Mixture in Philoponus: an encounter with a Third Kind of potentiality

Haas, F.A.J. de; Sorabji, R.R.K.

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Mixture in Philoponus: An Encounter with a Third Kind of Potentiality[1]

Frans A. J. de Haas

From Antiquity onwards readers of Aristotle's *De Generatione et Corruptione* (*GC*) have struggled with the notion of potentiality that is the foundation of Aristotle's theory of mixture. In *GC* 1.10, 327b22–31 Aristotle claims that ingredients somehow remain present in the resulting mixture in potentiality (*dunamei*). Only in this way, he explains, is it possible to extract the ingredients from the mixture and to restore them to their previous being in actuality (*energeiai*). But what does it mean for ingredients to exist in potentiality if a mixture (*mixis*) is a genuine unity sharply to be distinguished from a mere aggregate (*sunthesis*) as Aristotle stipulates in the same chapter? Do the ingredients not simply perish, so that Aristotle has recourse to a mysterious kind of potentiality only to meet his requirement that the ingredients can be extracted from the mixture again? The problem gains momentum when we realise that Aristotle's theory of mixture is crucial to his view of the constitution of the physical world. According to Aristotle each and every composite in the sublunary realm is a mixture of all four elements.[2] The homeomerous materials, such as blood, bile, bone, and flesh consist in such a mixture; they in turn make up the anhomeomerous parts of sublunary substances, such as face and hands. Without the theory of mixture, therefore, the material composition of every entity over and above the elements would remain completely unaccounted for.

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[1] This paper has much profited from discussions with audiences at the Universities of Amsterdam and Groningen, as well as from the insightful comments of Richard Sorabji, Sylvia Berryman, and my colleagues at the Utrecht University Department of Philosophy: Jaap Mansfeld, Keimpe Algra, Cees Leijenhorst, and Irma Croese. Over the past three years my research was supported in turn by the Foundation for Research in the Fields of Philosophy and Theology (SFT), subsidised by the Netherlands Organisation for Scientific Research (NWO); The Niels Stensen Foundation; and at present the Royal Netherlands Academy of Arts and Sciences.

[2] See Aristotle, *GC* 2.7, 334b16–18; 2.8 *passim*.

In a rather neglected Renaissance study of this problem, Jacopo Zabarella's *De mistione*,[3] we find a neat classification of the solutions its author has found in his sources:

1. the substantial forms of the elements are preserved integrally, but the basic qualities are reduced (cap. II: Avicenna),[4]
2. both the forms and the qualities are preserved in reduced actuality, which explains in what sense the elements cease to be in favour of the *forma misti* (cap. III: Averroes),[5]
3. both the forms and the qualities perish in the mixture and a new form and a new quality are generated, which exhibit only a degree of similarity with the original forms and qualities (cap. IV: Duns Scotus),[6]
4. the forms perish entirely, but the qualities are preserved in reduced actuality, which is apparent from the fact that their potencies (*vires* or *virtutes*) are found in the mixture (cap. V: Marsilius of Inghen,[7] Thomas Aquinas,[8] Aegidius Romanus,[9] Ludovicus Buccaferreus,[10] etc.).

[3] The *De mistione* is contained in Jacobus Zabarella, *De rebus naturalibus libri XXX. In Aristotelis libros De anima* (Frankfurt, 1606–7; repr. Frankfurt, 1966).

[4] Cf. Avicenna, *Liber tertius naturalium de generatione et corruptione* (ed. Van Riet), cap. 7: *Capitulum de destructione cuiusdam novae opinionis in mixtione elementorum*. The action and passion of the elementary qualities presupposes the actual presence of the elements themselves, whose essences should not be identified with the activities they give rise to.

[5] Cf. Averroes, *Commentarium medium in Aristotelis GC* (contained in *Aristotelis opera cum Averrois commentaria* (Venice, 1562–74; repr. Frankfurt, 1962), vol. 5) comm. 82–90 (pp. 86–94); cf. the *Paraphrasis*, pp. 392–3, and *in Cael.* Comm. 67 (pp. 227–8).

[6] Cf. Duns Scotus, *Reportata Parisiensia Super Sententias* lib. 2, dist. 15, q. un. (ed. Vivès, vol. 23): *Utrum maneant elementa in mixto.* Here Scotus explicitly opposes both Avicenna and Averroes by insisting that pluralities are never to be posited unnecessarily, *numquam sunt plura ponenda sine necessitate:* there is only a single *forma mixti* present in the compound. The forms of the elements merely exist *in virtute* in the sense in which any higher order form (e.g. rational soul) subsumes lesser forms (e.g. vegetative and sensitive soul) in a new unity, with the lesser forms surviving neither integrally (Avicenna) nor in reduced actuality (Averroes).

[7] Cf. Marsilius, *Quaestiones in libros de generatione et corruptione* (Venice, 1505; repr. Frankfurt, 1970), lib. 1, q. 22 *Utrum elementa maneant formaliter in mixto*, esp. p. 95ra. Cf. in the same volume Albert of Saxony, *Quaestiones in libros de generatione et corruptione* lib. 1, q. 19, esp. p. 145^{v}.

[8] Cf. Thomas Aquinas, *De mixtione elementorum*, in vol. 43 of the Leonine edition (Rome, 1976).

[9] Cf. Aegidius Romanus, *Commentaria in libros de generatione et corruptione* (Venice, 1505; repr. Frankfurt, 1970), esp. comm. 90. This line of argument can also be found in Boethius of Dacia, *Quaestiones de generatione et corruptione*, ed. Sajó (Hauniae, 1972), vol. 5, pars I, q. 52b.

[10] Cf. Ludovicus Buccaferreus, *In duos libros de generatione & corruptione Aristotelis commentarius* (Venice, 1571), textus 82 ff., pp. 122 ff., see esp. p. 124 for the potency which is called an intermediate potency, *potentia quadam quae dicitur potentia media* being explicitly attributed to 'Johannes' *sc.* Philoponus with whom Buccaferreus claims he is going to dissent. He deals with the question *An elementa remaneant in mixtione secundum eorum substantiam* on pp. 132b ff. with his own opinion on pp. 141v-142r. Buccaferreus defends the opinion that in a mixture all forms, both substantial and accidental, perish. The elements remain only with respect to their primary qualities in a single *complexio.* Rather indiscriminately, he sides with almost every predecessor who stated that the elements remain not *formaliter* but merely *virtualiter* in any sense of the term. All in all Buccaferreus seems to have had a different approach to our problem from Zabarella and therefore he distributes his ancient and medieval predecessors differently. This is not the place to compare their accounts of mixture in more detail.

As it turns out, the second view is the one Zabarella himself supports. Hence this view is most elaborately discussed and defended in chapters 7–13 of the *De mistione*. In chapter 10 Zabarella claims that his view is supported by 'the Greek commentators', to wit Alexander's *De mixtione*[11] and Philoponus' *in GC*.[12] As we shall see, Zabarella's presentation of his sources is not to be trusted entirely. Even if we assume he had access to the original sources the wish to produce ancient authorities for his own position may have influenced his judgement.

A first glance at the four positions reveals that unlike Aristotle they all distinguish between the *forms* of the ingredients and their *qualities*. Moreover, they speak of 'reduction' or 'reduced actuality' of forms and/or qualities where Aristotle used the term 'in potentiality' to describe how the ingredients are preserved in the mixture. This paper will focus on the background of these two characteristics of Zabarella's classification. Why and how did the distinction between forms and qualities become relevant to the problem of mixture, and what does it mean for a form or quality to be preserved in 'reduced actuality'?

Zabarella points to Alexander (fl. 205 CE) and Philoponus (± 485–570 CE) as his ancient sources for the view he favours. Here I shall focus mainly on Philoponus' *in GC*, which is still influential in modern times,[13] with a brief look at Alexander as a source of inspiration for Philoponus, and a more elaborate look at Proclus and Simplicius who provide a Neoplatonic alternative to Philoponus' view of mixture. First, however, a survey of the relevant statements in Aristotle is called for.

[11] Alexander's *De mixtione* (ed. I. Bruns, Supplementum Aristotelicum 2.2 (Berlin: Reimer, 1892), pp. 213–38) is an independent treatise attacking the Stoic theory of mixture and defending Alexander's own Peripatetically inspired concept of mixture. For a translation and commentary see R. B. Todd, *Alexander of Aphrodisias on Stoic Physics: A Study of the De mixtione with Preliminary Essays, Text, Translation, and Commentary* (Leiden: Brill, 1976).

