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The British Journal for the History of Science / Volume 47 / Issue 03 / September 2014, pp 421 - 431
DOI: 10.1017/S0007087413000666, Published online: 18 October 2013

Link to this article: http://journals.cambridge.org/abstract_S0007087413000666

How to cite this article:

GUY CLAESSENS (2014). A sixteenth-century Neoplatonic synthesis: Francesco Piccolomini's theory of mathematics and imagination in the *Academicae contemplationes*. The British Journal for the History of Science, 47, pp 421-431 doi:10.1017/S0007087413000666

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A sixteenth-century Neoplatonic synthesis: Francesco Piccolomini's theory of mathematics and imagination in the *Academicæ contemplationes*

GUY CLAESSENS*

Abstract. The metamathematical framework of the early modern period is primarily determined by two presuppositions stemming from the Aristotelian tradition: (1) mathematical objects are abstracted from sensible matter; (2) imagination is a reproductive faculty exclusively connected with the sensible realm. The recovery of the works of the Greek commentators confronted the early modern readers with rivalling philosophical–mathematical views that explicitly called into question some of their previously undisputed assumptions. In this article I will argue that Francesco Piccolomini (1523–1607) in his *Academicæ contemplationes* brings about an original fusion of these colliding horizons, by transposing the synthesis established by (?)Simplicius between Aristotelian abstractionism and Neoplatonic innatism into the sixteenth century.

The metamathematical framework of the early modern period is primarily determined by two presuppositions stemming from the Aristotelian tradition.¹ First, mathematical objects are considered to be abstracted from sensible matter. Second, imagination is understood to be a reproductive faculty exclusively connected with the sensible realm. The recovery and publication of the works of the Greek commentators (for example, Iamblichus, Syrianus, Proclus and Simplicius) during the sixteenth century not only provided a new, critical reading of the Aristotelian corpus, but also confronted the early modern readers with rivalling views that explicitly called into question some of their previously undisputed assumptions. For example, in the philosophical prologue to his *Commentary on the First Book of Euclid's Elements*, the fifth-century Neoplatonist Proclus presented a productive, geometrical imagination upon which innate mathematical concepts are projected as onto a mirror (see below). Obviously, the renewed dialogue between the Greek commentators and the prevailing epistemic horizon could take different forms, ranging from assimilation to integration to renunciation. In this article I will argue that the Sienese Francesco Piccolomini (1523–1607) in his *Academicæ contemplationes* (1576) establishes a highly original fusion of these conflicting horizons, paradoxically enough by transposing the synthesis established

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¹ See Guy Claessens, 'Imagination as self-knowledge: Kepler on Proclus' *Commentary on the First Book of Euclid's Elements*', *Early Science and Medicine* (2011) 16, pp. 179–199, 181–183.

by (?)Simplicius² between Aristotelian abstractionism and Neoplatonic innatism into the sixteenth century.

Francesco Piccolomini

After professorships in philosophy at the universities of Siena, Macerata and Perugia, Francesco Piccolomini held the chair of natural philosophy at the university of Padua from 1565 until 1598.³ During his *peregrinatio academica* the one constant is the texts of Aristotle. This resulted not only in the publication of numerous commentaries on the Stagirite's works, for example a commentary on the *De Anima* in 1602,⁴ but also in the production of various Aristotelian-inspired treatises in the domain of moral philosophy.⁵ Remarkably enough, Piccolomini's first two publications did not bear their author's true name. In 1575 the *Peripateticae de anima disputationes* were published under the name of Petrus Duodus (Pietro Duodo), while the ten books of the *Academicarum contemplationes* (1576) were printed under the name of Stephanus Theupolus (Stefano Tiepolo).⁶ Duodo and Tiepolo were both members of the Venetian aristocracy and pupils of Piccolomini during their stay in Padua. With respect to the attribution of both works to Piccolomini, Artemio Enzo Baldini refers to two contemporary testimonies – the first by Piccolomini's student and biographer Luigi Lollino, the second by the Florentine poet Jacopo Gaddi – which explicitly ascribe the works mentioned above to Piccolomini.⁷ Lollino adds as an explanation that Piccolomini's students, when graduating, received from their teacher – as a kind of reward – a manuscript bearing their name, which they subsequently published without mentioning its author's true name.⁸ Still according to Lollino, by means of this practice Piccolomini assured himself of the gratitude of his pupil and the latter's powerful family.⁹ Eugenio Garin's hypothesis that Piccolomini's use of pseudonyms was due to the fact that the strong Platonic vein

