysostomus Javellus, *In omnibus metaphysicae libris quaesita testualia metaphysicali modo determinata* (Venice: Bonellus, 1583), fol. 14v f: “Quaeritur [sc. Scotistis], si illa cognitio sensitiva necessaria pro habenda cognitione intellectiva incompleta terminorum, debeat appellari experimentalis. [...] Scotistae, ut patet in q. 4. Ant. Andr. in sua prima conclusione, ponunt indifferenter talem cognitionem, esse sensitivam, seu experimentalem, ita quod super hoc non faciunt vim. [...] Terminus vero incomplexus, ut incomplexus, cognoscitur cognitione incompleta, sicut complexus complexa, ergo ibi non cadit experimentum propriae dictum, [...]”
- 11 Javellus, *Quaesita*, fol. 15r: “[...] cognitio incompleta terminorum, requisita ad cognoscendum principia complexa, non est notitia perfecta quid rei terminorum, sed est notitia confusa parum excedens cognitionem quid nominis.”
- 12 Javellus, *Quaesita*, fol. 15r: “Quantum spectat ad viam nostram, advertet primo, quod experimentum est cognitio sensitiva complexa, eo quod est collatio multorum particularium. Nam dicit philosophus in textu, quod experimentum est cognoscere hanc herbam curasse Socratem, et Caliam, et multos singulares, ergo manifestae [sic!] patet, quod experimentum est notitia sensitiva, et per consequens deservit notitiae intellectivae complexae, tam principiorum quam conclusionum.”
- 13 Javellus, *Quaesita*, fol. 15r: “Quod autem huiusmodi notitia non solum sit utilis, sed et necessaria, probatur. Nam oportet assignare aliquod motivum, et determinativum intellectus, ad formandam hanc universalem propositionem. [...] Hoc autem motivum, et determinativum non potest esse sola notitia terminorum incompleta, cum ut incompleta non magis determinat intellectum ad hanc complexionem quam ad illam.”
- 14 Javellus, *Quaesita*, fol. 15r: “Nam experimur, quod habentes notitiam terminorum, nisi cognoscamus sensu tales terminos coniungi in re, nescimus formare principium complexum, [...]”
- 15 Cf. *An. Post. I.3*, 72b24 f: “ἀρχὴν ἐπιστήμης εἶναι τινὰ φαμεν, ἧι τοὺς ὄρους γνωρίζομεν: [...]” (“[...] we also say that there is not only understanding but also some principle of understanding by which we become familiar with the definitions. ”, transl. Barnes)
- 16 Andreas, *Quaestiones*, fol. 12r: “ad habendam de principiis noticiam complexam non est necessaria simpliciter cognitio sensitiva seu experimentalis. [...] nam ipse intellectus conceptis modo preexposito terminis simplicibus potest virtute propria ipsos componere vel

- dividere. ita quod conceptus tales complexi si sint principiorum primorum cognoscuntur esse veri lumine naturali intellectus. quia principia cognoscimus in quantum terminos cognoscimus. primo poste. et ideo cognitio sensitiva vel experimentalis non est simpliciter necessaria per tali complexa cognitione de principiis habenda.”
- 17 Thomas de Vio Cajetan, *In Praedicabilia Porphyrii, Praedicamenta, Postpraedicamenta, & libros posteriorum analyticorum Aristotelis ... commentaria* (Lugduni: Beraud, 1578), 667: “Et confirmatur, quoniam cum ex eisdem terminis varie possint fieri compositiones, ut manifestum est: nisi cognitio experimentalis determinet intellectum ad hanc compositionem, non erit maior ratio, quare intellectus acquirat hanc cognitionem complexam (quam vocamus principium) ex illis terminis magis, quam aliam, etc.”
- 18 Javellus, *Quaesita*, fol. 15v: “[...] nego, quod intellectus sua propria virtute conceptis terminis simplicibus ad componendum, vel dividendum hoc vel illud determinatum complexum, licet non sit verum, quod potentiae absolutae componere, vel dividere, non tamen determinatae hoc, ita quod constet sibi de veritate eius, nisi fuerit adiutus, et determinatus cognitione sensitiva complexa frequentata, quae dicitur experimentum, [...]”
- 19 Pedro Fonseca, *Commentariorum Petri Fonsecae Lvsitani, Doctoris Theologi Societatis Iesv, In Libros Metaphysicorum Aristotelis Stagiritae* (Frankfurt: Schonvvetterus, 1599), col. 95: “[...] ratio est, quia certitudo cognitionis abstractivae, qualis est cognitio universalium, indiget examine intuitivae, quae in hac vita sine sensu haberi non potest.”
- 20 Fonseca *Commentariorum*, col. 99: “[...] si Caietani 2. Post. ad c. 18 sententia probanda esset, dicendum foret, experimentum esse necessarium ad iungendos apte terminos. [...] Dicendum est [...], Veram et propriam causam habituum principiorum, esse lumen intellectus, quo cernimus praedicata esse immediata subiectis: neque experimentum esse necessarium, ut veram et per se causam illorum: [...]”