[12] Eiteded by H. Vitelli (CAG 14.2). Zabarella (1533–89) may have had access to the Aldine edition of the Greek text of this commentary (Venice, 1527, with a preface by Andreas Ausulanus), which was reprinted with slight variations. In the Aldine edition Philoponus' commentary is conveniently combined with Alexander's *De mixtione* in a single volume: *Ioannes grammaticus in libros de generatione et interitu. Alexander Aphrodisiensis in meteorologica. Idem de mixtione*. According to Vitelli, p. x, this edition was perhaps based on (a descendant of) the inferior manuscript Marcianus Ven. 232 (= T) dating from the fourteenth century. Zabarella may also have used the Latin translation of Philoponus' commentary by Hieronymus Bagolinus of Verona (Venice, 1549 and reprints), which closely follows the Aldine text. However, Zabarella's Latin technical vocabulary is entirely different from Bagolini's. For example, for *eilikrinôs* Zabarella has *perfecte* throughout, whereas Bagolini prefers *syncere*; for *kekolasmenos* Zabarella has *obfuscatus, impuratus, incompletus, imperfectus* where Bagolini prefers *temperatum*, *castigatum*; for *tas huperbolas kolazei monon* Zabarella has *frangere mutuo excellentias suas* where Bagolini translates *excessus domet solum*. Hence, it seems likely that Zabarella gives his own rendering of the Greek text – whether he knew the Bagolini translation or not.

[13] Cf. H. H. Joachim, *Aristotle On Coming-to-Be and Passing-Away* (Oxford: Clarendon Press, 1922), p. ix: 'The commentary of Philoponos is very valuable as an aid to the interpretation of Aristotle's treatise, and I have used it freely in my notes'; C. J. F. Williams, *Aristotle's De Generatione et Corruptione* (Oxford: Clarendon Press, 1982), index s.v. 'Philoponus'.

Aristotle

How and *why* did Aristotle introduce the potentiality of mixed ingredients?[14] It serves as the solution to a problem raised at the beginning of chapter 1.10 of the *De Generatione et Corruptione,* 327a34-b6. Aristotle tells us that some people[15] claim that mixture does not exist. In the sample case[16] of a mixture of two ingredients

1. either the two ingredients are preserved unaltered (*Preservation*), or
2. one of the two perishes because it is overcome by the other (*Domination*), or
3. both perish (*Corruption*).

The opponents point out that in the case of Preservation it makes no sense to speak of a *mixture* of the ingredients because this state is indistinguishable from the unmixed state. The case of Domination is a case of generation & corruption instead of mixture, and violates the principle that all mixed ingredients should be on an equal footing in the mixture. In the case of Corruption it makes no sense to speak of a mixture *of these ingredients* since both of them have perished in the process. Hence mixture does not exist.

If Aristotle wants to hold onto the notion of mixture (which he does), it seems fair to assume that he will try to show *both* (I) that mixture does not collapse into generation and/or corruption, neither in part (against 2) nor in whole (against 3), *and* (II) that mixture consists in a genuine change of the mixables (against 1). Indeed, in *GC* 1.10, 327b6–10 Aristotle announces that the problem set out earlier can be solved when two differences are brought to light, the first between mixture and generation & corruption, the second between what is mixable (*mikton*) and what is generable & corruptible (*gennêton*, *phtharton*). These two differences are the topic of the remainder of *GC* 1.10,

[14] The literature on Aristotle's theory of mixture is extensive. Apart from the classics H. H. Joachim, 'Aristotle's Conception of Chemical Combination', *Journal of Philology* 29 (1904), 72–86; Joachim (n. 13 above); W. J. Verdenius and J. H. Waszink, *Aristotle on Coming-to-Be and Passing-Away: Some Comments*, 2nd edn (Leiden: Brill, 1966), and Williams (n. 13 above), I have found most useful the exchange between R. Sorabji, 'The Greek Origins of the Idea of Chemical Combination: Can Two Bodies be in the Same Place?', *Proceedings of the Boston Area Colloquium in Ancient Philosophy* 4 (1988), 35–63 and J. G. Lennox, 'Commentary on Sorabji', *Proceedings of the Boston Area Colloquium in Ancient Philosophy* 4 (1988), 64–75; R. Sorabji, *Matter, Space, and Motion: Theories in Antiquity and Their Sequel* (London: Duckworth, 1988), ch. 5; A. Code, 'Potentiality in Aristotle's Science and Metaphysics', in F. A. Lewis and R. Bolton, eds, *Form, Matter, and Mixture in Aristotle* (Oxford: Blackwell, 1996), pp. 217–30; and E. Lewis, *Alexander of Aphrodisias, On Aristotle Meteorology 4* (London: Duckworth, 1996), esp. pp. 42–4. On potentiality in Aristotle and his interpreters see also E. McMullin, 'Four Senses of Potency', in E. McMullin, ed., *The Concept of Matter* (Notre Dame: University of Notre Dame Press, 1965), pp. 295–315.

[15] In view of the Zenonian structure of the argument R. Kent Sprague, 'An Anonymous Argument against Mixture', *Mnemosyne* 26 (1973), 230–3, has suggested that the argument derives from neo-Eleatic sophistical contemporaries of Aristotle's. However, since she is not convinced by Aristotle's solution she tends to overestimate the power of the argument and believes that Aristotle's theory is actually defeated by it. Cf. also Verdenius and Waszink (n. 14 above), pp. 47–8.

[16] For simplicity's sake the argument is confined to the case of a mixture of two ingredients, whereas Aristotle's more considered view is that each sublunary mixture contains all four elements, cf. *GC* 2.8.

327b10–31. In my view Aristotle only aims to achieve (I) in *GC* 1.10. For a discussion of (II) we have to wait until *GC* 2.7.[17]

In order to establish a difference between mixture and generation & corruption Aristotle has to defuse the radical distinction between being and not-being on which the argument of his opponents turns. He achieves this by introducing the famous distinction between actual and potential being. Here is how Aristotle introduces the potentiality of mixed ingredients:[18]

> Since, however, some things that are, are in potentiality, and some in actuality, it is possible for things that have been mixed, in some way to be and not to be. For that which has come to be from them [i.e. the mixture] is something else in actuality, whereas each [of them] is still in potentiality what they were before they were mixed, i.e. has not been destroyed[19] – which the previous aporetic argument tried to show.[20] Moreover, it is manifest that things that are mixed come together from having formerly been separate, and are capable of being separated again. So neither do they both remain in actuality like the body and its whiteness,[21] nor do they perish – either of them or both – because their potentiality is preserved.
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> *GC* 1.10, 327b22–31, trans. after Williams

The actuality-potentiality distinction clearly addresses the distinction between separation and the specific type of unification found in a mixture, i.e. a unification of things that have formerly been separate. The previous analysis of the problem yields that if mixture is to exist next to generation & corruption the ingredients cannot have

[17] Contrary to later interpretations, I do not believe that *GC* 327b30–1 'their *dunamis* is preserved', refers to the powers of the elementary qualities hot, cold, moist, and dry for the simple reason that Aristotle has not yet introduced these powers at this stage. Instead, I take it that after rejecting Preservation, Domination and Corruption in 327b29–30 Aristotle uses 'their *dunamis*' to pick up the *dunamei* of 327b25; 'their potentiality' is equivalent to 'their potential existence'. For the alternation between *dunamis* and *dunamei* in this sense cf. e.g. *Metaph.* 9.6, 1048a25–35; 13.10, 1087a16.

[18] Aristotle, *GC* 1.10, 327b22–31.

[19] It is difficult to decide whether this tantalizing sentence allots the potential being to the ingredients, or the mixture. Keimpe Algra suggested to me the following alternative translation: let 327b25–6 *hekaterou* be the subject complement on a par with 327b25 *heterou*, and *tou gegonotos ex autôn* the grammatical subject throughout: 'For that which has come to be from them [i.e. the mixture] is something else in actuality, whereas *it* [i.e. the mixture] is still in potentiality each [of the things] that were before the mixture occurred, and have not been destroyed.' Cf. Philoponus, *in GC* 191,16–17. Although it seems that neither alternative can be ruled out, I have a slight preference for the translation adopted in the text because it keeps the grammatical focus on things that have been mixed (*ta mikhthenta*) rather than shifting to the mixture and reverting to things that are mixed (*ta mignumena*) again in the sequel 327b27 ff. Cf. H. H. Joachim in J. Barnes, ed., *The Complete Works of Aristotle: The Revised Oxford Translation*, 2 vols (Princeton: Princeton University Press, 1984), vol. 1, p. 536.

[20] Cf. H. H. Joachim in J. Barnes (see previous note), p. 536: 'This was the difficulty that emerged in the previous argument'. Contrast Williams (n. 13 above), p. 34: 'This is the solution to the problem raised by the previous argument', which seems too much for the imperfect of *diaporein*. I suggest that the imperfect is intended to underline that the previous argument was still incomplete, and awaited Aristotle to bring out the implication just stated.

[21] From 327b15–17 it is clear that the union of body and whiteness and other affections and dispositions is not a mixture because this is an example of Preservation: their union leaves them untouched.

been destroyed. *Ipso facto* they must be capable of regaining their previous separate existence, as everyday examples such as the mixture of wine and water testify.[22] Judging from this text potential existence consists in this separability.[23]

In view of later interpretations it is important to note that Aristotle nowhere suggests that he attributes this potentiality to the primary qualities hot, cold, dry, and moist. As a properly dialectical argument *GC* 1.10 operates entirely within the confines of the initial problem and the obvious fact that mixture is opposed to separation. The latter gives rise to an analysis of separation and union from which mixture emerges as a specific kind of union *on these very terms*: it is a union of items all of which existed separately before they were united. Needless to say, the primary qualities are not such items. It is paramount to insist on the limited scope of *GC* 1.10, and, in consequence, the limited scope of the well-defined notion of potentiality introduced in it.

