

De mixtione VII–VIII: On the Possibility of a Stoic Blend

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Abstract

The paper discusses chapters VII–VIII of *De mixtione*, where Alexander argues against the possibility of a Stoic blend. I will show that Alexander offers good reasons in chapter VII to think that the Stoics were committed to co-extension and the preservation of surfaces in a mixture and that these constraints are indeed incompatible. I will argue further that Chapter VIII continues the argument of chapter VII by offering a response on behalf of the Stoics and that the two chapters are a unity. Building on my argument that Alexander's criticism is neither polemical nor confused, I argue that chapters VII–VIII, although employing a different terminology than chapters III–IV, provide an accurate picture of the Stoic theory and that Alexander's criticism is very much to the point.

1 Introduction

In chapters VII–VIII of *De mixtione*, Alexander argues against the possibility of a Stoic blend. He does so by showing that the two constraints on a Stoic blend—that the blended bodies are co-extended and yet keep their surfaces—are incompatible. Although Alexander announces in chapter I, 1.1–16, that this is the central difficulty for the Stoic theory, commentators reject Alexander's report as either polemical or confused.¹ While they agree that chapter VII addresses this difficulty, they argue that the Stoics were not committed to the two constraints that Alexander sets out. Chapter VIII, so the story goes, addresses a different topic: the impossibility of blending by infinite

¹ Representatives of one or several of the claims that follow are Groisard (2013), Todd (1976), Collette-Dučić and Delcomminette (2006), and Rashed (2009). But if we include authors who dismiss Alexander's interpretation without direct reference to *De mixtione* VII–VIII, the list also includes Lewis (1988), Long and Sedley (1987), Sambursky (1987) and Harven (2018). Exceptions are Helle (2018) and Nolan (2006), whose interpretations of the Stoic theory are compatible with the account of the Stoic theory that I ascribe to Alexander.

division. Although some commentators think that blending by infinite division is also not part of the Stoic theory, most believe that the Stoics assumed it. Still, many think that either Alexander distorts the view or it is inherently flawed for some other reason.

I will argue against all these assumptions. I will show that Alexander offers good reasons to think that the Stoics are committed to the preservation of surfaces (section 3) and assume a spatial interpretation of co-extension (section 4). Consequently, his criticism in chapter VII is sound (section 5). I will argue further that Chapter VIII continues the argument of chapter VII by offering a response on behalf of the Stoics (section 6). A Stoic blend is possible because blending by infinite division explains how bodies can both co-extend and keep their surfaces (section 7). Finally, I will show that Alexander's critique of blending by infinite division raises a formidable difficulty for the Stoics, namely, that the parts in a blend have no exact size (section 8). Thus, by focusing on (1) Alexander's argument for the incompatibility of these two constraints, (2) how the account of blending by infinite division shows that the constraints are compatible, and (3) why Alexander thinks that blending by infinite division is nevertheless impossible, I hope to demonstrate that Alexander's criticism is neither polemical nor confused.

However, my ambition is not merely to close a gap in our understanding of Alexander's argument; I also want to pursue the closely related question of whether Alexander interprets the Stoic theory correctly. Alexander's *De mixtione* not only is one of the principal sources of the Stoic theory of blending, but also affords an insight into how Alexander himself understood this theory and whether he offered a viable interpretation of it. Scholars have devoted considerable attention to Alexander's presentation of Chrysippus's views on blending in chapters III–IV, and their inclusion in collections of testimonia shows that they are taken to be a (more or less) accurate statement of the Stoic view. In chapters VII–VIII, however, Alexander expresses the view differently. As a matter of interpretative principle, one cannot simply assume that the later chapters are less accurate; instead, building on my argument that Alexander's criticism is neither polemical nor confused, I argue that chapters VII–VIII provide an accurate picture of the Stoic view and that Alexander's criticism is very much to the point.

2 The Impossibility of Blending

In the central part of chapter VII (13,21–15,2) Alexander argues that a blend according to the Stoic conception is impossible, starting from the Stoics'

differentiation of blending from other kinds of mixing. Blending (κράσις) differs from fusion (σύγχυσις) in that the blended bodies, as Alexander calls the ingredients,² persist in the blend. In particular, this condition explains the recoverability of numerically the same bodies from the blend. Since this is also true of juxtaposition (παράθεσις), we need another condition to distinguish blending from it, namely, that the bodies in a blend are wholly co-extended with one another.

Alexander uses a constructive dilemma to show why it is impossible to satisfy both conditions: If the bodies keep their surfaces, they are not blended but merely juxtaposed. For if some parts keep their surfaces in a mixture, they are separate and unmixed, and therefore only juxtaposed (*Mixt.* 14.13–22). However, if no parts remain unmixed and separate, they cannot keep their surfaces, and so the bodies do not persist and their fusion constitutes a new body. Evidence for this is that, when fused, the original bodies cannot be (numerically) recovered (*Mixt.* 14.22–15.2). Thus, either the bodies keep their surfaces or they do not, but in neither case will there be a blend, but instead either a juxtaposition or a fusion.

Alexander then gives a separate argument (*Mixt.* 15.3–10) for the claim that bodies in a blend cannot retain their states (ἔξεις): Since fusion results in a new individual body, and an individual body is held together by a single state, the fused bodies cannot preserve their states.

I will comment on and refine the argument further below, but for now, I want to address the presupposition of the constructive dilemma, namely, Alexander's understanding of the conditions on blending. Alexander believes that a Stoic blend has to satisfy the following two constraints:

Constraint 1: The bodies in a blend keep their surfaces.

Constraint 2: The bodies are blended through and through, that is, there are no unmixed, separate parts in the blend.

But since the bodies, when blended through and through, cannot preserve their surfaces, the constraints on a Stoic blend are incompatible. That Alexander understood blending in this way and believed that this is one of the central absurdities in the Stoic theory of blending is clear not only from how he introduces the argument in chapter VII (*Mixt.* 14.13–16) but also from the beginning of chapter I, where he gives essentially the same formulation and describes it

2 As I will explain below, a body is a composite of matter and a state. Alexander uses Stoic terminology but within a Aristotelian framework; for the Stoics, the state and matter would be bodily, too.

as the main difficulty for the Stoics (*Mixt.* 1.1–6, 10–16).³ Although Alexander thought that this is what the Stoics claimed, it is far less clear that he was right. My answer will be that, although the formulation of the constraints, especially the first one, is not Stoic, Alexander accurately points to commitments of the Stoic theory.