2 The authorship of the *De Anima* commentary was already questioned by Francesco Piccolomini himself (*In tres libros Aristotelis de anima lucidissima expositio*, Venice, 1602, f. 216r), and is still disputed. Fernand Bossier and Carlos Steel, 'Priscianus Lydus en de "In de anima" van Pseudo(?)Simplicius', *Tijdschrift voor Filosofie* (1972) 34(4), pp. 761–822, French summary 821–822, attribute it to Priscian. For a different view see I. Hadot, *Le problème du néoplatonisme alexandrin: Hiéroclès et Simplicius*, Paris: Etudes augustinienes, 1978, pp. 193–202. Since Steel's and Bossier's arguments contra Simplicius' authorship are convincing – while their pro-Priscian arguments are still much debated – I refer to the commentary's author as '(?)Simplicius'.

3 Jill Kraye, 'Francesco Piccolomini', in Kraye (ed.), *Cambridge Translations of Renaissance Philosophical Texts*, 2 vols., Cambridge: Cambridge University Press, 1997, vol. 1, pp. 68–88, 68.

4 *Commentarii duo, prior in libros Aristotelis De ortu et interitu, alter in tres libros eiusdem De Anima*, Frankfurt, 1602.

5 See the bibliography of Piccolomini in Charles Schmitt and Quentin Skinner (eds.), *The Cambridge History of Renaissance Philosophy*, Cambridge: Cambridge University Press, 1988, p. 861.

6 Francesco Piccolomini, *Stephani Theupoli Bened. F. Patric. Veneti, Academicarum Contemplationum Lib. X. in quibus Plato explicatur & Peripatetici refelluntur*, Venice, 1576.

7 Artemio Enzo Baldini, 'Per la biografia di Francesco Piccolomini', *Rinascimento* (1980) series ii, 20, pp. 389–420, 399–401.

8 Luigi Lollino, *Francisci Piccolominei, Iacobique Zabarellae praestantium nostrorum temporum philosophorum vitae*, cc. 34v–35r, quoted in Baldini, op. cit. (7), p. 399.

9 Lollino, op. cit. (8), cc. 34v–35r.

characterizing both works was not tolerated of a professor – certainly not *nominatim* – at the university of Padua, a well-known bastion of Aristotelianism, appears to be very doubtful.¹⁰ The fact that many of his contemporaries linked together Piccolomini and the works mentioned above indicates that it was an open secret, and in late sixteenth-century Padua it was not particularly risky to publish ‘Platonic’ writings.¹¹ It would therefore be wrong to deduce from the above the image of the ‘clandestine Platonist’ Piccolomini.¹² Both works are to be evaluated in the light of Piccolomini’s complete *oeuvre*, out of which, as Leen Spruit remarked,¹³ emerges rather the persona of a ‘versatile commentator on Aristotle’ than that of an adherent of one fixed philosophical doctrine.

The *Academicae contemplationes*

The goal of the *Academicae contemplationes* is, according to Piccolomini, at odds with the prevailing approaches to the two beacons of wisdom (*duo humanae sapientiae lumina*), Plato and Aristotle.¹⁴ In reviewing the traditional approaches, Piccolomini observes the following. On the one hand, there are those who, out of excessive admiration for one of them, have fully neglected the other (*alterum penitus neglexerunt*).¹⁵ On the other hand, some were blinded to such a degree by their adoration of both of them, that they were unable to believe that sometimes Plato and Aristotle actually disagree (*induci non potuerunt, ut crederent eos re vera esse discordes*).¹⁶ According to Piccolomini, neither one of these approaches deserves recommendation: the first ignores the substantial mutual impact between the Academy and the Lyceum, while the second – which was followed, among others, by the Neoplatonist Simplicius – inevitably leads to the perversion of one view, or even both views (*modo unam, modo alteram, & frequenter utranque non sine perniciose confusione pervertere coguntur*).¹⁷ However, the deadlock is easy to overcome by exchanging the widespread models of concordance or conflict for a paradigm of complementarity. One should simply take the best of two worlds – the method and scientific model of Aristotle, and the theology and metaphysics of Plato – and when they openly disagree, reason will have the last word (*ei adhaerendum maxime est, cum quo ratio magis videbitur consentire*).¹⁸ Nevertheless, the work’s full title¹⁹ clearly betrays that Plato is given a comfortable head start: *Plato explicatur & Peripatetici refelluntur*.

10 Eugenio Garin, *Storia della filosofia italiana*, Torino: Einaudi, 1978, p. 659.

11 Baldini, op. cit. (7), p. 400.

12 See, for example, Garin, op. cit. (10), pp. 658–659, who refers to ‘una professione di fede platonica’ and calls Piccolomini a ‘platonico convinto’.