- 21 Fonseca *Commentariorum*, col. 99: “Dicendum est [...] idcirco [sc. experimentum] esse necessarium, quia [...] nemo absque erroris periculo principiis assentitur, nisi illa [sic] expertus sit in aliquibus singularibus nullamque reperiat instantiam.”
- 22 Fonseca *Commentariorum*, col. 100: “Occurrendum est, et experimentum per se aliquando fallere, et intellectum nonnunquam in ea re hallucinari. Verum cum ambo conveniunt, tunc habent omnem certitudinem quae naturaliter haberi potest.”
- 23 Francisco Suárez, *Metaphysicarum disputationum [...] tomus prior* (Salmanticae: Renaut, 1597).
- 24 Suárez, *Disputationes*, V.1.25, 45: “Relinquitur ergo experientiam solum requiri ad scientiam ut intellectus noster manu ducatur per eam ad intelligendas exacte rationes terminorum simplicium, quibus intellectis ipse naturali lumine suo videt clare immediatam connexionem eorum inter se, quae est prima et unica ratio assentiendi illis.”
- 25 Suárez, *Disputationes*, V.1.26, 46: “Est namque in primis unum et alterum generalissimum et notissimum, scilicet, Quodlibet est, vel non est. Impossibile est idem simul esse et non esse: [...]”
- 26 Here is not the place to evaluate this argument thoroughly. It seems to rest on the view that negations in a certain sense can be taken to be real. Cf. J. Schmutz, “Réalistes, Nihilistes, et Incompatibilistes Le débat sur les negative truthmakers dans la scolastique jésuite espagnole”, *Cahiers de Philosophie de l’Université de Caen*, 43 (2007), 142: “[...] l’homme est homme tout autant qu’il est non-âne, et la pierre est une pierre tout autant qu’elle est non-arbre, ou [...] le cygne noir est aussi noir qu’il est non-blanc.” If one aspect of being a stone is being a non-tree, a *distinct* experience of being a non-tree is impossible, because being a non-tree is always perceived in the same mental act that contains the apprehension of being a stone.
- 27 Suárez, *Disputationes*, V.1.26, 46: “[...] et ad haec cognoscenda nulla requiritur experientia, sed sola terminorum apprehensio, intelligentia seu explicatio: imo vix possunt illa principia ad positivam experientiam reduci: nam licet de quocumque singulari possimus experiri quod sit: tamen quod tunc non careat existentia, non possumus positive experiri distincto experimento ab eo quo videtur illud esse, sed sola intelligentia id percipitur explicatis terminis. Et hoc videtur adeo per se notum, ut alia probatione non indigeat.”
- 28 Javellus *Quaesita*, fol. 14 v: “Hominibus autem scientia, et ars per experimentum evenit seu inductivae, et confirmativae, sed non principaliter, cum scientia non a sensu, sed ab intellectu est principaliter, unde aliqui sic exponunt dictum philosophi, hominibus fit scientia per experimentum, id [sc. est] post experimentum. cum prius habitum experimentum confirmat intellectum in assensu, et tu adverte, quod in his conclusionibus communiter concordant commentistae, et Scotistae, et Thomistae.”
- 29 Javellus *Quaesita*, fol. 13 v: “[...] causa cognitionis est duplex, quaedam principalis, in qua fundatur notitia scientifica, quaedam dispositiva, et iuvativa, quam quidam dicunt

- occasionalem, vel instrumentalem.”
- 30 Cf. Javellus, *Quaesita*, fol. 16v: “et adverte, quod omnia argumenta, quibus solet probari, experimentum non generare artem, et scientiam, ex eo quod experimentum dicit quia, et ars dicit propter quid, sed quia non manifestat quid, aliter minor cognitio causaret perfectiorem, et ex eo quod causa productiva, esset imperfectior suo effectu, et ex eo quod ex multis non potest inferri omne, aliter committeretur fallacia consequentis.” (“The reader should note that all arguments which are commonly used to prove that experience does not bring about art and science, [namely that] experience contains only [sc. propositions] quia [sc. brute facts], art contains [sc. propositions] propter quid [sc. causes], [sc. propositions] quia do not prove [sc. propositions] quid, because a minor cognition cannot cause a more perfect one, that a cause bringing about an effect would be less perfect than its effect, that we cannot derive [sc. a proposition about] all [sc. particulars of a given type] from [sc. a proposition about] many [sc. particulars of a given type], or else we would commit the fallacy of affirming the consequent, [...]”)
- 31 Cf. Javellus, *Quaesita*, fol. 16v: “Omnia inquam haec argumenta concludunt, quod experimentum non est causa essentialis, et principalis artis, et scientiae, non autem quin sit causa iniciativa, et occasionalis. Unde nego quin ipsum, quia manifestet iniciativae ipsum quid, et eodem modo causa imperfectior occasionaliter, et instrumentaliter, potest producere effectum perfectum, et ex multis probabiliter potest inferri omne, quando non datur manifesta instantia, non autem potest inferri necessario et essentialiter. unde quando ex multis experientiis infertur universalis conclusio, est illatio probabilis, et occasionalis.” (“All these arguments, I say, only show that experience is not the essential and main cause of art and science. They do not show that it cannot be the beginning or circumstantial cause. I negate [sc. that experience does not prove an essence], because it proves the ipsum quid [sc. i. e., the essence] of beginning science. In the same manner, a less perfect cause can bring about a more noble effect as an instrument for or occasion of [sc. this] effect, and we can infer from many [sc. objects] to all [sc. objects] with a degree of probability, [sc. even] if we have no clear instance [sc. of what is proven]. However, we cannot infer with necessity and about essences. Thus an inference from many experiences to a universal conclusion is only probable and circumstantial.”)