3 The Preservation of Surfaces

When characterizing blending at the beginning of chapter VII, Alexander does not mention that the blended bodies keep their surfaces. Rather, he says that the bodies “are preserved in what they were [before blending] and retain their own qualities” (*Mixt.* 13.27–14.1: σώζεσθαι τὰ ἐξ ἀρχῆς μένοντα, καὶ σώζειν τὰς οἰκείας ποιότητας). This characterization is itself based on chapter III, where Alexander informs us that according to Chrysippus there are three types of mixture: by juxtaposition, by fusion, and by blending (*Mixt.* 6.10–7.8). After stating Chrysippus’s definitions of juxtaposition and fusion, he continues:

τὰς δὲ τινὰς γίνεσθαι μίξεις λέγει δι’ ὄλων τινῶν οὐσιῶν τε καὶ τῶν τούτων ποιότητων ἀντιπαρεκτεινομένων ἀλλήλαις μετὰ τοῦ τὰς ἐξ ἀρχῆς οὐσίας τε καὶ ποιότητος σώζειν ἐν τῇ μίξει τῇ τοιαύτῃ, ἣντινα τῶν μίξεων κράσιν ἰδίως εἶναι λέγει.

3 It is commonly assumed that chapter VII explicitly addresses this problem: see Todd (1976), 180; Groisard (2013), 78. There is a complication, however. Alexander emphasizes in chapter I that the bodies retain their *original* surfaces (ἕκαστον αὐτῶν ὑπὸ τῆς οἰκείας ἐπιφανείας περιέχεσθαι, ὅφ’ ἥς περιείχετο καὶ πρὸ τῆς μίξεως) whereas in chapter VII he assumes only that the *parts* retain their surfaces. Why? Part of the difficulty here is that Alexander says very little about the individuation and ontology of surfaces, so that it is hard to tell what counts as preserving the *original* surfaces. In my interpretation, I will rely on a minimal conception of surfaces: a surface is the boundary separating the interior of a body from its exterior, and by keeping their surfaces, the bodies persist in the blend. Since the Stoics assumed that numerically the same bodies, though divided and scattered throughout the blend, persist in the mixture, I see no principled reason not to think that the original surfaces also remain, since on this conception the boundaries are individuated by the bodies to which they belong. If it makes sense (as it must) to say that a scattered body remains the same, we can also say that it still has its original surfaces by which it is separated from its exterior.

Betgegh in this volume posits a more complex relationship between chapters I and VII. He suggests that Alexander deliberately chooses the formulation in chapter I to cover also the arguments in chapters V and VI, which depend on a change in volume of the blended bodies; the idea is that the bodies cannot retain their surfaces if their volume changes.

Other mixtures occur, he [i.e., Chrysippus] says, when certain substances and their qualities are mutually co-extended through and through while the original substances and qualities are preserved in such a mixture. This kind of mixture he calls specifically blending,⁴ (*Mixt.* 6.25–7.1)

According to these passages, the Stoics do not state blending in terms of the preservation of surfaces, but instead require that the bodies in a blend preserve their substances and qualities.⁵ Since Alexander gives the impression that he is consulting texts first hand (“Chrysippus’s theory of blending is as follows,” and “he says”), and since we find similar formulations elsewhere,⁶ we might assume that this formulation is close to the original Stoic formulation, or at least closer than the formulation in terms of the preservation of surfaces.⁷ If the Stoics did not explicitly state that the blended bodies keep their surfaces, is Alexander’s reformulation legitimate?

Before addressing how the preservation of substances and qualities connects to the preservation of surfaces, let me briefly say what “substance” and “quality” mean here. Later (lines 14.6 and 15.6) Alexander will refer to what is preserved as the “underlying subject” (ὑποκειμενον) and the “state” (ἔξις), and flags “state” as a Stoic technical term. Plausibly, Alexander refers here to the active and passive principles in Stoic metaphysics, which together constitute a composite body. The passive principle is the underlying subject or matter of a body, whereas the active principle is the state, which individuates the matter “by holding it together” (“An individual body is, they say, held together by a single state,” *Mixt.* 15.8–9).⁸ In a nutshell, the claim is that individual bodies retain their matter and their (essential) state.⁹

4 Translations are based on Todd (1976) but are often modified.

5 Similarly, they do not explicitly state constraint 2; instead, they require that the bodies in a blend be wholly co-extended. I address this difference in section 4.

6 See *Stob.* 1.155,5–11 = LS 50D = *SVF* 2.471, part.

7 See also Todd (1976), 202; Groisard (2013), 78; Betegh, in this volume; Mikes in this volume, who all arrive at the same conclusion; Todd goes a step further in maintaining that Alexander formulates constraint 1 in terms of the preservation of surfaces for polemical purposes. By contrast, I will show that there is a sound basis in Stoic thought for the claim that the surfaces persist in a blend.

8 The Stoic active principle is, in its theoretical role, comparable to an Aristotelian essence. Alexander recognizes this role, I believe, though of course in later chapters he heavily criticizes the alleged corporeality of the qualities and state. For a study of the complex relationship between Aristotelian forms and Stoic qualities through Alexander’s lens, see Kupreeva (2003).

9 Alexander does not explicitly say that he means the essential qualities, nor does he say how the quality and the state are related to each other. Strictly speaking, *hexeis* are modifications of *pneuma*, which holds bodies together, and can also encompass accidental qualities. But

So how are these two ideas—preserving matter and state, and preserving surfaces—connected? Alexander does not elaborate on how they are connected, but a plausible assumption is that they express the same idea, namely, that the bodies persist. According to Alexander, the Stoics thought that bodies persist in a blend, and that one can recover numerically the same bodies from it; this can be seen from Alexander’s repeated claims that bodies “keep their original substances and qualities” (*Mixt.* 6.27–28: τοῦ τὰς ἐξ ἀρχῆς οὐσίας τε καὶ ποιότητος σώζειν), and “remain what they were at the beginning” (*Mixt.* 13.27: τὰ ἐξ ἀρχῆς μένοντα). One can also infer this from his own preferred theory of mixture, in which, contrasting it to the Stoic account, he emphasizes that one can recover only bodies of the same *kind* but not numerically the same bodies (*Mixt.* 33.17–34.10). Since bodies are composites of matter and a state, they numerically persist in the blend, despite being scattered into parts, because their matter and state persist.

If the blend contains numerically the same bodies that entered into it (though now scattered), it must contain the parts into which the bodies are scattered as separate ingredients in it. The parts are separate precisely because they have surfaces that separate them from the parts of the other ingredient. Thus, by formulating constraint 1 in terms of preservation of surfaces, Alexander calls attention to the fact that the persistence of numerically the same bodies in a blend requires that the parts of those bodies, unchanged in their matter and qualities, persist with their surfaces separating them from other parts. On the reconstruction offered, Alexander correctly assumes that the Stoics, even if they did not themselves use the word “surface” in their account of blending, are committed to the preservation of surfaces.