So far, Aristotle has shown how we may conceive of the mode of being of the ingredients of a mixture. However, we have not been presented with an account of the change the mixables undergo in order to be unified in a mixture, other than the suggestion that its beginning and end terms are separation and lack of separation. The concise closing statement of *GC* 1.10 that 'mixture is the unification of things altered' affirms that Aristotle is still aware that some kind of alteration is needed to escape the objection that mixture makes no difference (against 1). Yet, he has not given the slightest indication as to the nature of this alteration, in spite of the contrast between the sense of the term 'alteration' in the initial statement of the problem and in *GC* 1.4.[24]

[22] According to Stobaeus, *Ecl.* 1.17, 1,54,8–11 W (= *SVF* 2, p. 153,21–3) water and wine can be separated by means of an oil-drenched sponge; see Todd (n. 11 above), p. 241 *ad* 232,2–5 with S. Sambursky, 'On Some References to Experience in Stoic Physics', *Isis* 49 (1958), 331–5, at 332–3. Cf. Nemesius, *Nat. Hom.* 3, c. 128–9 (Moriani, p. 39c) where this example serves to illustrate the preservation of constituents in a blend below the level of perception, a theory attributed to Democritus by Alexander at *Mixt.* 2, 214,18–28 and similarly *Mixt.* 15, 232,18–20: 'such an alteration in these bodies entails that they be held capable of dissociation, because the body that was affected by them originally came to be from their mixture' (trans. Todd). Philoponus, *in GC* 191,29–31 explains that when a mixture of wine and water is pressed through water-lettuce only the water is drawn up, especially when the wine is thick. In commenting on Aristotle's claim that ingredients can be separated again Philoponus, *in GC* 191,31–192,4 carefully adds that even if there are no means to neatly separate the ingredients they should still be regarded as separable because they are capable of existing independently (*kath' heauta hupostênai*) insofar as depends on them (*hoson eph' heautois*). The tools fail to oblige the theory, not the ingredients.

[23] Here I have no space to elaborate on how precisely this separation is supposed to take place (but see Richard Sorabji, *Matter, Space and Motion* (n. 14 above), p. 103, n. 101). Cf. Joachim (n. 14 above), 81–6, stressing the importance of Aristotle, *Meteor.* 4.1. Most recently Lewis (n. 14 above), pp. 3–15, has convincingly defended the authenticity and importance of *Meteor.* 4 in the introduction to his translation of Alexander, *in Meteor.* 4.

[24] G. Morrow, 'Qualitative Change in Aristotle's *Physics*', in I. Düring, ed., *Naturphilosophie bei Aristoteles und Theophrast* (Heidelberg: Lothar Stiehm Verlag, 1969), pp. 154–67, provides a thoroughly Platonic interpretation of alteration in Aristotle. He believes that Aristotle does not succeed in upholding the distinction between alteration and generation (Morrow ignores the difference between change in form and change in the whole of both matter and form, Aristotle, *GC* 1.2, 317a23–7). Morrow aims at showing that in spite of Aristotle's claims to the contrary (*Phys.* 5) alteration is not in fact a primary kind of change in Aristotle's physics. The qualitative changes surrounding the transformation of the elements and mixture are a case in point (pp. 159–61, 164–5). As I hope to show elsewhere this interpretation shows a remarkable affinity with the ancient Neoplatonic approach to Aristotle's physics.

We have to wait until *GC* 2.7 before more is revealed about the alteration of the mixables. In *GC* 2.1–6 Aristotle has developed a sophisticated theory of the nature and role of the primary qualities hot, cold, moist, and dry in the constitution and change of the elements 'out of' each other. In *GC* 2.7 Aristotle points out that if we want to say that homeomerous materials like flesh and marrow are 'out of' the elements, a different understanding of the phrase 'out of' is needed. If flesh is constituted 'out of' e.g. fire and earth, we seem to have two options:

i. fire and earth both perish so that flesh is neither (which conflicts with the notion that flesh consists of *the elements*), or
ii. fire and earth are preserved which means that flesh is a mere combination (which conflicts with the notion of homeomereity).

This dilemma is similar to the argument against mixture discussed above, so it is not surprising that here the alternative of mixture comes in:

> [1.] Is there a possible solution along these lines, taking into account the fact that things can be more or less hot and cold? When one exists *simpliciter* in actuality, the other exists in potentiality; when, however, it is not completely so, but one is cold *qua* hot, the other hot *qua* cold, because in being mixed things destroy each other's excesses, then what will exist is neither their matter nor either of the contraries existing *simpliciter* in actuality, but something intermediate, which, in so far as it is in potentiality more hot than cold or vice versa, is proportionately twice as hot in potentiality as cold, or three times, or in some other similar way.
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> [2.] It is as a result of the contraries, or rather the elements,[25] having been mixed that the other things [*sc.* the homeomerous compounds] will exist, and the elements from them [*sc.* the compounds], which are in some way <the elements>[26] in potentiality, not in the same way as matter but in the way we have explained.[27] In this way what comes to be is a mixture, in that way it is matter.
>
> [3.] Since the contraries are also acted upon as stated in the definition in Book I – for the actually hot is cold in potentiality and the actually cold hot in potentiality,

[25] Cf. Verdenius and Waszink (n. 14 above), pp. 62–3.

[26] Joachim (n. 13 above), p. 243, and Verdenius and Waszink (n. 14 above), p. 62, read 'and the elements, which are in some way <the contraries> in potentiality, will come to be from [the contraries].' However, with G. A. Seeck, *Über die Elemente in der Kosmologie des Aristoteles: Untersuchungen zu "de generatione et corruptione" und "de caelo"* (Munich: Beck, 1964), p. 60, n. 1, they take 'or rather the elements' as an epexegetical addition to 'the contraries' (see previous note). Accordingly, we should take Aristotle as continuing with the elements (334b18, rather than the contraries) as the complement of the compounds. On this interpretation the structure 'the compounds out of the elements and vice versa' is set against 'one element out of another and vice versa' in order to bring out a different sense of 'out of' and a different sense of potentiality (see next note). Cf. also Philoponus *in GC* 275,31 ff. discussed below.

[27] i.e. as explained above in *GC* 1.10. Joachim refers to both 1.10, 327b22–31 and 2.7, 334b8–16 as if the same kind of potentiality were involved throughout. Verdenius and Waszink, in line with their understanding of the previous sentence, mistakenly refer to the theory of the reciprocal action of contraries in *GC* 1.7.

> so that unless they are in balance they change one into the other, and the same holds in the case of the other contraries – first, the elements change in this way; but flesh and bones and suchlike come from these <elements>, the hot becoming cold and the cold hot when they approach the mean, for here they are neither one thing nor the other, and the mean is large and not an indivisible point. Similarly dry and wet and suchlike produce flesh and bone and the rest in the middle range.
>
> Aristotle, *GC* 2.7, 334b7–30, trans. Williams, modified

Aristotle distinguishes between two kinds of potentiality rooted in the primary qualities. *Qua* opposites, they are potentially their opposites; *qua* contraries with latitude between them,[28] they are potentially any intermediate stage on the way towards their opposite. The realisation of these potentialities gives rise to two different changes, which affect the elements in two different ways. When primary qualities change into their opposite the elements suffer substantial change: they perish and are transformed into another element. When primary qualities change into an intermediate stage on their scale under the influence of mutual interaction, i.e. when 'they[29] destroy each other's excesses', the elements are mixed. The presence or absence of a certain balance between the primary qualities (on the same range) determines whether transformation or mixture occurs, as we already saw in the account of mixture. In short, both the transformation and the mixture of the elements depend on changes of the primary qualities.

At the same time the important distinction between mixture and generation & corruption is maintained because they are caused by different kinds of change of the primary qualities. What is more, since we are dealing with qualitative changes, mixture consists in a genuine change (against 1) which is not fatal to the nature of the mixables (against 2 and 3).[30] Since by definition mixture occurs when the qualitative changes are such as not to cause a transformation of the elements, the elements are preserved in the mixture. Finally, though in the initial argument of *GC* 1.10 the term 'alteration' remained ambiguous, it now turns out that the final statement 'mixture is the unification of mixables when altered' can be evaluated on Aristotle's terms: the mixables are unified as the result of a particular kind of *qualitative* change.[31]

Apart from the potentialities of the qualities to change into either their opposites or an intermediate degree, Aristotle seems to refer to the kind of potentiality he discussed

[28] Cf. *Cat*. 10, 12a9–25; *Metaph.* 10.7. These are the *emmesa enantia* of the later tradition.