13 Leen Spruit, *Species Intelligibilis: From Perception to Knowledge. 2: Renaissance Controversies, Later Scholasticism, and the Elimination of the Intelligible Species in Modern Philosophy*, Leiden: Brill, 1995, pp. 239–240.

14 See Garin, op. cit. (10), p. 658; and Uberto Motta, *Antonio Querenghi (1546–1633): Un letterato padovano nella Roma del tardo Rinascimento*, Milan: Vita e pensiero, 1997, p. 22.

15 Piccolomini, op. cit. (6), p. 12.

16 Piccolomini, op. cit. (6), p. 12.

17 Piccolomini, op. cit. (6), p. 12.

18 Piccolomini, op. cit. (6), p. 13.

19 Piccolomini, op. cit. (6).

On mathematical forms and Platonic Ideas

In Book III of the *Academicae contemplationes*, Piccolomini examines a cluster of questions concerning the Platonic Ideas²⁰ – do they exist? What exactly are they? And so on – and investigates the domain of mathematics as well: “Whether Ideas of mathematical forms should be accepted” (*Utrum mathematicarum formarum dentur Ideae*).²¹ Piccolomini starts by expounding two rivalling views. The view is held by some philosophers that Ideas of mathematical objects cannot exist, simply because Ideas are substances (*substantiae*) and mathematical objects are mere accidents (*vilia accidentia*). Conversely, the Neoplatonist Proclus states that Ideas of mathematical objects have to exist, since mathematical objects *as such* are not found in the sensible realm:

Proclus, on the contrary, who is peerless among the Platonists, clearly asserts – and reinforces with arguments – in his commentary on the first book of Euclid that one has to accept Ideas of mathematical forms, and indeed correctly: if the Idea ‘straight line’, the Idea ‘circle’ or the Idea ‘line’ did not exist, they would be found nowhere, and the mathematical sciences would disappear; for in matter no straight line without obliquity, no truly round circle, no line without breadth is found.²²

For that reason, Piccolomini says, Plato contends that the geometer, when drawing a line in the sand, does not make his demonstrations about the drawing, but about the line that resides in the soul’s essence (*de illa, quae in animae essentia est inserta*), and projects an image of itself onto the imagination (*in virtutem imaginandi imaginem promit*).²³ In reconstructing Plato’s stance, Piccolomini thus combines the well-known passage from Book VI of the *Republic* (510d5–8) with Proclus’ notion of a productive imagination; that is to say, the geometrical imagination upon which the innate concepts of the understanding are projected as onto a mirror.²⁴ Piccolomini then continues the doxography and exchanges Proclus’ authority for that of Simplicius. According to Piccolomini, Simplicius also assumes that Ideas of mathematical objects exist, and that traces and images of them (*vestigia & imagines*) are projected onto the imagination, triggered by external stimuli (*praecedente tamen excitatione ab externis sensibilibus facta*).²⁵ Subsequently, Piccolomini refers to Simplicius’ distinction between ‘vulgar’ and ‘true’ mathematics, namely the non-scientific and non-philosophical mathematical

20 Piccolomini, op. cit. (6), pp. 81–115; I. *An Ideae sint*. II. *Inventores Idearum*. III. *Quid sint Ideae*. IV. *Cui convenient Ideae*. V. *Quomodo in mente se habeant & consurgant Ideae*. VI. *Convenientia et differentia Idearum*. VII. *Quorum non sint Ideae*. VIII. *Utrum mathematicarum formarum dentur Ideae*. IX. *Quorum sint Ideae*. X. *Quos usus praebeant Ideae*. XI. *An Aristoteles in disputatione de Ideis cum Platone debeat conciliari*.

21 Piccolomini, op. cit. (6), p. 100.

22 Piccolomini, op. cit. (6), pp. 100–101: ‘Ex adverso Proclus inter platonicos nemini secundus, in primum Euclidis manifeste asserit, rationibusque confirmat, rerum mathematicarum dari Ideas; & iure quidem: nisi enim daretur Idea recti, Idea circuli, Idea lineae; haec nullibi invenirentur, & evanescerent mathematicae scientiae; cum in materia nec rectum sine obliquitate, nec circulus exacte rotundus, nec linea sine latitudine inveniatur.’ See Proclus, in *Eucl.*, 12, 19–26.

23 Piccolomini, op. cit. (6), p. 101.

24 On Proclus’ concept of the geometrical imagination see Dmitri Nikulin, ‘Imagination and mathematics in Proclus’, *Ancient Philosophy* (2008) 28, pp. 153–172.