However, other considerations might suggest that we should not ascribe this view to the Stoics. First, we have some evidence that the Stoics deny the existence of limit entities such as surfaces, and view them as mere mental constructs.¹⁰ If so, it is highly contentious of Alexander to explain the Stoic theory in terms of surfaces. But while Alexander phrases his objection in what appears to be a distinctly Aristotelian fashion, there are aspects of the Stoic theory that he might have responded to. From his report in chapter 3, the Stoics appear to have used the term “circumference” (περιγραφῆ) in their

since Alexander says that an individual body is held together by a single state (221.19), he appears to treat the state as the defining feature of a body. On this, see also Long and Sedley (1987), 292–293; Helle (2018), 91–92.

10 I cannot here discuss in detail the status of limits in Stoic theory, or the conflicting evidence for them as either mental constructs or as incorporeals. For a recent discussion of the evidence, see Ju (2009). The view of the status of limit entities in Stoicism that I ascribe here to Alexander is akin to Scade’s (2013) interpretation.

definition of juxtaposition, and it is natural for Alexander to take this to be a surface.¹¹ Thus, Alexander can rely on Stoic usage, at least for juxtaposition. Crucially, however, he has good reason to generalize from this case. According to the Stoics, different states hold different parcels of matter together so that the world comprises a multitude of distinct individuals.¹² Limits are, as Scade (2013) puts it, the “markers that map or describe the corporeal structure of the world” (86). We might spell out the ontology of these markers in several ways,¹³ but unfortunately Alexander gives us no guidance as to how he viewed them, either according to the Stoic theory or his own. For his argument to work, however, he does not need to make any strong assumptions about the ontology of limits; all he needs is for the fact that different states hold together different parcels of matter to entail that bodies are objectively bounded, in that one can distinguish between the interior of a body and its exterior, and that this distinction is not arbitrary. On this conception, a bronze sphere has a surface because it has a limit, such that, as Aristotle would say, every part of the bronze sphere is within this limit, and no part is outside of it (*Metaph.* v 18, 1022a4–5). This definition does not commit us to viewing limits as *belonging* to the bodies, as their parts or otherwise; indeed, it is compatible with the view that bodies are open objects.¹⁴ But it is not arbitrary or up to us to determine which parcels of matter are held together by a state and, thus, where the limit lies. (By contrast, it might be a matter of our choosing which inner limits we might want to impose in thought on the bronze.)¹⁵ It is difficult to see how the Stoics could deny this minimal conception of how bodies have surfaces.

11 See also Mikes in this volume. One might reply that juxtaposition is about dry bodies and blending with liquids, and that only the former have surfaces (See Stobaeus 1.153.24–155.14 = *SVF* 2.471). But I agree with Groisard (2016), 98; Collette-Dučić and Delcomminette (2006), 10, that this distinction does not play a significant role in Alexander’s discussion of the Stoics and that it might not have been Stoic in the first place. Moreover, the account of limits that I will develop entails that liquids must have surfaces, too.

12 It is noteworthy that the word *συνέχειν* (holding together) has a strong spatial connotation, and τὸ συνέχης is the continuum (lit., ‘that which holds together’). The Stoics might have taken up Aristotle’s definition in *Phys.* v 3, 227a10–12 and developed it further; see Sambursky (1987), 1.

13 Scade (2013) himself sees this (plausibly, I think) as evidence that limits are incorporeal.

14 To see this, consider the definition in Cartwright (1975), 154: “A point *p* is said to be a boundary point of a region *A* if and only if every open sphere about *p* has a non-null intersection with both *A* and the complement of *A* (where the complement of a region is the set of points of space not in the region).” Alexander could accept this definition, but it does not entail that objects are identical with their closures.

15 This picks up an idea by Scade (2013), 83, who argues that limits, viewed as mental constructs, are arbitrary divisions of the objects. I think, however, there are other ways to spell out the mental construct view. See my previous footnote.

Second, the Stoics saw the relation between matter and *pneuma* as a paradigmatic case of mixture. Here, however, it is doubtful whether we should conceive the matter and *pneuma* as individual bodies with surfaces. Since, as argued above, the boundary results from *pneuma* holding matter together, constraint 1 seems not be applicable, or at least not straightforwardly, to *pneuma* and matter themselves. In this vein, Long and Sedley (1987), addressing the question of whether the bodies in a blend are co-located, write: “We should regard the two things that occupy the same place not as two determinate and independently existing bodies, but as the two bodily functions (*pneuma* and matter) which jointly constitute every determinate and independently existing body” (294). Thus, some scholars distinguish between an “ordinary” blend of two previously separate bodies¹⁶ and a blend of a state and the matter, which is what constitutes an individual body in the first place.¹⁷ Since Alexander’s argument in chapters VII–VIII relies on constraint 1, it is, one might say, effective only against the first conception.

While it is true that chapters VII–VIII focus on “ordinary” blends, this is hardly an objection, since Alexander is aware of this possible distinction between kinds of blend. He opens chapter IX by saying that the Stoics thought that “also the state itself is mixed with the things that have it” (*Mixt.* 17.16–17: καὶ τὴν ἕξιν τοῖς ἔχουσιν αὐτὴν μεμίχθαι). Alexander treats this as a further claim, different from the one discussed in chapters VII–VIII. Interestingly enough, the conclusion he draws is the opposite of that of Long and Sedley: *pneuma* cannot be an ingredient of a blend because it is not an independently existing body. And I think Alexander is right. For as he points out (17.15–22), the Stoics believe that numerically the same ingredients are recoverable from the mixture, which presupposes that they can exist independently. For as Long and Sedley acknowledge, *pneuma* and matter are bodily functions, and so their numerical identity depends on the individual bodies that they constitute. If the Stoics did in fact hold the view that Long and Sedley ascribe to them, they would not be able to explain the recoverability condition. Thus, instead of distinguishing between two kinds of blend, which is vulnerable to the objection in chapter IX, a better answer to Alexander’s criticism would be to show how

16 In his own theory of mixture, Alexander, picking up Aristotle’s theory from *GC* I 10, emphasizes that the blended bodies must have existed separately before being blended. Cf. *Mixt.* 27.12–16.

17 See also Marmodoro (2017), 174; Mikes in this volume. Todd (1976), 29–73 argues that Alexander did not understand this, and the Stoics only recognized the latter kind. But I agree with Collette-Dučić and Delcomminette (2006) that the Stoic theory also applies to ordinary blends. Note that this does not mean that the Stoics themselves treated these mixtures differently.

the surface condition can hold in a Stoic blend. As I will argue, the theory of blending by infinite division that Alexander discusses in chapter VIII aims to show how this is possible.