[29] 'They' here refers to two qualities on the same scale, e.g. the hotness in fire and in air, or the hotness in fire and the coldness in earth. When fire and air, or fire and earth combine a mean is reached between the different degrees of temperature. Note that for Aristotle the difference between these opposites is relative to our sense of touch (*DA* 2.11, 424a2–7). In reality there is one range of temperature.

[30] It is a burning question whether it is convincing to regard a change in constitutive qualities as a merely qualitative change, but an exploration of this problem in Aristotle's view exceeds the limits of this paper. Here I am only concerned to show how Aristotle may have conceived of his solution judging from the two major texts used by the later tradition.

[31] The question how Aristotle could believe that such qualitative changes caused the unification and separation of mixables will have to remain open here.

in *GC* 1.10. Moreover, he claims that the homeomerous mixture is in potentiality the elements in this sense. Apparently, he does not feel the need to distinguish between this kind of potentiality as a mode of being of the ingredients in the mixture, and the potentiality of the mixture to yield the ingredients when analysed.[32]

We may conclude that the distinction between the forms and the qualities of the ingredients that we found in Zabarella has a basis in Aristotle's two-tiered discussion of mixture in *GC* 1.10 and *GC* 2.7. The problem of how to connect the two accounts raises a plethora of questions. Does Aristotle *reduce* mixture to the mutual blunting of the elementary qualities, and, hence, does he *reduce* the potentiality of the ingredients to the potentiality of the elementary qualities? If so, does this apply in all cases, or merely when the elements are concerned as in *GC* 2.7? Does the potentiality of the *ingredients* consist in the potentiality of their *forms*, although Aristotle does not mention them even once? If so, is the potentiality of the ingredients to be explained in terms of their being "blunted" as in the case of the qualities? Are the qualities of the elements *constitutive* of their essence and form? These and other questions Aristotle left for his commentators to ponder.

Philoponus[33]

In his introduction to the first part of *GC* 1.10 Philoponus duly summarises the problem Aristotle has to face: in a mixture either both ingredients are preserved, or they both perish, or one is preserved while the other perishes. As Philoponus will note further on in his textual commentary (*in GC* 189,10–17), this aporia demands a proper distinction between generation & corruption, and mixture. He states that Aristotle solves the problem by means of the distinction between potentiality and actuality (*in GC* 188,14–15) which he goes on to explain in the following way:

> [1.] In mixed wine both the water and the wine exist in potentiality. This is neither according to the first sense [of potentiality], i.e. in terms of suitability (*epitêdeiotês*) as water is air in potentiality; nor according to the second sense without qualification, i.e. in terms of mere disposition (*hexis*), like the sleeping geometer.
>
> [2.] But both the water and the wine are disposed in the mixture in the way in which a geometer who is drunk and trying to do geometry is in actuality with respect to disposition, though not purely. For each is actual in the mixture in a

[32] Cf. n. 19 above.

[33] Philoponus' main comments on mixture were already translated into German by W. Böhm, *Johannes Philoponos, Grammatikos von Alexandrien: Ausgewählte Schriften* (Munich: Schöningh, 1967), pp. 283–99, with extensive notes on their influence in Arabic and Medieval thought, pp. 450–4, which in effect summarise the pioneering results of A. Maier, *An der Grenze von Scholastik und Naturwissenschaft: Die Struktur der materiellen Substanz, Das Problem der Gravitation, Die Mathematik der Formlatituden*, 2nd edn (Rome: Edizioni di Storia e Letteratura, 1952), Part I: 'Die Struktur der materiellen Substanz'. There is a full English translation with notes of Philoponus' *in GC* by C. J. F. Williams (2 vols, 1999) and Inna Kupreeva (2005) in the series Ancient Commentaries on Aristotle, edited by Richard Sorabji.

> tempered mode (*kekolasmenôs energei*). So in this way both are preserved in potentiality though neither is preserved in actuality as it was originally. For their pure actuality has been tempered, and is not as it was before they were mixed.
>
> [3.] In this way, then, we shall escape all difficulties.
>
> Philoponus, *in GC* 188,16–26

In an attempt to locate the relevant kind of potentiality in Aristotle's philosophy Philoponus resorts to a comparison with the two kinds of potentiality that Aristotle distinguished in *De Anima* 2.5 in relation to both sense perception and knowledge.[34] A human being has *first* potentiality for knowledge when he is born, simply because as a human being he has a soul which is naturally disposed to acquire knowledge.[35] Aristotle notes that we say that someone can see or hear even when he is asleep (*DA* 417a11). Apparently, the potentiality is preserved even when physical causes prohibit its actualisation. In the physical context of mixture Philoponus uses the example of the transformation of water into air to illustrate first potentiality: water may turn into air (§1).

A human being who has acquired knowledge of a particular field (which is first actuality or disposition, *hexis*), e.g. a geometer or a grammarian, has *second* potentiality for knowledge. He is able to use the knowledge he possesses and to apply it to a particular case whenever he wishes, external circumstances permitting. A sleeping geometer does not lose his knowledge; he is merely incapable of using it until he wakes up.[36]

Philoponus claims that the potentiality of mixed ingredients is different from both first and second potentiality (§2). For although mixed ingredients retain their actuality (*hexis*) in the mixture, they do so in a reduced or tempered mode (*kekolasmenôs*).[37] This reduced actuality constitutes a separate type of potentiality,[38] viz. the potentiality to recover the previous purity of actuality. In the sequel Philoponus explains what actuality he has in mind: it is the actuality of the essential form of the ingredients.[39] Water and wine do not perish but continue to exist, and hence their actuality or form

[34] More detail is provided in a parallel passage in the *theoria* to *GC* 2.7 (271,1–24), to which I refer in the following notes and p. 423 ff.

[35] Cf. *An. Post.* 2.19, 100a13–14.

[36] Cf. *Phys.* 7.3, 247b13–16. Philoponus also regards sleep as an impediment, see *in GC* 271,7–10; however, contrary to Aristotle he seems to identify second potentiality with the state of a sleeping builder, or a builder who cannot apply his knowledge because he does not have the proper building materials.

[37] Cf. 198,26–7: 'it does not totally destroy, but only tempers (*kolazei*) the extremes'. See also 198,21–3: 'if a drop of wine is mixed with an increasing amount of water, first the quality is blunted (*amblunêtai*), and finally it changes completely (*pantelôs metaballei*)'. For the quality see also 202,12–13 and below p. 424.

[38] Here Philoponus seems to speak of a qualified instance of the second type, whereas in 271,14.16 he considers it as an independent meaning (*sêmainomenon*) of the term 'in potentiality', which is to be located between first and second potentiality (271,18); see below p. 423.

[39] Cf. 191,26–8: '. . . [Aristotle] means that mixed ingredients are naturally disposed to wholly recover their own form (*eidos*) by means of certain separating (cf. *diakritikon* at Alexander, *On mixture* 232,25) tools that cause alteration, because they have not lost their complete (*teleion*) form but only its purity (*eilikrines*)'; cf. 192,11–14, esp. 12: 'the forms themselves tempered'.

is not lost. Nevertheless, the mixture does affect them in that their actuality or form is somehow tempered.[40]

The example of the drunken geometer (§2) explains the character of this third kind of potentiality.[41] Unlike the sleeping geometer (§1), a drunken geometer may still try to use the knowledge he possesses. However, the intoxication affects the disposition of the geometer and keeps him from reaching full second actuality (i.e. a successful application of geometrical knowledge). This example concerning *second* actuality (188,21–3) serves to introduce the notion of tempering which Philoponus then applies to the *first* actuality (188,23–6) by which the ingredients exist in a mixture. For in a later passage Philoponus locates the corresponding type of potentiality on a range *between first and second potentiality* (271,14–24, see below). This location seems to rule out that the tempered second actuality of the drunk geometer, which is to be located between second potentiality and second actuality, is itself an illustration of the mode of being of the ingredients in a mixture. As the later passage makes clear (271,11–14), their mode of being is conceived as a kind of *potentiality* between existence and non-existence, not between degrees of second *actuality*.

This solution meets all requirements of the argument in *GC* 1.10: generation & corruption are avoided; mixing somehow affects the ingredients; the mixed ingredients have an equal status in the mixture; they both exist 'in potentiality'. Hence Philoponus triumphantly concludes that hesitation concerning the obvious reality of mixture is removed and plain experience is vindicated (188,30–3).