25 Piccolomini, op. cit. (6), p. 101. Piccolomini probably refers to (?)Simplicius, in *de Anima*, 233, 7–30.

knowledge dealing with images (*in dictis imaginibus versantur nec scientiae sunt, nec philosophiae pars*), and the proper mathematical sciences which, dissatisfied with mere images, strive for the Ideas themselves (*imaginibus non contentus, ad rationales Ideas ascenderit*).²⁶ After presenting both sides, it is now up to Piccolomini to provide an answer, backed up by Plato (*nitar tamen ego ex Platonicis regulis & principiis conspicuam resolutionem elicere*).²⁷

Strictly speaking, Piccolomini writes, Ideas of mathematical objects – both numbers and geometrical figures – do not exist. Mathematical objects can, however, be traced back to so-called principles (*principia*).²⁸ From both Plato and Pythagoras we learn that physics resolves into geometry, and geometry into arithmetic. Hence numbers are the first principles of the sensible world (*numeri sint prima principia omnium*).²⁹ Likewise, in the intelligible realm, numbers fulfil the role of principles with respect to the Ideas, namely as intelligible numbers (*intelligibiles illi numeri sunt principia, conditio, natura & terminus omnium Idearum*).³⁰ As a network relationally structured from unity to multiplicity, the intelligible numbers are, as it were, a generative blueprint for the (ordered) world of Ideas. The same goes for geometrical figures: as far as their essential being is concerned, they are reducible to the same numerical principles as numbers. At the same time, they share in the Infinite (*infinitus*) and the Limit (*terminus*), the common principles of all Ideas. Hence the soul can project similar images onto the imagination (*valet anima consimiles imagines expromere in phantasiam*).³¹ The Infinite guarantees the infinite divisibility of geometrical figures, whereas the Limit safeguards their identity and stability.³² Is it not strange, then, Piccolomini observes, that mathematical objects, which are only secondary accidents with regard to physical objects in the sensible realm (*sunt posteriora physicis & sunt accidentia*), are prior in the intelligible realm? The answer is negative, since there needs to be a clear-cut distinction between the principles, on the one hand, and their adumbrations in the sensible world (*externas eorum umbras*), on the other.³³

At first sight, Piccolomini's account raises more questions than it answers. What is the exact ontological status of mathematical objects? How can they be known? What role does imagination play in all this? In Book IV Piccolomini presents an interesting ontology of numbers, which I will have as my starting point.³⁴

26 Piccolomini, op. cit. (6), p. 101. The corresponding passage is (?)Simplicius, *in de Anima*, 277, 1–6.

27 Piccolomini, op. cit. (6), p. 102.

28 Piccolomini, op. cit. (6), p. 102.

29 Piccolomini, op. cit. (6), p. 102.

30 Piccolomini, op. cit. (6), p. 103. Piccolomini adds the sentence 'and therefore the Ideas are able to display the images of mathematical objects in the imagination' (*& propterea valent Ideae imagines mathematicorum in phantasiam expromere*). I cannot, however, explain in which way the Ideas themselves could display projections in the imagination, except indirectly.

31 Piccolomini, op. cit. (6), p. 103.

32 Nikulin, op. cit. (24), p. 158. See Proclus, *in Eucl.*, 6, 7–7, 7.

33 Piccolomini, op. cit. (6), p. 104.

34 Piccolomini, op. cit. (6), p. 118 ff.

A Neoplatonic ontology of numbers

According to Piccolomini, there are five kinds of number (*quinque subordinati numeri*) or – to put it differently – the numerical is found on five levels: divine number (*numerus divinus*), substantial number (*numerus substantialis*), soul-number (*numerus animarius*), natural number (*numerus naturalis*) and mathematical number (*numerus mathematicus*). In its first form, number is uniform and it is contemplated by God; in its second appearance, number is motionless and belongs to Mind (*Mens*) and the Ideas; in its third state, number moves itself (*se movens*) and belongs to the soul by means of concepts (*rationes*); in its fourth appearance, number partakes of the sensible world; in its fifth form, number is an image projected onto the imagination by the rational soul (*mathematicus, qui imago est ab anima rationali in phantasiam expromptus*). It is important to note that in each case the numerical is considered to be a generative power: as regards the soul, Piccolomini claims that number generates itself (*seipsum generans*), rotates on itself (*in seipsum conversivus*), and produces harmony (*ex numero harmonia consurgit*). Piccolomini's theory of number thus encompasses both an analogical discourse (the numerical structure of reality) and an ontological discourse (number appears as principle, idea, concept, projection and part of the sensible world).