Third, even without distinguishing the kinds of blends, one might argue against the suggested dialectic of chapters VII–VIII and resist the conclusion that surfaces are preserved in a blend by understanding the persistence condition differently. Thus, Lewis (1988) argues that it is not the *bodies* (as Alexander understands this notion, i.e., the individual composite bodies) that are preserved, but the matter and the qualities, understood in the technical Stoic sense. When wine and water are blended, the wine and the water are destroyed, and a new body comes into existence, namely, the blend, which is composed of the total amount of matter (Lewis understands this as unqualified “prime” matter) and the qualities formerly possessed by the wine and water. Although Lewis relies to a great extent on evidence from Diogenes Laertius, which might (or might not) suggest that the bodies are destroyed, it is significant that he bases his interpretation on Alexander’s initial description of constraint 1 in chapter III (also quoted above):

τὰς δὲ τινὰς γίνεσθαι μίξεις λέγει δι’ ὅλων τινῶν οὐσιῶν τε καὶ τῶν τούτων ποιότητων ἀντιπαρεκτεινομένων ἀλλήλαις μετὰ τοῦ τὰς ἐξ ἀρχῆς οὐσίας τε καὶ ποιότητος σώζειν ἐν τῇ μίξει τῇ τοιαύτῃ, ἥντινα τῶν μίξεων κράσιν ἰδίως εἶναι λέγει.

Other mixtures occur, he [i.e., Chrysippus] says, when certain substances and their qualities are mutually co-extended through and through while the original substances and qualities are preserved in such a mixture. This kind of mixture he calls specifically blending. (*Mixt.* 6.25–7.1)

While one can interpret this passage as saying that only the substances and the qualities are preserved, and not the bodies, Alexander himself clearly did not understand it this way. Not only does he repeatedly emphasize, as shown above, that the *bodies* persist, he also restates the passage in chapter III as follows in chapter VII:

ἐπὶ δὲ τῆς κράσεως ἐκάτερον τῶν ἐν τῷ κεκραμένῳ σωμάτων ἔτι σώζεται καὶ κατὰ τὸ ὑποκείμενον καὶ κατὰ τὰς ποιότητας, καίτοι δι’ ὅλων ἀλλήλοις κεκραμένων τῶν σωμάτων.

In the case of a blend, each of the bodies in the blend is still preserved both in its underlying subject and in its qualities, although the bodies have been blended with one another through and through. (*Mixt.* 14.5–8)

In contrast to chapter III, chapter VII says explicitly that the *bodies* remain according to their subjects and qualities.¹⁸ Here “body” must refer, as it does elsewhere in *De mixtione*, to composite bodies. One could of course understand preserving the bodies according to X as preserving the bodies only insofar as X is preserved, where X is the thing that is strictly preserved. More plausibly, however, for Alexander the bodies are preserved precisely because their matter and qualities are preserved—that is just what it means for a body to be preserved. Thus, preserving the bodies according to X does not mean that only X is preserved, but that the bodies are preserved because X is preserved. Therefore, Lewis’s interpretation is not supported by Alexander’s *De mixtione*.¹⁹

4 The Co-extension of Blended Bodies

According to my interpretation, Alexander understands blending spatially:²⁰

Constraint 2: The bodies are blended through and through, and there are no unmixed, separate parts in the blend; that is, no subregion of the whole blend is occupied by only one of the ingredients.

The first part of constraint 2 is a more or less verbatim quotation (*Mixt.* 1.3–5, 11–13; 14.13–15, 23–25), and the second part expresses it in a distinctly spatial sense. The spatial interpretation is a natural way of understanding the claim that the bodies in a blend are “wholly co-extended” (*Mixt.* 13.26: πάντη παρεκτείνόμενα; cf. 6.25–27; 7.2, 19): two bodies are co-extended if and only if no subregion of the region occupied by the blend is occupied by only one of the blended bodies.²¹ The spatial interpretation is further suggested by (1) the technical term ἀντιπαρέκτασις, which derives from the verb παρεκτείνω, which in a military context denotes the act of an army stretching out its lines to encircle the enemy,²² and by (2) the claim that blending is a case of body going through body.²³

18 Lewis (1988), 89 claims that chapter VII also assumes that only the substance and qualities are preserved. But the quoted passage shows that this is wrong.

19 See also Collette-Dučić and Delcomminette (2006), 30, who emphasize that other testimonies speak against Lewis’s interpretation, too.

20 In this section, I have greatly benefited from comments by Reier Helle.

21 See also Nolan (2006), 169–171.

22 For discussion, see Lewis (1988), 90; Kupreeva (2004), 299–304; and Helle (2018), 88. It also occurs in Plutarch (*Comm. not.* 1078E = LS 48B = SVF 2.480).

23 Cf. *Mixt.* 1.12–16, where Alexander explicitly connects body going through body with the two constraints.

It should be noted that the spatial interpretation of constraint 2 does not entail co-location in the sense of superimposition (“two bodies being in the same place”).²⁴ As I will argue below, blending by infinite division satisfies constraint 2 but does not entail that the bodies are superimposed. Moreover, some scholars paraphrase constraint 2 in mereological terms: Every part of the blend has all the ingredients of the blend as parts.²⁵ Again, the spatial interpretation does not entail this. While one can understand Alexander’s claim that no unmixed parts exist in the blend mereologically, I will argue, in my discussion of chapter VIII, that we have good reasons to adopt a purely spatial interpretation.

Although Alexander’s constraint 2 should find wide acceptance, one might wonder whether it misses a key feature of the Stoic view. Constraint 2 is based on the exposition of the Stoic theory in *De mixtione* 3, which is in all likelihood close to the original Stoic formulation:

τὴν δὲ τοιαύτην ἀντιπαρέκτασιν τῶν κίρναμένων ὑπολαμβάνει γίνεσθαι χωροῦντων δι’ ἀλλήλων τῶν κίρναμένων σωμάτων, ὡς μηδὲν μόνιον ἐν αὐτοῖς εἶναι μὴ μετέχον πάντων τῶν ἐν τῷ τοιούτῳ κεκραμένῳ μίγματι.

He assumes that such a mutual co-extension of the blended things occurs if the blended bodies go through one another so that there is no part in them that does not participate in all the things in such a mixture through blending. (*Mixt.* 7.18–22)

Helle (2018) has argued that we should interpret “to participate” causally:²⁶ all parts in a blend are in “a continuous exchange of motion” (105). While he agrees that the spatial interpretation is an element of the Stoic view, he insists that a purely spatial interpretation cannot explain blending. Since Alexander drops the language of participation in chapters VII–VIII and there shows

24 Many commentators have, to mind incorrectly, concluded that it entails co-location. See Collette-Dučić and Delcomminette (2006), 33; Harven (2018); Todd (1976); Groisard (2016); Long and Sedley (1987), 293–294. Since this claim has also been the major source of criticism in antiquity, modern commentators want to find an acceptable version of the principle. Yet, the basic assumption is the same: the bodies co-locate. How significant the differences seem depends on how far away you stand.