In the *theoria* to *GC* 2.7 Philoponus provides further details concerning his third type of potentiality (271,14–24). It should be regarded as a range between first and second potentiality as its extremes. He compares it with the ontological status of a house in the process of being built: it is not a house in potentiality as are the bricks and wood (i.e. first potentiality), nor – we should add – a complete house ready to serve as shelter (second potentiality). Again, sperm is a human being in potentiality in a different sense from an embryo that is being formed. Again, a newborn baby is a grammarian in a different sense from a child that has the proper age to learn grammar, or a child that is being taught grammar. There is a wide range (*platos polu*) in these cases because one state is closer to the form, another further away from it. This intermediate range of potentiality constitutes the third sense of 'in potentiality'.[42]

[40] Here we encounter the famous issue of the latitude of forms which I have to leave aside here. In discussing the fourteenth century Oxford Calculators E. D. Sylla, 'Medieval Concepts of the Latitude of Forms: The Oxford Calculators', *Archives d'Histoire doctrinale et littéraire du Moyen Age* 48 (1974), 223–83, at 227, n. 10, already noted the presence of this theory in Philoponus *in GC* 170,12 but it is widely spread in both Philoponus and other Neoplatonists. See further I. Croese, *Simplicius on Continuous and Instantaneous Change* (Utrecht: Faculteit Wijsbegeerte, 1998), pp. 82–4.

[41] Philoponus uses the same kind of potentiality and the same example to explain Platonic recollection in Aristotelian terms in *De intellectu* 39,1–20 (ed. Verbeke). For this and other applications of the third type of potentiality see F. A. J. De Haas, 'Recollection and Potentiality in Philoponus', in M. Kardaun and J. Spruyt, eds, *The Winged Chariot* (Leiden: Brill, 2000), pp. 165–84.

[42] Of course this range is to be distinguished from the range of the hot, cold, wet, and dry mentioned by Aristotle *GC* 2.7, 334b28, which explains how different kinds of mixture can arise from a mixture of the same four elements in different ratios. For Philoponus' comments on *this* range, see the *theoria,* 272,12–33, and the textual commentary, 274,21 ff.

Unlike Aristotle, Philoponus already brings the qualities of the ingredients into play in the context of *GC* 1.10. He implies that the process of mixing consists in a blunting of the *quality* (198,22–3); he states that mixing occurs because the mixables act and are acted on with respect to *quality* (202,12–13). Finally, he seems to reduce the potential existence of the *ingredients* to the tempered mode of their characteristic *qualities*. Likewise, each ingredient needs an addition (*prosthêkê*) with respect to its own quality in order to become in actuality what it was beforehand – which, we are told, is not a full-scale change entailing generation & corruption (202,21–5).[43]

When commenting on the final sentence of *GC* 1.10, Aristotle's definition of mixture, Philoponus makes a careful attempt to connect *GC* 1.10 and 2.7 into a single description of mixture:

> This can be the definition of mixture, 'unification of the mixables through alteration', because the things mixed are preserved in one way but perish in another. For, as was said, they are not such-and-such in actuality, but having been tempered they appear to have perished, and they no longer preserve the perfection of such-and-such a form. On the other hand they remain and are preserved in this way that their qualities have not changed entirely but their unity remains.
>
> Philoponus, *in GC* 203,10–16

The ingredients appear to have perished because their *form* has lost its perfection in that it is reduced to a tempered mode of being. In reality, the ingredients remain because their distinctive *qualities* have not changed entirely but continue to exist in a unified mode.

It is to be noted that this interpretation is reflected in a slight though perhaps significant change in the wording of Aristotle's definition. 'Mixture is the unification of mixables *that have been altered* (*alloiôthentôn*)' in the lemma (203,8) is rephrased as 'mixture is the unification of the mixables *through alteration* (*di' alloiôseôs*)' in the commentary (203,11). The latter phrase leaves open the possibility of distinguishing between a non-qualitative change of the ingredients as such (i.e. the loss of perfection of their essential form) and a concomitant change of their qualities (i.e. their 'blunting' so as to form a new unity). Moreover, the latter phrase more clearly distinguishes mixture from alteration, which may be a necessary part of, or preparation for mixture, but not all that the process of mixing consists in. Mixture is to be distinguished from mere alteration as much as from generation & corruption.[44]

So far we may conclude that our commentator sees the need to combine *GC* 1.10 and 2.7. He reduces the potentiality of the ingredients to a reduced status of their forms, which explains their apparent corruption. At the same time the qualities of the ingredients are blunted so as to constitute a new unity. In this way the ingredients are preserved.

[43] The vocabulary of this passage is very close to Alexander, *Mixt.* 231,16–22, see below pp. 429–30. These lemmata may be indebted to Alexander, *in GC* 1.10 even though he is not mentioned explicitly.

[44] For the need to distinguish mixture from alteration cf. Philoponus, *in GC* 327b14, 190,15–21; 327b27, 192,4–8. On the status of alteration as a necessary part of a different kind of change see *Phys.* 7.3 and Croese (n. 40 above), ch. 6 for its reception by Simplicius.

However, this is not Philoponus' final word on the issue. In the footsteps of Aristotle he returns to the topic of mixture in his *theoria* and commentary on *GC* 2.7. In this context the ingredients are the four elements, which constitute the primary mixtures, i.e. homeomerous substances like bile, blood, bone, and flesh. Philoponus identifies Aristotle's solution to the problem of *GC* 2.7 as the solution of *GC* 1.10, (270,16–18) which he describes at length in its application to fire and the four elementary qualities (270,18–271,2). As the form of fire is not preserved in purity, so the highest degree of each quality is lost in the composite. As the pure form of fire remains in potentiality, so does the highest degree of each quality.[45] Then he lists the three senses of 'potentiality' discussed above (271,2–24, see pp. 422–23). So far, so good.

At this point, however, Philoponus draws attention to the essential relation between fire and the highest degree of hotness, which implies that the preservation of fire and the reduction of hotness are irreconcilable.

> [1.] So this [i.e. the account summarised above] is obvious, but one must know the following which is worth critical reflection. For someone will say that if we say that the purely hot has not perished qua hot but it has perished qua *purely* hot, we can no longer say that fire too has perished qua *pure* fire but not qua fire as such. For if fire insofar as it is fire is seen as maximally and purely hot (fire qua fire is not hot in relation to one thing and cold to another but maximally hot) – if, then, you say that the maximally hot qua maximally hot has perished, and fire qua fire is maximally hot, it is clear that fire insofar as it is fire has perished in the compound. Moreover, it will be true to say that fire insofar as it is fire has *completely* perished, but the hot qua hot has not perished *without qualification*, but [only] qua *maximally* hot.
>
> [2.] And this is reasonable. For it is not the same to say 'hot' and 'fire', since it is not the case that if something is hot, it is fire, but if something is *maximally* hot, it is fire, and if something is fire, it is *maximally* hot. If fire qua fire has completely perished, it is clear that the compound is fire in potentiality according to the first sense of 'in potentiality', according to which we also say that matter is fire in potentiality. The compound does not possess anything of fire in virtue of which [fire] is fire.
>
> [3.] However, what has been stated earlier remains true of the hot. Since it has perished qua maximally hot but not qua hot without qualification, it is reasonable that the compound is not called maximally hot in potentiality according to the first sense of 'in potentiality', but it will be called thus according to the distinctions made above.
>
> Philoponus, *in GC* 271,25–272,10

Philoponus makes perfectly clear that if the elements are essentially characterised by hot, cold, moist, and dry *to the highest degree*, they cease to exist the moment a change

[45] From *in GC* 277,27–278,2 it is clear that this description applies to all qualities whether constitutive of substances or not.

of degree in these qualities occurs.[46] If the compound no longer possesses anything distinctive of fire, it is no longer fire in potentiality in the third sense of potentiality; first potentiality now suffices. Yet, the third sense of potentiality still applies to the qualities themselves inasmuch as they may regain their highest degree once it is lost.

How are we now to interpret the commentary on *GC* 1.10? Is it perhaps an earlier stratum of the commentary, to be overruled by this later insight which was prompted by an objection not envisaged before?[47] I believe not: in the textual commentary on *GC* 2.7, 334b18 ff. it becomes clear that the commentary on *GC* 1.10 should be regarded as a faithful account of what Philoponus believes to be *Aristotle's* theory of mixture,[48] although *Philoponus* himself wishes to restrict the application of third potentiality to qualities alone.

In *GC* 2.7, 334b18–19 Aristotle stated that the compounds are 'in some way <the elements> in potentiality, not in the same way as matter but in the way we have explained' (translated above p. 419). We already saw that this passage takes up the notion of potentiality used in *GC* 1.10. Philoponus provides two explanations of the difference this sentence indicates. The second is most interesting for our present concerns. He explains the difference in terms of the different senses of 'in potentiality':

> [1.] However, perhaps one will provide a more natural interpretation of the phrase 'the compound is not the simple [elements] in potentiality in the same way as matter is' when one points to that difference between the senses that we have also mentioned above in the *theoria*. The difference is this: matter is said to be the simple [elements] in potentiality without possessing any trace of their form, which is the first sense of 'in potentiality', but not so the compound. For it already has something of the form of the simple [elements] even though their purity has perished. This cannot be the case according to the first sense of 'in potentiality'.
>
> [2.] Moreover one must point out the following, viz. that if Aristotle says that matter and compounds are not said to be the simple [elements] in potentiality in

[46] Aegidius Romanus, *Comm. in GC* comm. 90 (n. 9 above) uses the same argument to the same effect. However, Averroes, *Comm. in Cael.* comm. 67 (n. 4 above) uses the argument to defend why it cannot be said that the elements remain *perfectly* in the mixture. He goes as far as to compare their ontological status to an intermediate state between substance and accident: the substantial forms of those elements are reduced from perfect substantial forms and their being (*esse*) is as if intermediate between forms and accidents.