The Neoplatonic undercurrent of Piccolomini's theory of number is hard to miss. Iamblichus and Syrianus should, I think, be named as his main sources.³⁵ In his *De communi mathematica scientia*, which, as was demonstrated by Dominic O'Meara,³⁶ has to be read as the third book of a larger work on Pythagoreanism, Iamblichus ascribes a similar division to the Pythagoreans. There is number associated with the gods (ποῖοι τινες ἀριθμοὶ ποίοις θεοῖς συγγενεῖς εἰσι καὶ ὁμοφυεῖς), intellectual or ideal number (ἀριθμὸς εἰδητικός), number moving itself (αὐτοκίνητος ἀριθμός), and physical number in the heavens and the sensible realm.³⁷ Remarkably, Piccolomini's fifth category, 'mathematical number', is lacking. Iamblichus appears to suggest that for the Pythagoreans proper mathematical study takes place at the level of number moving itself.³⁸ The matter is, I think, further elucidated by Syrianus. In his commentary on *Metaphysics M* and *N* Syrianus sketches a similar, slightly modified division of number. After the principle of the One, follows the pair of the Monad (μονάς) and the Dyad (δύάς); that is, the Limit (πέρας) and the Infinite (ἄπειρία).³⁹ Most likely, this level is identified by Piccolomini with the divine numbers (*numeri divini*). The pair

35 Both Iamblichus' *De secta pythagorica* and Syrianus' commentary on *Metaphysics M* and *N* were known in the early modern period. Ficino, for example, translated Iamblichus' work (preserved in MS Vat. lat. 4530) probably before 1464; see Christopher Celenza, 'Pythagoras in the Renaissance: the case of Marsilio Ficino', *Renaissance Quarterly* (1999) 52, pp. 667–711, 692–693. Syrianus' commentary was translated by Hieronymus Bagolinus: *Syriani antiquissimi philosophi interpres in II, XIII et XIV libros Aristotelis Metaphysices commentaries*, Venice, 1558. Piccolomini mentions Syrianus' work in his *Naturae totius universi scientia perfecta atque philosophica*, p. 399 – I follow the second edition, Frankfurt, 1628.

36 Dominic O'Meara, *Pythagoras Revived: Mathematics and Philosophy in Late Antiquity*, Oxford: Clarendon Press, 1989.

37 Iamblichus, *Comm. Math.*, 63, 23–64, 19. See O'Meara, op. cit. (36), p. 79.

38 Iamblichus, *Comm. Math.*, 64, 4–6.

39 Syrianus, in *Metaph.*, 112, 31 ff. See John Dillon and Dominic O'Meara (trans.), *Syrianus: On Aristotle's Metaphysics 13–14*, London: Duckworth, 2006, p. 5.

Monad–Dyad subsequently generates the world of Ideas and the corresponding ideal numbers, termed *numeri substantiales* by Piccolomini. Presumably, these ideal numbers can be equated with the Decade – both the whole and the parts – since the Decade contains all possible relations and ratios based upon which all remaining numbers can be constructed.⁴⁰ The analogical discourse about the (intelligible) world is then justified as well: as a product of the pair Monad–Dyad the intelligible realm is a numerically ordered network. Moreover, the Ideas themselves also form a Decade, in as far as they are the all-encompassing model for the sense world.⁴¹

On the level of the soul, Syrianus distinguishes between two kinds of mathematical number: essential number (οὐσιώδης μαθηματικός), for example the undivided essence ‘five’, which was placed in the soul by the Demiurge, and monadic number (μοναδικὸς μαθηματικός), namely the proper mathematical number that contains several units and is therefore divisible, multipliable, and so on.⁴² For Syrianus as well, physical numbers – the numerical properties by means of which physical phenomena can be explained – are located at the lowest level.⁴³ The latter are referred to by Piccolomini as *numeri naturales*.