25 Long and Sedley (1987), 293; Mikes in this volume.

26 The causal interpretation does not originate with Helle but has also been proposed by Collette-Dučić and Delcomminette (2006). Indeed, all commentators who emphasize the active and passive principles in a Stoic blend are arguably committed to some kind of causal interpretation. Helle’s interpretation is distinctive because he bases it on the term “to participate.”

no awareness of the causal interpretation, his interpretation is incomplete. Alexander thus misses what is most important.

My response is twofold. First, the evidence in Alexander in favour of taking “to participate” causally is not decisive, and one could just as well interpret it spatially.²⁷ Second, understanding it causally, the dialectic between Alexander and the Stoics explains why Alexander does not address the causal aspect of participation. Alexander thinks that both the Stoics and the Peripatetics have the theoretical resources to explain blending because they assume a single underlying matter (*Mixt.* 5.20–22). That being the case, Alexander wants to identify those features in the Stoic theory that prevent them from giving a satisfactory account of blending, and in his view it is their commitment to constraints 1 and 2. Causal interaction, on the other hand, is a shared feature of the Peripatetic and Stoic theories, and for this reason he might see no need to discuss this aspect.²⁸

To sum up: Both constraints, though formulated in a distinctly Peripatetic fashion, may well capture the Stoic view. Moreover, key elements of Alexander’s interpretation—the spatial reading of blending through and through and the assumption that the blended bodies retain their identity—are widely held by modern commentators as well. All of this adds up to a picture in which Alexander’s interpretation is as reasonable as any currently available.

5 Why Blending Is Impossible

Let me now return to Alexander’s argument that blending is impossible, in particular to the two crucial inferences it relies upon:

1. If the bodies keep their surfaces in a blend, they are merely juxtaposed (and preserved in their substance and qualities).
2. If the bodies lose their surfaces in a blend, they are fused (and not preserved in their substance and qualities).

From these inferences, it follows that blending is impossible. The sole, and rather unhelpful remark supporting the first inference is that “the surface of the wine cannot be the surface of the water” (*Mixt.* 14.17–18). Still, the inference should be relatively straightforward by now. For the parts to keep their

²⁷ For discussion, see Mikes in this volume. One should note, though, that Helle does not base his interpretation of the word solely on Alexander but also on evidence in Hierocles.

²⁸ In his discussion of the role of *pneuma* in chapters IX–XI, Alexander is evidently aware of the Stoic theory’s causal aspect. On Alexander’s argumentative strategy in *De mixtione*, see Betegh in this volume.

surfaces in a blend is for the blend to contain different parcels of matter held together by different states. On this reading, the reason why the surface of wine cannot be the surface of water is that being the surface of wine means being the boundary of some matter held together by the wine-state and *not* by some water-state. As explained above, Alexander does not need to rely on any strong metaphysical assumptions about surfaces; all he needs for his argument is the premise that if a water part keeps its surface, it is separate from the other parts, and the region in the blend that lies inside the boundary contains only water. Thus, this part is not mixed with the other parts but only juxtaposed to them.

But why does losing the surfaces imply fusion and non-preservation of the matter and state? Alexander appears to give two arguments, one that deals with non-preservation of matter (*Mixt.* 14.22–15.2), the other with the non-preservation of the state (*Mixt.* 15.3–10). Unfortunately, these arguments are not very clear. Indeed, the first one seems not to give any reason why losing the surfaces entails fusion:

εἰ δὲ μηδὲν μόριον κατ' οἰκείαν περιγραφὴν τε καὶ ἐπιφάνειαν εἶη τῶν μεμιγμένων, ἀλλ' εἶη πᾶν ὁμοιομερές γεγονός τὸ σῶμα, οὐκέτι μὲν ἂν εἶη παράθεσις, ἀλλὰ δι' ὅλων κρᾶσις· οὐ μὴν ἔτι σώζοιτο ἂν τὰ ἐξ ἀρχῆς σώματα τῶν μεμιγμένων, ἀλλ' εἶη ἂν συγκεχυμένα τε καὶ συνεφθαρμένα.

But if no part of the bodies that had been mixed existed with its own shape and surface but the body had become totally uniform, there would no longer be juxtaposition but blending through wholes, as the original bodies that had been mixed would no longer be preserved but would be fused and destroyed together. (*Mixt.* 14.22–27)

Alexander seems to assume what he needs to show, namely, that by losing their surfaces and being wholly co-extended, the bodies are fused. I suggest that Alexander's reason lies in the blend's uniformity.²⁹ A blend is uniform if every part of it contains all the blended bodies. In a blend of water and wine, for example, every part of the blend is a blend of water and wine, and no part of the blend is either water or wine; losing the surface entails that there are no separate water and wine parts in a blend of water and wine, and that the blend is uniform. But if there are no distinct parcels of matter held together by either the water-state or the wine-state in the blend, the matter of the water

29 Todd (1976), 203 thinks that Alexander illegitimately slips into Aristotelian language here. Although the language might be Aristotelian, I assume that the blend's uniformity is a consequence of the parts losing their surfaces.

and the matter of the wine have become unified. Alexander thinks that unification of the underlying matter entails that the ingredients are not preserved (*Mixt.* 28.13–16), since for numerically the same water to persist in the blend, the same parcels of matter must be held together by the water-state, but as already shown, this is impossible if the water parts lose their surfaces.

This kind of reasoning also underlies the second argument, that the states are not preserved:

ἔτι δέ, εἰ ... τὰ δὲ συγκεχυμένα τε καὶ συνεφθαρμένα οὐχ οἶόν τε αὐτὰ σώζεσθαι, οὐδ' ἂν ἕξεις σώζοιντο αὐτῶν, εἴ γε ἔν μὲν τι τὸ γεγονὸς ἐκ τῶν συγκεχυμένων τε καὶ συνεφθαρμένων. ἀνάγκη δὲ τὸ ἔν σῶμα ὑπὸ μιᾶς, ὡς φασιν, ἕξεως συνέχεσθαι, ὥστε καὶ κατὰ τοῦτο ἂν ἀχώριστα ἀλλήλων εἶη τὰ κεκραμένα κατ' αὐτούς.

Further, if ... things that are fused and destroyed together cannot be preserved as they were, then also their states would not be preserved, if indeed what result from things that are fused and destroyed together is one single thing. But it is necessary that one body is held together by one single state (as they call it), so that also in this way blended things would be inseparable from one another, according to their own theory. (*Mixt.* 15.3–10)

Alexander assumes the conclusion of the first argument, the unification of matter in a blend, and argues that, for this reason, the states also cannot be preserved. Key to Alexander's argument is the Stoic dictum that “one body is held together by one single state,” which in this context I take to mean that numerically one state holds together a parcel of matter so as to yield a bounded and separate body. Since the blend has a unified matter, the water-state and the wine-state no longer exist because they do not hold together separate parcels of matter in the blend; instead, since the blend is itself a body, it must be that a new state, distinct from both, holds together the whole blend.