[47] A further complication is that Philoponus' *in GC* is a report of Ammonius' teachings 'together with a number of critical reflections (*epistaseis*) of his own' (*in GC* 1,1–5). It is conceivable that Ammonius relied on Alexander for most of his account, and that Philoponus added this criticism as a consideration of his own. The passage Philoponus, *in GC* 271,26 ff. is emphatically introduced as 'a worthwhile remark someone might make'.

[48] In the next section we shall see that it was probably Alexander who introduced the reduction of the forms of the ingredients in the explanation of mixture. If so, Philoponus' restriction is a correction of Alexander's view rather than Aristotle's. In *Aet.* 13.14, 518,17–18 Philoponus also speaks of 'tempering the excess of fire' (not heat) in an argument designed to ridicule Aristotle's criticism of Plato's *Timaeus* in *Meteor.* 1.3, 340a1; here we would indeed expect Philoponus to argue on Aristotle's terms.

> the same sense, he necessarily believes that fire and the other [elements] have not perished completely qua fire in the compound, but qua *pure* fire, and that tempered fire is identical with relative hotness.
>
> Philoponus, *in GC* 276,11–23

From the first paragraph it is clear that Philoponus believes that this interpretation does more justice to Aristotle's allusion to a difference in potentiality. Moreover, from the second paragraph it appears that he believes that Aristotle here alluded to the difference between first and third potentiality. If so, Philoponus is right to bring out the implication that Aristotle must have believed the elements to be present in the compound in a tempered mode. We have already seen that Philoponus agreed with an anonymous objection against Aristotle that fire is only convertible with *the highest degree* of hotness (271,25–272,10, see above). Hence we may infer that he knowingly disagrees with (what he believes to be) Aristotle's view.

This interpretation of Philoponus can be confirmed from *in GC* 2.5, 245,18–246,1 and from later writings. At *in GC* 2.5, 245,18–246,1 Philoponus discusses a rather curious interpretation of the statement 'Everything comes to be from fire; hence everything is fire'. Some people suggested that everything is fire because while changing into the other elements fire is not destroyed but only loses its purity (245,18–25). Philoponus replies that partial loss of the nature of the elements in terms of their qualities (*sic*) is relevant only to the generation of a composite, not to the generation of the simple elements out of each other. For each of the elements has its qualities to the highest degree, unmixed, and untempered. Dry fire cannot remain medium dry after turning into moist air for air is moist *to the highest degree* as fire is dry *to the highest degree*. To avoid the attribution of sheer contradictory qualities the entire nature of fire must change in order to become air (245,25–246,1).

In later writings Philoponus holds on to the view of mixture defended in *in GC* 2.7. In *Contra Proclum* 11.14 Philoponus aims at showing that Plato's philosophy is full of contradictions. One of these is that according to *Timaeus* 54B1-D2 the element earth cannot change into any of the other three, whereas from *Timaeus* 42E8–43A2 it follows that all four elements are combined in creating the visible world. Such a composite must be a homeomerous fusion of the elements. Hence, Philoponus concludes, 'if none of the elements is present in the composite in actuality, but the form (*idea*) of each has perished when they have been mixed and some other form (*eidos*) has supervened upon their mixture and fusion (e.g. the form of flesh or blood), I believe it is clear to everyone that in the composite earth too has changed' (*Aet.* 462,9–15). Finally, in the *Tractatus de totalitate et partibus* Philoponus stipulates once again that the elements remain potentially in the mixture only in the sense that they may reappear as specifically (not numerically) the same elements when the mixture falls apart, whereas only the qualities of the elements remain in reduced purity.[49]

[49] Philoponus, *Tractatus de totalitate et partibus ad Sergium presbyterum* cap. 4, pp. 130–1 (ed. and Latin translation from the Syriac in A. Šanda, *Opuscula monophysitica Iohannis Philoponi* (Beirut: Typographia Catholica PP. Soc. Jesu., 1930); German in Böhm (n. 33 above), pp. 297–8; English in D. King, *Philoponus, A Treatise Concerning the Whole and the Parts* [publ. with *Philoponus, On*

We have seen that Zabarella refers to Philoponus in support of the view that both the forms and the qualities of the ingredients are preserved in reduced actuality. Now we can say that Zabarella was wrong.[50] It seems likely that he only consulted Philoponus' comments on *GC* 1.10 without taking into account the correction Philoponus added in his commentary on *GC* 2.7. Indeed, Zabarella focuses on Philoponus' commentary on *GC* 1.10 for the 'third intermediate mode' (472A *tertio modo medio*) of potentiality with respect to the forms of the elements.[51] He does not mention any statement contained in Philop. *in GC* 2.7! Hence it passed unnoticed that Philoponus himself adhered to the fourth view Zabarella listed, which was to be defended by e.g. Thomas Aquinas: the forms perish but the qualities are preserved in reduced actuality.[52]

Alexander of Aphrodisias: A Source of Inspiration?

Zabarella mentions Philoponus together with Alexander, and we have seen that the interpretation of Aristotle that Philoponus provides in his comments on *GC* 1.10 contains some echoes of Alexander's *De Mixtione*. Hence Alexander deserves closer inspection.

As Todd already noted,[53] Philoponus' commentary is our principal source for Alexander's lost commentary on *De Generatione et Corruptione* with which our

Aristotle Categories 1–5] (London: Bloomsbury, 2015), pp. 199–200): 'So of these parts and elements, there are some that are in the whole in potentiality, others in actuality. Examples of the former are the four elements, viz. water, air, earth and fire, in a body. The substances of these [elements] are destroyed, for water is not in actuality [present] in corporeal composites and neither is earth, air or fire; rather, it is [present] only in potentiality and it is so in such a way that the composite entity could be dissolved into its individual [parts], each in accordance with its own species, yet without their being numerically identical with those from which it was originally composed. For how could things that had just been destroyed come back into being? Their qualities, namely heat, coldness, dryness and wetness, persist through confusion and mixture within the composite, and therefore their purity decreases. . . . Therefore the integrity of qualities that are in opposites is destroyed and the elements thus exist merely in potentiality within composites, since it is possible that sometimes one of the opposed qualities will overcome [the other] and it will again become very cold or hot, as it had been originally. This is especially evident when the composite is dissolved.' Cf. cap. 7, pp. 134–5 Šanda. In the context of Philoponus' monophysitism it is useful to have mixture as an example of how a new unity may come to be from different elements: so did the unique nature of Christ come to be out of its divine and human components.

[50] Böhm (n. 33 above), p. 452, made the same mistake. In the case of Zabarella this mistake cannot be attributed to the inferiority of the manuscript on which the Aldine edition and its descendants was based (see n. 12). The text of the relevant passages is virtually the same as that of our Berlin edition. In the 1527 Aldine edition, see for *GC* 1.10 p. 42ab and for *GC* 2.7 p. 60ab, 61b; in the 1549 Bagolinus translation, see for *GC* 1.10 contextus 82 ff. pp. 29a ff.

[51] Zabarella, *De mistione* c. 10, 471F-472C paraphrases Philoponus, *in GC* 188,17–25 = contextus 82, containing the contrast between the sleeping and drunken geometer, 191,26–7 = contextus 84, and 198,24–30 = contextus 89; see above p. 415.

[52] Among recent commentators Lewis (n. 14 above), pp. 42–4, also understands Aristotle in this way: 'The *potential* existence of a constituent in a compound is grounded by the *actual* existence of the chemical powers which constitute the constituents' (p. 44). To him Aristotle's motive was: 'If [the elements] existed actually they would actually move towards their natural places, yielding the dissolution of the compound. So they exist, but potentially' (p. 43).