Unlike Iamblichus, Syrianus calls into being a fifth category by distinguishing between conceptual and monadic number. This division coincides with Piccolomini’s distinction between *numerus animarius*⁴⁴ and *numerus mathematicus*. Syrianus describes the production of monadic number by the soul as a form-giving act, namely as the projection of conceptual number in/upon dianoetic matter (διανοητὴ ἢ ὕλη).⁴⁵ O’Meara rightly observes the similarity with the psychic creation of geometrical figures as projections of innate concepts, as presented in Proclus’ *Commentary on the First Book of Euclid’s Elements*.⁴⁶ However, a completely worked-out comparison falls short, because the material component of geometrical figures, namely intelligible matter/imagination, can exist *apart from* the projections, whereas the material substrate of mathematical number can only co-exist with the imposed form.⁴⁷ In other words, dianoetic matter only appears in the creative act: the units of mathematical number emerge together with the generated form, and do not precede it. Although Syrianus holds to the idea of mathematical number as a combination of matter and form, he situates discursive matter at a higher psycho-ontological level than imagination.⁴⁸ Yet the seeming parallel with Proclus’ and Simplicius’ views on the genesis of geometrical figures explains, I think,

40 Dillon and O’Meara, op. cit. (39), p. 6.

41 O’Meara, op. cit. (36), p. 135.

42 Syrianus, in *Metaph.*, 88, 7–9 and 123, 19–20.

43 O’Meara, op. cit. (36), p. 134.

44 Piccolomini uses the uncommon adjective *animarius* as equivalent for the Greek ψυχικός, since, according to Syrianus, this number belongs to the soul.

45 Syrianus, in *Metaph.*, 133, 4–15.

46 O’Meara, op. cit. (36), p. 133.

47 See Ian Mueller, ‘Syrianus and the concept of mathematical number’, in Gerald Bechtle and Dominic O’Meara (eds.), *La philosophie des mathématiques de l’Antiquité tardive*, Fribourg: Ed. universitaires, 2000, pp. 71–83, 77: ‘Syrianus first points out that the material component of numbers never appears separately from the formal component (just as unformed matter never occurs in the ordinary world)’.

48 Mueller, op. cit. (47), p. 78.

Piccolomini's conception of mathematical number as an image projected by the soul onto the imagination (*imago ab anima rationali in phantasiam expromptus*), although he brushes aside Syrianus' distinction between intelligible and dianoetic matter. Imagination now turns into the matter and receptacle of numbers as well.

Imagination and geometry: Piccolomini and (?)Simplicius

In Book VII, Piccolomini works out a parallel ontology and epistemology with reference to geometrical figures.⁴⁹ Apart from the level of the numerical principles into which geometrical objects resolve (*in numeros resolvuntur, & eorum essentia numeri sunt*), Piccolomini suggests that geometrical objects can be found at all resulting steps of the ladder of reality, albeit each time in an adapted form: a *figura substantialis, animaria, naturalis* and *mathematica*.⁵⁰ He mentions the existence of the undivided and accurate figure (*figura individua & exactissima*)⁵¹ on a par with substantial number, and the existence of inborn concepts in the soul (*rationes animae insertae*). Here as well, imagination seems to be the place where geometrical figures appear as such. In the light of the above, it is strange that Piccolomini nonetheless asserts that mathematics deals with objects of the sensible world:

Mathematics, which is called the most certain of sciences, is by no means a science: on the one hand, because it does not deal with intelligible, but sensible objects; on the other hand, because it is not practised by means of the principles of a science ... The forms considered by the mathematician are indeed projected by the soul onto the faculty of imagination by means of concepts, as Simplicius has shown clearly together with Proclus. Nevertheless, the mathematician does not know the concepts and is not elevated towards them, and even less towards the Ideas: for knowing by means of concepts is different from knowing concepts.⁵²

It is beyond doubt that in this passage 'mathematics' should be understood to mean geometry: geometry is the mathematical science that studies forms (*formae*) in the imagination, and Proclus did not develop a parallel theory of projection with respect to arithmetic. At first sight Piccolomini's statement can be read as an echo of Proclus' criticism of the use of images in geometry: geometry is not able to rise above the divided projections in the imagination and can therefore only indirectly grasp the essential definitions with which discursive thought is equipped.⁵³ However, a second reading of the text brings to light a bizarre difference from the Neoplatonist's point of view. Piccolomini mentions the projection of geometrical figures *by means of* concepts

⁴⁹ Piccolomini, op. cit. (6), p. 268 ff.

⁵⁰ Piccolomini, op. cit. (6), p. 269.

⁵¹ Piccolomini, op. cit. (6), p. 270.

⁵² Piccolomini, op. cit. (6), pp. 352–353: 'Mathematica, quae certissima dicitur scientiarum, minime est scientia: tum quia non de intelligibilibus, sed de sensibilibus est: tum insuper, quoniam non traditur per principia scientiae ... Promuntur quidem in facultatem imaginandi formae illae, quae a mathematico considerantur, ab anima per rationes; ut cum Proclo etiam Simplicius manifestavit; attamen Mathematicus rationes eas non cognoscit, nec ad eas, & longe minus ad ideas elevatur: aliud enim est cognoscere per rationes, & cognoscere rationes'.