6 Blending by Infinite Division

One can express the gist of Alexander's criticism in chapter VII as follows: Either the mixed bodies keep their surfaces or they do not. If they do, the bodies will not be co-extended because parts of the bodies remain unmixed; if they do not, the bodies will be fused, and a new body will come into existence. This is a simple, powerful, and straightforward argument. Ironically, its

very strength and simplicity might be evidence that Alexander gets the Stoics wrong. It seems too apparent that constraints 1 and 2 cannot jointly be satisfied, and it is hard to believe that someone of Chrysippus's intellectual caliber would not have noticed this. Thus, if chapter VIII of *De mixtione* had been lost and only chapter VII had been transmitted, we would have good reasons to assume that Alexander's constraints 1 and 2 misrepresent the Stoic theory, and we should search, as many have implicitly done, for an alternative interpretation. I will argue, however, that chapter VIII confirms my analysis of chapter VII, for Alexander adds one crucial detail to the Stoic account of blending that shows how both constraints can be satisfied after all: The bodies are not fused, and yet no region in the mixture is occupied by only one of the blended bodies if blending occurs by infinite division.³⁰ On this conception, the Stoics can find a middle way between juxtaposition and fusion.

Since blending by infinite division is at the heart of the spatial interpretation of the Stoic theory of mixture, and since the concept of infinite division was absent in chapter VII, chapter VIII cannot be regarded as a mere appendix. As many modern commentators would agree, the concept of infinite division is critical for understanding the Stoic theory of mixture. If blending by infinite division has this important theoretical role, this provides further evidence that Alexander is reporting an authentic Stoic doctrine.³¹ In my assessment of chapter VIII, I differ starkly from Todd (1976), who believes that "the whole chapter neglects the Stoic claim ... that the constituents are preserved in a blend" (204); rather, precisely the opposite is the case. I also reject the view that chapter VIII merely discusses additional problems with the Stoic view which stem from the reliance on infinite division.³² Although this view does not necessarily make chapter VIII an appendix, it cannot account for the theoretical importance of

30 It is not the only way. The constraints could also be satisfied by superimposing the bodies. Harven (2018) argues that we must understand co-location in this way. She bases her claim on an analysis of chapters V–VI, which, I agree, might suggest superimposition. See also De Haas in this volume p. 000. Be that as it may, chapter VIII presents a different, and what I see as a philosophically much more plausible way to understand co-location and body going through body.

31 For the opposing view, see Collette-Dučić and Delcomminette (2006), 49. They argue that since this view leads to absurdities, we should not ascribe it to the Stoics, and that Alexander presents it only because it the last viable alternative. I do not agree that the view is inherently absurd; and if I am correct, their argument loses its force.

32 Against this view, see Groisard (2013), 79–80, who argues (1) that this is not Stoic and (2) that by arguing against infinite division, Alexander is fighting a straw man. But Alexander does not dispute that an infinite division is possible, as Groisard thinks; instead, he argues that the *outcome* of such a division is impossible. To phrase it more carefully: Alexander's arguments attack the Stoic conception of blending insofar as it relies on a blend having infinitely many parts.

infinite division vis-à-vis constraints 1 and 2, which also loom large in chapter VIII. For if I am right, in this way the Stoics can salvage constraints 1 and 2. Thus, it should be seen as an integral part of the argument that began in chapter VII. Of course, Alexander still thinks that the Stoic theory fails, but, as I will argue, this is far from obvious; and even if it fails, it fails for sophisticated and non-obvious reasons.

7 Two Types of Blending by Infinite Division

Alexander discusses blending by infinite division in 16.9–17.14, the second part of chapter VIII.³³ Alexander sets out two competing views about infinite division that the Stoics might adopt. On the first view, a body cannot be infinitely divided in actuality, but only potentially by a *process* of division. On the second view, a body can be infinitely divided in actuality.

7.1 The First View

Alexander first considers the case of an infinite process of division:³⁴

εἰ μὲν γὰρ λέγουσιν ἐπ' ἄπειρον εἶναι διαιρετὰ τὰ σώματα τῷ μηδέποτε ἐπιλείπειν τὴν τομὴν, ἀλλ' αἰεὶ ἐκ τῶν τεμνομένων περιλείπεσθαι τι τέμνεσθαι δυνάμενον, οὐχ οἷόν τε ἔσται σῶμα τι πάντῃ διαιρεῖσθαι ὡς μηκέτι ὑπολείπεσθαι τι ἐξ αὐτοῦ τομὴν ἀναδέξασθαι δυνάμενον.

For if they say that bodies are divisible ad infinitum in virtue of the fact that the division does not come to an end, but that something always remains from the things that are divided which is capable of being divided, it is impossible that a body is everywhere divided in such a way that no longer something from it remains which is capable of division. (*Mixt.* 16.12–17)

33 Chapter VIII falls into two parts. In the first part of the chapter (15.22–16.8), which I skip here, Alexander discusses two ways of dividing the bodies. The first option is that they are divided into parts of some size *s*, but this is a non-starter because the outcome of this is juxtaposition. The second option assumes that the bodies are divided into lower-dimensional parts, such as surfaces or lines ('divisions' signifies lower-dimensional entities; see esp. Aristotle, *Metaph.* IX 2, 1060b12–19). Alexander thinks that this is impossible because of the Aristotelian argument that a body cannot be composed of lower-dimensional magnitudes; see Aristotle *Phys.* IV 10, 218a6–8; *GC* I 2, 316b4–5, and fn. 45.

34 This view of infinite divisibility has a distinctive Aristotelian ring to it. Based on *Mixt.* 6.2–9, it is reasonable to ascribe this version of blending to Sositigenes and later Stoics, who deviated from Chrysippus and adopted a more Aristotelian version of mixture.

As Alexander correctly points out (14.22–15.2), an infinite *process* of division does not result in a blend, satisfying constraint 2 (in a finite time, at least). When water is poured into wine, the parts of water and the parts of wine will get smaller and smaller, but there will always be subregions in which the ingredients are present in an unmixed state. Thus, the first view is a non-starter.

7.2 *The Second View*

The second view is more promising:

εἰ δὲ λέγοιεν ἐπ’ ἄπειρον εἶναι τὰ σώματα διαιρετὰ τῷ εἰς ἄπειρον δύνασθαι διαιρεῖσθαι [τὸ] πᾶν διηρημένον σῶμα,³⁵ κατ’ αὐτοὺς εἶη ἂν εἰς ἄπειρα ἐνεργεῖα διηρημένα τὰ κεκραμένα ἀλλήλοις. εἰ γὰρ πάντη κέκραται, πάντη διήρηται. πάντη δὲ διηρημένα <εἰς ἄπειρα ἐνεργεῖα εἶη ἂν διηρημένα>.