[53] Todd (n. 11 above), pp. 251–2.

commentator was plainly familiar.[54] Alexander's *De Mixtione* chs 13–15 is a restatement of Aristotle's theory of mixture that may derive from the lost commentary although it has been restructured to fit the purpose of the anti-Stoic treatise. At *Mixt.* 15, 232,24–32 Alexander explains that the ingredients of a proper mixture do not remain the same in form as they do in apparent mixtures:

> [1.] In these cases [i.e. apparent mixtures] the residue after the dissociation stays the same in form as before and is only decreased in quantity, but with the bodies that have been blended the difference is that each of the things in potentiality in the body produced from the blend is separated out, changing into the perfection (*teleiotês*) of which it was deprived through the process of balanced reciprocal interaction; and because of this characteristic 'being separated' (*khôrizesthai*) is also predicated of these bodies.
>
> [2.] So if it is reasonable to describe the bodies perfected (*teleioumena*) by such a change not as 'coming to be' but as 'being separated', and if the other statements made about the process of blending follow our basic principles, are consonant with how bodies change and come to be, and preserve the common preconceptions about blending, only Aristotle will have propounded the true theory of blending.
>
> trans. Todd, modified

For Alexander, blending and separation become a special kind of change 'between' generation and alteration. As such, it is a rather awkward intermediate between a change in substance and a change in quality. According to Alexander separation of the ingredients of a mixture is the result of restoring the perfection that was lost through qualitative interaction during the process of mixing. Earlier at *Mixt.* 15, 231,16–22 Alexander had couched the same change in terms of the preservation of the ingredients in potentiality, with a corresponding loss of actuality. To restore them to their perfection requires 'just slight assistance', and 'some addition' which is not a full generation or change.[55] All in all this account compares well with the form's loss of purity and

[54] Philoponus often refers to Alexander *in GC*, otherwise lost in Greek. E. Gannagé, 'Alexandre d'Aphrodise *In De generatione et corruptione apud* Gabir b. Hayyan, *K. al-Tasrif*', *Documenti e studi sulla tradizione filosofica medievale* 9 (1998), 35–86, has published fragments of Alex. *in GC* 2.2–5 in Arabic, embedded in an extensive commentary on Aristotle's *GC* 2.2–6 transmitted under the name of the eight century Arabic alchimist Gabir ben Hayyan but probably dating from the ninth-tenth century CE (translated into English in E. Gannagé, *Alexander of Aphrodisias, On Coming-to-Be and Perishing 2.2–5* (London: Duckworth, 2005)). In the context of mixture an indication of Alexander's influence is Philoponus' tendency to restrict the phenomenon of mixture to particular kinds of liquids: compare Alex. *Mixt.* 8 *passim* (see Todd (n. 11 above), p. 204), 13, 228,36–229,3; 14, 230,34–231,4, 231,12–13 with Philoponus, *in GC* 200,19–23; 200,30–201,5; 202,16–18; only at 200,25–7 does Philoponus preserve Aristotle's perspective (328a33-b5) that liquids mix *most easily*. In the context of Alexander's polemic against Stoicism a denial of the universality of mixture served to deny the universal validity of the Stoic theory of blending. For Alexander's introduction of the reduction of the form see the main text.

[55] Alexander, *Mixt.* 15, 231,22–9 also makes the important point that the recovered ingredients are only specifically, not numerically, identical with the original ingredients. In *Mixt.* 15, 231,30–232,18 Alexander describes a number of illustrations of his theory. Philoponus mentions specific recovery only in the *Tractatus de totalitate et partibus ad Sergium presbyterum* 130–1 Šanda (German in Böhm, p. 297; English in King, p. 199), quoted in n. 49 above.

actuality as described by Philoponus in his comments on *GC* 1.10,[56] although we have seen that he is more explicit about the ontological status of the ingredients in the mixture than Alexander.[57] The conclusion seems warranted that the view Philoponus sets out and later rejects is at least partly due to Alexander. Although he was surely aware of this debt to Alexander, he considers the commentator as a faithful expounder of Aristotle to such extent that he presents his (implied) rejection of the view that forms persist in reduced actuality as a rejection of Aristotle's, not Alexander's, view (cf. 276,18–23).

A Neoplatonic Alternative to Philoponus: Proclus and Simplicius

Philoponus' view of Aristotle's theory of mixture is relatively moderate when compared to his fellow Neoplatonists Proclus and Simplicius. Both Proclus and Simplicius revive a neo-Aristotelian interpretation of *GC* 1.10 already mentioned (not supported) in Galen, Stobaeus, and Plotinus.[58] On this interpretation of mixture the bodies of the ingredients remain juxtaposed, while only the qualities mix. With this interpretation in hand Proclus and Simplicius reject Aristotle's notion of mixture as part of the defence of Plato's theory of triangles of the *Timaeus* against Aristotle's attack in *De Caelo* 306a1–307b24 which they read in the interpretation of Alexander. Let us study this complex situation somewhat further.

One of Aristotle's fifteen arguments against Plato's theory of triangles aimed at showing that combinations (*suntheseis*) of atomic triangles or Democritean atoms fail to constitute the continuous wholes that homeomerous bodies like flesh and bone are believed to be, because mere contact does not constitute continuity. Combination may suffice to constitute the elements, but not continuous bodies; hence generation, which is generation of bodies, is abolished (*Cael.* 306b22–9).[59] Simplicius reports that Alexander went even further and emphasised that there will always be void between adjacent particles of the elements.[60]

[56] A similar terminology with regard to the mixing of qualities is found in Plotinus, *Enn.* 2.7.2.22–5: 'When quality comes together with quality it is not that quality which it was before, but is associated with another, and, because in that association it is not pure, it is no longer perfectly what it was, but is dimmed (*êmaurôtai*)' (trans. Armstrong). The verb *amaurô* is a hapax in Plotinus.

[57] On Alexander's reticence in this respect see Todd (n. 11 above), p. 240, who refers to Philoponus' drunken geometer as an improvement on Alexander.

[58] Galen, *In Hipp. de Nat. Hom.* vol. 15, p. 32,1–11 Kühn (= *SVF* 2.463); Arius Didymus *Epitome* fr. phys. 4 (= *Dox.gr.* 449,1–3 = Stobaeus *Ecl.* 1.17.2,1–4); cf. Plotinus, *Enn.* 2.7.1.8–9; 2.10–11, without attribution. Cf. Sorabji (*Matter, Space, and Motion*, n. 14 above), p. 72.

[59] In Arabic and Latin medieval commentaries on the *De Caelo* this passage often provides the occasion for a discussion of mixture; see e.g. Avicenna *De caelo* III summa VIII cap. 3, Averroes *De caelo* III comm. 67, Albertus Magnus *De caelo et mundo* III tr. 2 c. 1.

[60] In Alex. *Mixt.* 2,215,22–7 a theory of mixture that employs the juxtaposition of surfaces is mentioned and dismissed without further discussion. Simplicius reports Alexander as having claimed that, even if we allow the triangles to constitute the elements, they do not constitute bodies, so that every atomic theory does away with generation altogether (Simplicius, *in Cael.* 659,33–660,3).

In his *De Caelo* commentary (640,20–672,23) Simplicius sets out to refute each of Aristotle's fifteen arguments on the basis of Proclus' otherwise lost treatise *Investigation of the Objections of Aristotle to Plato's Timaeus*.[61] Here we also find a discussion of mixture (659,11–661,14). Simplicius reports that Proclus gave an adequate reply to Alexander (660,4–14). Proclus' second argument is most striking: 'No wonder if there is juxtaposition, not union. For [the ingredients] also had to be separable from each other' (660,7–8). Proclus simply constructs a contradiction between Aristotle's requirements that the elements in a mixture are separable again and that the mixture is a unity: if the former, not the latter. Exit Aristotle's theory of mixture! The thrust of his argument is not unlike the Eleatic argument Aristotle set out to overcome in *GC* 1.10.

Simplicius develops Proclus' idea (660,19 ff.) and suggests that even the four elements are merely juxtaposed in small particles. He explains that the appearance of unity and continuity is caused by the unity of the form of flesh or bone that supervenes, just as robes made of threads of different colours give the impression of one mixed colour. The same applies to the four elements:

> [1.] So even when the four elements, juxtaposed to each other, exchange qualities and in some way alter each other towards themselves, even so their bodies themselves neither pervade one another nor are they unified with each other nor do they change into each other completely. This is evident from the fact that the elements are separated again in the case of corruption, and each of them moves towards its own wholeness because they inhered in actuality.
>
> [2.] For if each lost its own form during composition, how does it receive it again on the corruption of the composite? For even if during the composition they change towards each other and the water in us is made watery and the air blazes up, even so their bodies hold together by contact, and generally constitute an analogue to glue used in the arts. The glue does not make things continuous either, because the limits of the things glued together do not disappear.
>
> [3.] It is rather as when a number of torches come together and all their flames mix and appear to be one, but when the torches are separated each torch's own flame and the light it spreads are drawn apart with them. In this way too the conglomerate of the four elements displays a single appearance while their bodies are adjacent to each other and mutually alter each other by means of their qualities. In the same way a song composed of different sounds mixed by juxtaposition in small parts also appears to be a unity. Some such thing the so-called blend is too: a common alteration of bodies adjacent to each other, as long as they are adjacent.
>
> Simplicius, *in Cael.* 660,26–661,14

[61] Cf. Proclus, *in Tim.* 1,404,20–1; 2,279,2–4 for the existence of this work.

This is a view of mixture that agrees for the most part with the atomistic spirit of Plato's *Timaeus*. Mixture is merely apparent, because against the Stoics it must be held that the elements can never pervade each other *qua* bodies.[62] Moreover, complete blending cannot explain the increase of volume of the mixture.[63] At the same time the absence of pervasion explains why the elements can be separated again. Hence Simplicius believes, against Aristotle, that the elements remain present in the mixture in actuality (§1) – he has no need for the potentiality that Aristotle brings into play.[64] The elements remain discontinuous, only held together by contact as if they are glued together (§2).[65]

When dealing with the shape of squeezed elementary particles (*in Cael.* 657,2–9) Simplicius is willing to allow some loss of purity although *pace* Philoponus that does not result in corruption. Although the particles have lost their pure shape (*to skhêma eilikrines*) they should not be called 'out of elements': 'they are elements but somewhat unnaturally disposed'. He makes a rhetorical appeal to the fact that 'to some people' a similar anomaly of the elements is acceptable in mixtures and various changes. Here he is in clear opposition to Philoponus who only allows preservation of the elements when the purity of the qualities is preserved.