⁵³ Proclus, in *Eucl.*, 55, 5 ff.

(*per rationes*), whereas in Proclus the concepts themselves are projected.⁵⁴ In discussing the way in which knowledge of the idea ‘circle’ is established, Piccolomini holds on to this indirect use of the innate concepts. When someone explains to us the definition of a circle, he writes, we will first consider some material image or copy (*consideratur simulacrum & imitatio quaedam in materia recepta*).⁵⁵ At that moment, however, we realize that the depicted circle is not a true circle (*quod ille non est verus circulus*). From that experience, by means of the stimulus given by the image, and by means of an inborn concept in the soul (*per rationem animae insertam*), we project the innate figure of a circle (*expromimus ingenitam circuli formam*).⁵⁶ This seemingly small difference, namely the insertion of the preposition *per*, lays bare a fundamental difference between both views.⁵⁷ The intervention allows Piccolomini to safeguard both the idea of geometry as an abstracting science and the existence of inborn concepts in the soul. From this perspective the Aristotelian and (Neo)platonic approaches of mathematics do not conflict with one another. But which ingenious shift is brought about by the introduction of a tiny preposition? How exactly do geometrical objects come into being from Piccolomini’s perspective? Although Piccolomini’s reference to Proclus may seem unfounded and incorrect, (?)Simplicius offers a way out of the impasse ‘abstraction’ versus ‘innate concepts’. In his commentary on the third book of Aristotle’s *De Anima*, (?)Simplicius gives the following account of the role played by imagination in the projection of mathematical concepts:

Imagination itself is stimulated to project imaginary impressions in accordance with corresponding concepts and similar to sensible forms. Sometimes it needs sensible impressions to project similar [impressions], not once or twice, but more often. But when [imagination] is stimulated, it projects the images from itself, and models and forms the figure from itself, either similar to the way in which it makes the forms of sensible objects, or by adding accuracy, like when [it projects] a straight line without breadth and figures that are fully accurate.⁵⁸

54 Proclus, *in Eucl.*, 54, 27–55, 6: ‘For the understanding contains the ideas but, being unable to see them when they are wrapped up, unfolds and exposes them and presents them to the imagination sitting in the vestibule; and in imagination, or with its aid, it explicates its knowledge of them, happy in their separation from sensible things and finding in the matter of imagination a medium apt for receiving its forms’. Cf. Proclus, *in Eucl.*, 141, 4–7: ‘Therefore just as nature stands creatively above the visible figures, so the soul, exercising her capacity to know, projects on the imagination, as on a mirror, the ideas of the figures; and the imagination, receiving in pictorial form these impressions of the ideas within the soul, by their means affords the soul an opportunity to turn inward from the pictures and attend to herself’. All translations from Proclus’ commentary on Euclid are from Glenn R. Morrow (tr.), *Proclus: A Commentary on the First Book of Euclid’s Elements*, Princeton: Princeton University Press, 1992, with some modifications.

55 Piccolomini, op. cit. (6), pp. 344–345.

56 Piccolomini, op. cit. (6), p. 345.

57 Motta oversimplifies matters when he states that Piccolomini simply copies Proclus’ system; see Motta, op. cit. (14), p. 30.

58 (?)Simplicius, *in de Anima*, 214, 5–11: ‘αὐτὴ ἡ φαντασία ἐγείρεται πρὸς τὴν κατ’ οἰκείου λόγου τῶν φανταστικῶν τύπων προβολὴν οἰκείως τοῖς αἰσθητικοῖς εἶδεσιν, οὐχ ἅπαξ ἢ δις ἐνίστε μόνον τῶν αἰσθητικῶν δεηθεῖσα τύπων ἀλλὰ καὶ πλεονάκις πρὸς τὴν τῶν ὁμοίων προβολὴν. ἐγερθεῖσα δ’ οὖν καὶ ἅφ’ ἑαυτῆς προβάλλει τὰ φαντάσματα καὶ τυποὶ καὶ διαμορφοὶ τὸ σχῆμα ἅφ’ ἑαυτῆς ἢ ὁμοίως τοῖς εἶδεσι τῶν αἰσθητῶν ἢ καὶ τὸ ἀκριβὲς προστιθεῖσα, ὥς καὶ τὴν ἀπλατὴν προτείνουσα εὐθείαν καὶ σχήματα τὰ ἀκριβέστατα’.