But if they said that bodies are divisible ad infinitum in virtue of the fact that every divided* body can <, in fact,> be divided ad infinitum, the mutually blended things would, according to them, be divided* into infinitely many parts in actuality. For if they are blended* everywhere, they are divided* everywhere. But being divided* everywhere they would be divided* into infinitely many parts in actuality. (*Mixt.* 16.23–17.3)

On this proposal, the process of division “ends” so that the blended bodies are divided into infinitely many extended parts. Of course, speaking of the completion of a process of infinite division is conceptually difficult, but I think

35 I follow the edition of Bruns. It is perplexing that the infinitive διαιρεῖσθαι and the participle διηρημένον do not have the same tense (In my translation, I followed Todd’s convention to signal a perfect form with an asterisk). Since the tense in the Greek language also expresses the aspect of a verb, and the present has a durative aspect, whereas the perfect expresses something’s completion, it is difficult to understand how something whose division is completed can be divided (durative aspect) ad infinitum. For this reason, Todd reads τῷ εἰς ἄπειρον δύνασθαι διηρησθαι [τὸ] πᾶν διηρημένον σῶμα (every body that has been divided can be actually divided). Groisard reads τῷ εἰς ἄπειρον δύνασθαι διαιρεῖσθαι τὸ πάντη διηρημένον σῶμα. But this exacerbates the difficulty, for how could a body that already is *everywhere* divided be further divided? Groisard dodges the problem in his translation: “parce qu’un corps qu’on divise partout se laisse diviser.” But I think we can make sense of Bruns’s text precisely because the perfect tense does not imply that no further divisions are possible. Alexander imagines the case in which something is already divided, but is further divisible, and in contrast to the first option, these further divisions will eventually not leave a remainder. In this sense, the body can in fact *be* divided into infinitely many parts.

little hinges on this.³⁶ The important point is that it sheds light on what mereological structure of bodies the Stoics assumed. In contrast to what Aristotelians and possibly some Stoics like Sosigenes thought, the infinitely many parts exist actually and not merely as possible divisions. Moreover, in contrast to the Epicureans, who believed that there are mereological atoms, (some of) the Stoics thought that bodies are continua (i.e., every part has itself proper parts) and that there are no mereological atoms (though Alexander does not explicitly state this assumption). In contemporary mereology, this theory has been called “Stoic gunk.”³⁷ Nolan sums it up as follows:

To assert the existence of gunk is to assert that there is an object such that all of its parts have proper parts: it follows from this that each of its parts can themselves be further divided, without end, and without at any stage (finite or infinite) reaching a bedrock of indivisible minimal parts (that is, the object is not made up of atoms). (Nolan (2006), 163)

In his paper, Nolan shows that there is evidence in Sextus Empiricus and Plutarch that supports ascribing this view to the Stoics.³⁸ If we combine this finding with the fact that Alexander certainly appears to be referring to it as a view that some philosophers did in fact hold, we have reason to believe that this is an authentic piece of Stoic philosophy. So if this view satisfies Alexander’s constraints on a blend, we have good evidence that chapters VII–VIII accurately present an authentic Stoic doctrine.

Does the view deliver on its promise? Let us recall Alexander’s understanding of blending. If water and wine blend, it must be true that (constraint 1) there are still parts of water surrounded by their surfaces, and the parts of wine surrounded by their surfaces; and that (constraint 2) there is no subregion of some size s of the whole region occupied by the blend where there is only water or only wine. Since, on the present hypothesis, the water and the wine are divided into magnitudes, I see no reason not to assume that the parts

36 For problems concerning infinitely dividing gunk, see Hawthorne and Weatherston (2004).

37 See Nolan (2006); Marmodoro (2017), chapter 6. For modern-day discussion, see Zimmermann (1996); Sider (1993).

38 Rashed (2009) argues that also DL VII 150–151 (= LS 48A and 50B = SVF 2.479 and 2.482 part) supports the view that the Stoics believed in the reality of infinitesimal parts of the bodies, thereby rejecting the traditional interpretation of the passage. According to the traditional interpretation, Chrysippus believed in potential infinite division; see, e.g., Collette-Dučić and Delcomminette (2006), 35. Rashed differs from the view offered here insofar as he endorses a division into points and distinguishes between blending and division.

keep their surfaces. After all, the ingredients do not “change” in a significant way: the water and the wine are still there, untransformed but divided into infinitely many parts and scattered throughout the blend. And since their size must be > 0 (otherwise they would be points, not magnitudes), each of the parts is surrounded by a surface (since any finite three-dimensional object is bounded³⁹). Constraint 2 is also satisfied because no subregion is occupied by only one ingredient. However many divisions of the blend we carry out, all regions in the blend will contain parts of both ingredients. This is true because there is no smallest size.⁴⁰ For any region of size s^* , there is a size $s < s^*$ into which the ingredients are divided so that every subregion will have both water and wine in it.⁴¹

One might wonder whether this is not just juxtaposition after all, since the infinitely many parts end up being next to each other. As Parsons (2007) rightly observes: “On Nolan’s view, there are still parts of the blend that are pure wine and pure water, rubbing shoulders in the blend just like grains of wheat and lentils” (208). But there is an important difference: in the case of juxtaposition, there are parts that have not been mixed, that is, divided. These parts will have some size s and occupy a region of size s in the blend. For if the ingredients are divided into finitely many parts of size s and juxtaposed to each other, there is a size $s^* \leq s$ such that there are regions of size s^* occupied by only one ingredient. But on the present proposal, that is not the case. There are no regions in the blend occupied by only one ingredient.

Parson’s observation also highlights the crucial difference between a mereological interpretation of blending and a spatial one. The mereological interpretation assumes that the blend is uniform, that is, that every part of the blend has all the ingredients as parts. The spatial interpretation does not; rather, there are still parts in the blend that are pure water or pure wine. The claim of the spatial interpretation is that *no region* in the blend is occupied by either pure water or pure wine. While this distinction might sound *recherché*, the evidence suggests that blending by division must be understood spatially. First, it is unclear how a process of division would lead to parts of water having parts of wine in them. After all, the parts only get smaller but do not change in their composition. Second, if chapter VIII presupposed a mereological interpretation, it would be moot. As discussed above, Alexander has shown already in

39 Note that on our minimal conception of boundaries, introduced in the last section, being bounded has no ontological import. Even if bodies are open, they will have a boundary, although it is not a *part* of them.

40 At least that is how, following most interpreters, I understand the Stoic theory. The evidence from Alexander is less clear; see my discussion below.