On the other hand (§3), since the bodies are adjacent to each other the immaterial qualities that inhere in them may mutually affect each other, much as Aristotle described. Here, as in Aristotle, contact is a necessary requirement for the 'mixture' to occur. A bundle of torches is a vivid image of this conception (§3): the flame and the light it spreads appear to be a new single item (like the form of the mixture) but when the torches are separated it becomes clear that there was no such thing as a new unity.

Simplicius' distinction between separation *qua* body and mutual interaction *qua* qualities seems to be a conscious answer to Alexander, with whom he shared the rejection of Stoic blending. However, Alexander clearly stated that in the case of mixture 'a single body comes to be *both* with respect to the substrate *and* with respect to the quality'.[66] He subscribed to Aristotle's definition of mixture as 'the unification of mixables when altered', which he glosses in a way that contains much of the vocabulary Simplicius used: 'The unification through action and passion of bodies adjacent to each other through change, without corruption of any of them'.[67] Simplicius' definition is phrased as a rival definition: 'A common alteration of bodies adjacent to each other as long as they are adjacent'.[68]

As we may expect from a Neoplatonist, the supervenience of the form on a mixture is not the same as the unity of form and matter in Aristotle. True unity must remain the prerogative of the intelligible realm, for which the interweaving of forms in

[62] See e.g. *in Phys.* 530,9–531,10. Cf. Sorabji (*Matter, Space, and Motion*, n. 14 above), ch. 5.
[63] For this issue see Sorabji (ibid.), p. 72, cf. Plotinus, *Enn.* 2.7.1.15–20.
[64] For Simplicius' reservations about the potentiality of mixed ingredients see esp. *in Cat.* 281,4–6.
[65] This seems to be a clear reminiscence of *Tim.* 42E-43A, esp. 43A2: *sunekollôn*.
[66] Alexander, *Mixt.* 15, 231,15–16.
[67] Alexander, *Mixt.* 14, 231,10–12.
[68] Simplicius, *in Cael.* 661,13–14.

Plato's *Sophist* is an important precedent.[69] Simplicius regards the lack of union at the corporeal level as a manifestation of the dispersion and scattering that distinguishes the physical realm from the intelligible.[70] Elsewhere he also questions the blending of physical qualities. At *in Cat.* 281,2–31 he reports that Plotinus' view of *krasis* as the blending of extremities which produces another quality (not substance) from the blend, was not accepted wholesale by later philosophers. They did accept that the intermediate quality was different from the extremities, but not as the result of blending or composition, for these are corporeal processes inappropriate to immaterial qualities. The superior view is that physical mixture does not occur at all since each so-called intermediate quality is caused directly by its own intelligible *logos*.[71] It is clear that in this framework the unity and continuity of a mixture that was so dear to Aristotle cannot survive.[72]

How does Philoponus' position compare? Between Aristotle's text, Alexander's authoritative interpretation, and the rival Stoic theory of blending Philoponus finds a different route than Simplicius. Against Proclus and Simplicius and with Alexander, Philoponus accepts the notion of mixture. He even elaborates on the notion of potentiality involved. With Proclus and Simplicius but against Alexander, Philoponus limits mixture to the level of qualities, although like Alexander he opposes qualities to forms rather than bodies. Unlike Proclus and Simplicius he seems to question neither the unity of the mixture nor the possibility of regaining the ingredients from it.

Philoponus' acceptance of mixture and the type of potentiality involved leads him to interesting speculations on a third sense of 'potentiality'. For Philoponus this third sense of 'potentiality' is not restricted to the explanation of mixture: his examples show that the range between first and second potentiality is exhibited in all areas where its extremities are found. More specifically, the third type of potentiality also features in Philoponus' explanation of recollection in an Aristotelian framework, where it has parallels in Simplicius.[73] More research is needed to see how

[69] Cf. *in Phys.* 100,1–22, esp. 15–18.

[70] A concise statement to this effect is Simplicius, *in Phys.* 531,5–7: 'So perhaps sublunary [bodies] do not pervade each other because they are most material and resistant and by nature scattered from each other (hence, too, mixed entities constitute something larger), but the heavenly bodies are different.' Cf. more elaborately *in Ench.* 38, 361–99 Hadot (= 99,50–100,45 Dübner). For Simplicius the scattering is caused by indefinite three-dimensional prime matter, see Sorabji (*Matter, Space, and Motion*, n. 14 above), pp. 7–18; F. A. J. De Haas, *John Philoponus' New Definition of Prime Matter: Aspects of its Background in Neoplatonism and the Ancient Commentary Tradition* (Leiden: Brill, 1997), pp. 120 ff.

[71] At *in Cat.* 281,7–15 Simplicius (Iamblichus?) argues against colours as proper mixtures of the opposites white and black, drawing on Aristotle, *Sens.* 439b17–440b24 in support for the view that juxtaposition of extremes, or overlay, or some greater distance is what we are dealing with in this case. However, in that passage Aristotle argues that these alternatives are to be rejected in favour of the mixture view!

[72] In the tentative discussion at *in Cael.* 306,1–16 Simplicius is close to attributing a theory of combination, not mixture, to Aristotle. See further Simplicius, *in DA* 52,19–22.

[73] See my paper 'Recollection and potentiality in Philoponus' (n. 41 above).

this particular range or latitude is connected to Neoplatonic physics and metaphysics in general.

Conclusion

In this study I have tried to show that Philoponus' commentary on Aristotle's account of mixture has to be understood against the background of a discussion between three views of mixture that dominated the Aristotelian tradition as a whole. The starting point was Zabarella's classification of solutions to the main problem of mixture: how to interpret Aristotle's claim that the ingredients are preserved in the mixture in potentiality. If we correct and supplement Zabarella's classification on the basis of our findings, the following table is the result.

		Forms	**Qualities**
1	Early neo-Aristotelians – Proclus – Simplicius – Avicenna	preserved in actuality	preserved in reduced actuality
2	Alexander – Averroes – Zabarella	preserved in reduced actuality	preserved in reduced actuality
3	Duns Scotus	perish	perish
4	Philoponus – Marsilius, Thomas, Aegidius – Buccaferreus	perish	preserved in reduced actuality

In a sense Proclus and Simplicius belong with Avicenna because they accept the preservation of the elements in actuality, along with reduced actuality and interaction in the realm of qualities. However, since they reject Aristotelian mixture and discuss the problem in terms of body vs. qualities rather than forms vs. qualities they are best regarded as belonging to a different school altogether. Alexander is probably the main source of the influential account of Averroes. Philoponus belongs with the fourth group due to his criticism of Aristotle (or rather Alexander). He accepts the corruption of the ingredients while only their qualities are preserved in reduced actuality. It remains to see whether his influence on the medieval authors that subscribe to a similar view can be established.

Zabarella's reports on his sources should be handled with care. His summaries of Alexander are inadequate, his understanding of Philoponus is wrong. He himself claims that his 'true' interpretation of Averroes was not followed by any Averroist (see e.g. 465A, 466B) which should give us pause as well. Moreover, I fail to see how he can believe that his complicated interpretation of Averroes can be backed up by his interpretation of Alexander and Philoponus: they seem to represent three quite different doctrines indeed. Although a quick glance at Zabarella's other medieval sources seems to confirm his classification of them it cannot be ruled out that closer inspection will yield some surprises as it did with Philoponus. The details of Zabarella's own theory of mixture still await further investigation.

To conclude on a more general note: in charting the commentary tradition on Aristotle's work from Late Antiquity through Arabic, Latin Medieval, and Renaissance

authors it is tempting to assume we are dealing with a single line of tradition. However, it is still far from clear which ancient commentaries were available (in Greek or in Arabic, Syrian, or Latin translation) at what date.[74] But even if this can be established we cannot be sure that a particular commentator actually used his predecessors' commentaries, even when he refers to them by name: perhaps he merely copied a reference from another commentary. In this way Zabarella's mistake may have arisen. More importantly, every commentator who analyses the problem of the potentiality of the ingredients in a mixture as it is presented in Aristotle's texts in *On Generation and Corruption* is faced with a limited number of possible solutions. Every commentator, then, is perfectly capable of re-inventing the wheel. However, the application of the third kind of potentiality in the context of mixture seems to have been invented for the first time by John Philoponus.

[74] But see now M. Rashed, *Al-Ḥasan ibn Mūsā al-Nawbakhtī: Commentary on Aristotle De generatione et corruptione* (Berlin: De Gruyter, 2015).