The very same Simplicius who was reviled by Piccolomini in the introduction as a naive reconciler between Plato and Aristotle is here gratefully introduced as an authority. In a first phase imagination mirrors sense perception: imagination is stimulated by sensory impressions and projects similar images, according to (?)Simplicius. When this occurs a sufficient number of times, imagination acquires a certain autonomy: it no longer needs the stimulus of the senses and is able to project images whenever it wishes. However, in the case of geometrical figures, we are not dealing with genuine reproductions, since the inborn concepts are used to provide the abstracted – here, separated from matter – images with an accuracy (*ἀκρίβεια*) that cannot be found in the sensible world, for example the ‘being without breadth’ of lines and the ‘being perfectly round’ of circles. In his *Peripateticae de anima disputationes* Piccolomini explicitly calls imagination the faculty that occasions mathematical abstraction by separating the common sensibles – in this case number and shape – from the individual sensibles (*sumere ortum ab imaginatione, quae sensile commune seorsum a praesentia materia valet seiungere a proprio*).⁵⁹ What is more, Piccolomini appears to indicate that mathematical numbers are also abstractions instead of projected innate concepts. One can therefore suppose that from Piccolomini’s point of view mathematical numbers come into being *per rationes* as well, although he only writes that mathematical number (*numerus mathematicus*) is an image projected in the imagination by the rational soul (see above). Yet it seems plausible that Piccolomini dealt with both parts of pure mathematics from an analogic ontological and epistemological perspective.

By exploiting (?)Simplicius’ idea of imagination as perfecting and idealizing (copies of) sensory impressions based on innate concepts, Piccolomini does more than just establish a synthesis between abstractionist and projectionist accounts of mathematics. First, by introducing imagination as a faculty that tunes and refines its objects by means of innate concepts, he explains the incongruence between the imperfect material circles in the sensible world and the perfectly round circles in the geometer’s imagination. Second, this view can be incorporated within the traditional Aristotelian paradigm of a reproductive imagination. Elsewhere, Piccolomini clearly shows that he considers imagination to be exclusively connected with data gained from sense perception.⁶⁰

Conclusion: Piccolomini’s synthesis

Piccolomini’s reception of (?)Simplicius’ commentary on the third book of *De Anima* clearly reflects the complicated position in which sixteenth-century philosophers and mathematicians found themselves when faced with the challenging views of the Greek commentators. Piccolomini’s way of responding to the (Neo)platonic claim that only the existence of innate mathematical concepts can account for the incongruence between the imperfect geometrical objects in the sensible world and the perfect figures in the

⁵⁹ Piccolomini, *Peripateticae de anima disputationes*, p. 146.

⁶⁰ Piccolomini, op. cit. (59), p. 155: ‘quia ex se cum quadam libertate novas imagines formare valet, sumpto tamen semper initio ab illis quae sub sensum cadunt’: ‘because imagination is able, with a certain liberty, to form new images from itself, albeit always starting from things that fall under sense perception’.

geometer's mind is to stretch the traditional boundaries of the early modern metamathematical framework to the limit. By appealing to (?)Simplicius' notion of imagination, Piccolomini is able to establish a synthesis between Aristotelian abstractionism and (Neo)platonian innatism that saves geometrical figures as abstractions from sensible matter, and imagination as a reproductive faculty. Nevertheless, Piccolomini cannot but violate the Aristotelian credo *nihil est in intellectu, quod non prius fuerit in sensu*.

The originality of Piccolomini's undertaking lies in the fact that he endorses the (Neo)platonian viewpoint just mentioned, and takes it as his starting point to explore and even question the limits of the traditional metamathematical framework. In this respect, he fundamentally differs from contemporary mathematicians like Alessandro Piccolomini (1508–1579) and Francesco Barozzi (1537–1604), who worked – so to speak – the other way around.⁶¹ Although they were both well acquainted with the (Neo)platonian perspective (particularly via Proclus' *Commentary on the First Book of Euclid's Elements*), it was in the first place the elasticity of the Neoplatonic concepts that was put to the test, and not the flexibility of the overarching Aristotelian account of mathematics. Alessandro Piccolomini, for example, assimilated Proclus' concept of a productive imagination into a traditional, abstractionist perspective, by brushing aside some of its crucial features.⁶² Perhaps, for Piccolomini, the conciliatory goal of the *Academicarum contemplationes* created a space in which the presuppositions of the traditional Aristotelian framework could not only be scrutinized but even temporarily suspended.

61 See Guy Claessens, 'Clavius, Proclus, and the limits of interpretation: snapshot-idealization *versus* projectionism', *History of Science* (2009) 47, pp. 317–336, 322–326.

62 Claessens, op. cit. (61), pp. 319–322.