- 32 Suárez, *Disputationes*, V.1.28, 46: “At vero qui sola inventione scientias acquirunt, indigent experientia ad horum principiorum cognitionem: quia sine illa, et sine exteriori adiutorio praeceptoris et doctrinae, non possunt haec principia satis proponi, aut rationes terminorum satis cognosci, ut illis evidens praebeatur assensus. [...] Ratio autem est, quia nostra intellectiva cognitio valde limitata est, et imperfecta, nimiumque a sensu pendet, et ideo sine sufficiente adminiculo eius non potest cum sufficiente certitudine et firmitate procedere, et inde accidit saepe, ut qui multum de intellectu confidunt sensum deserentes, facile in rebus naturalibus errent, [...]”
- 33 Cf. Suárez, *Disputationes*, V.1.28, 46: “[...] dicunt Theologi animam Christi ex sola efficacia naturalis ingenii, sine speciali adminiculo supernaturali ex uno phantasmate elicuisse multas veritates vel principia.” (“[...] theologians say that Christ's soul gleaned from one impression of the senses many truths or principles without needing supernatural assistance, relying only on the power of his natural cognitive abilities.”)
- 34 Javellus, *Quaesita*, fol. 17r: “[...] si quando ars, et scientia acquiruntur per inventionem, necesse est ut semper acquirantur per experimentum, et videtur quod non, nam si quis semel tum viderit, quomodo triangulus habet tres aequales duobus rectis, vel quomodo contingit super lineam datam, triangulum constituere aequilaterum, per certitudinem cognoscat semper sic esse, ex consequenti de hac conclusione triangulus habet tres etc. habebit scientiam. et non per experimentum, cum non fit experimentum, per unam sensationem, vel per unam memoriam tantum, sed per multas, ut dicit philosophus in textu, [...]”
- 35 Javellus, *Quaesita*, fol. 17r: “Respondeo, dico quod semper requiritur experimentum. Sed adverte, quod est duplex, sive formale, et virtuale, formale est quod fit ex pluribus sensationibus eiusdem rei, et multis memoriis eiusdem. virtuale autem est, quod fit unica sensatione, et unica memoria, quae licet in se sit una tantum, aequivalet tamen multis, nam sunt quaedam res adeo stabiles, quod semel vidisse quomodo se habent, est semper vidisse, Quaedam autem sunt adeo variabiles, quod nisi multiplicatur earum sensationes, respectu eiusdem effectus, parva aut nulla potest haberi de eius certitudo. et tales sunt rerum inferiorum naturae. In primis sufficit experimentum virtuale. In secundis autem requiritur formale, et cum in gradu primo reponuntur mathematica, ideo in eis sufficit experimentum virtuale. In naturalibus autem requiritur formale.”
- 36 Fonseca, *Commentariorum*, col. 97: “Praeterea, definitiones geometricae, quae ante



theoremata ponuntur, ut quid sit linea, quid triangulus, sunt quaedam principia: haec autem non indigent experimento, cum iis propositis nemo fit, qui non statim assentiatur: igitur non omnia principia proprio indigent experimento.”

- 37 Fonseca, *Commentariorum*, col. 98: “Ad tertium, quod attinet ad principia propria, dicendum est, conclusionem nostram non esse intelligendam de iis propriis principiis, quae sunt merae positiones, hoc est, quae solum permittuntur ad explicanda nomina, quibus in demonstrationibus utendum est: quales sunt definitiones, quae initio Geometriae ponuntur. nec enim praemittuntur ad declarandas rerum essentias, sed ut is, cui fit demonstratio, intelliget, quid Geometra significare velit vocabulo lineae, trianguli, et caeteris: ne demonstrator in ipso demonstrationis cursu cogatur ea explicare.”
- 38 Fonseca, *Commentariorum*, col. 98: “Quo fit, ut nihilominus Geometra demonstret sua theoremata, etsi definitiones, quas posuit, non explicant essentias rerum, modo per eas constet, quid vocabulis, quibus inter ipsos disseritur, significetur. Hac autem de causa appellaverim huiusmodi definitiones, meras positiones, quia sunt velut conventiones quaedam inter eos, qui disserunt, quasi dicant, ponamus nomine lineae significari longitudinem sine latitudine, et profunditate; nomine trianguli figuram planam tribus lineis contentam: et ita in caeteris. Cum ergo principia conventionem sola constent, satis perspicuum est, nullo opus esse experimento, ut illis assentiamur.”