41 See Nolan (2006), 171–172.

chapter VII that a Stoic blend cannot be uniform because this implies fusion.⁴² Of course, one could still hold that Alexander, or even the Stoics themselves, adopted a mereological interpretation, but the interpretative costs of doing so would be significant: the account of blending in chapter VIII would turn out to be unrelated to the two constraints, even though Alexander's inference—that the parts are unmixed if they are undivided (*Mixt.* 15.24–25)—explicitly links constraint 2 to blending by division. It is also a disingenuous interpretation of the Stoics because they cannot escape Alexander's criticism in chapter VII, which, as we have seen, is almost too straightforward.⁴³ On the present proposal, however, it makes perfect sense: in chapter VII, Alexander correctly identifies the two salient constraints on Stoic blending and points to an incompatibility between them. Chapter VIII considers a Stoic response: that the constraints are incompatible only if the bodies are not infinitely divided. Alexander accepts that blending by division into infinitely many parts satisfies constraints 1 and 2, but he raises a further difficulty, to which I now turn: that the parts cannot have an exact size or location.

8 Alexander's Criticism of the Second View

Alexander envisages two possible outcomes of the division of the wine and water into infinitely many parts, corresponding to an εἰ μὲν (17.3) ... εἰ δὲ (17.10) construction. The latter option (*Mixt.* 17.10–14) is that what is left are points. This implies that “a magnitude is not composed of magnitudes” (*Mixt.* 17.12–13), which is an unpalatable consequence for Alexander.⁴⁴ But since our available evidence also speaks against the view that the Stoics assumed that matter is divisible into points, I will not discuss it further here.⁴⁵

The first option (*Mixt.* 17.3–10), on the other hand, corresponds to the gunk hypothesis: The infinitely many parts are all extended. Alexander criticizes this position because a blend with infinitely many parts would be infinitely large. His argument, however, contains a fallacy, for the expression “what is

42 Helle (2018), 93–94, also emphasizes that the preservation of the blended bodies cannot be squared with a mereological interpretation.

43 It was suggested to me that the Stoics embraced the incompatibility because they loved paradoxes. To propose such an explanation is a desperate move.

44 Alexander does not state his reasons, but he clearly follows Aristotle here, who discusses and rejects this view in texts such as *Phys.* IV 10, 218a6–8, VI.1, and *GC* I 2, 316b4–5. For discussion of the Aristotelian evidence, see Sedley (2004); Pfeiffer (2018), 6.4.5; Bostock (2006).

45 But see Rashed (2009), who believes that Stoic bodies do consist of points.

composed of infinitely many things that have some magnitude and extension is infinite” (τὸ γὰρ ἐξ ἀπειρῶν μέγεθός τι καὶ διάστασιν ἔχόντων συγκείμενον ἄπειρον) (*Mixt.* 17.5–6) is ambiguous. It can mean either that there is a size s such that all parts are equal or larger than s (i.e., $\exists s \forall x (Part(x) \wedge x \geq s)$) or that for all parts there is a size that they have (i.e., $\forall x \exists s (Part(x) \wedge x \geq s)$). Relying on what has been a standard objection to the existence of infinitely many parts,⁴⁶ Alexander takes the expression in the first sense; the Stoics, however, take it in the second sense, on which it does not follow that the blend is infinitely large (because the size of the parts approximates zero). Alexander appears to presuppose that a smallest size exists; the Stoics deny precisely this.

Nevertheless, I think that Alexander is onto something here, for his objection relies on the premise that each part has an exact size, which one can measure. If we accept the Stoics’ claim that the process of infinite division has resulted in infinitely many parts in actuality, each of which has some size or other (they are not points!), what then is their size? Since the parts exist in actuality, and not merely as outcomes of *further* divisions, they should have some size. It is also plausible that a part of size s exactly occupies a region of size s . Thus, for each part in the blend, we should be able to point to a region of some size that it exactly occupies.

But it turns out that we cannot. As Nolan and Parsons have shown, the parts in a Stoic blend cannot have an exact location.⁴⁷ Here is why: for a blend to exist, any subregion of the region occupied by the mixture of wine and water must contain both wine and water; if some region were solely occupied by a part of water or a part of wine, water and wine would not be co-extended. Thus, there is no region occupied only by wine or only by water. However, if the parts into which wine and water are divided have an exact size, they should be located exactly at a region of that size. But this is impossible, since it would follow that there are regions in the blend occupied solely by water or solely by wine. Hence, the parts of water and wine cannot have an exact size. But this result is truly perplexing! Since the parts of wine and the parts of water remain distinct, each should have an exact size that corresponds to its spatial extension.

Here a Stoic might object that Alexander falsely assumes that there are ultimate parts, since his objection seems to presuppose that we can find the ultimate bottom layer of parts, so to speak, and then ask what the size of these ultimate parts is. The Stoic will reply that this is not possible because there are no ultimate parts, and every part has further parts without an end. In the conceptual framework of *De mixtione*, however, we must distinguish two

46 Cf. Todd (1976), 207, though Todd thinks that the Stoics did not posit an actual infinity.

47 See Nolan (2006), 172–176; Parsons (2007), 207–210.

ways of conceptualizing being divided everywhere in actuality. One way is to assume that we have reached ultimate parts, which cannot be further divided. Of course, it is possible that Alexander himself made this assumption: his assertion that there is an end to the division whose outcome is infinitely many parts might suggest that we have reached the bottom layer. This would contradict Chrysippus's claim that regarding the ultimate parts, "we ... must say neither of what parts we consist, nor, likewise, of how many, either infinite or finite" (LS 50C = Plut. *Comm. not* 1078e–1080e), which, following Nolan (2006, 165), I read as denying ultimate parts. But for Alexander's objection to work, we need not make this assumption; instead, we should insist that the Stoics are committed to the actual existence of the parts (without being committed to ultimate parts).⁴⁸ Yet, if these parts are actual, Alexander will ask: "What is their size?" The only answer available is that their size *approaches* zero.⁴⁹

Of course, it is possible that the Stoics actually embraced this result. Michael J. White (1992, 285–313) has proposed (independently of this debate) that Stoic bodies have fuzzy boundaries. On this theory, we could explain why the parts have no exact size and location. In the dialectical context of *De mixtione*, however, I think that Alexander's point still stands. For it puts pressure on the Stoic insistence that the bodies in the blend are "still there." For if parcels of matter have no exact size, in what sense are they held together by the water-state or the wine-state in the blend? Alexander rightly points out that it is incumbent on the Stoics to explain this.

The verdict is still out on whether the claim that every body has an exact size and an exact location is a conceptual or metaphysical truth. It might be, as Nolan (2006) says, that "this strikes us as bizarre (though whether it is deeply bizarre or merely unfamiliar is a further question), ... [but it] is a distinctive option that falls prey to no obvious incoherence or metaphysical intractability" (175). But our task here was not to evaluate contemporary accounts of gunk or fuzzy boundaries, but rather to ask whether Alexander's objection has philosophical value within the framework of *De mixtione*. My answer is that it does.⁵⁰

48 This assumption is explicit in Nolan (2006), 167, who relies on Sextus's report. See LS 50F. I would tentatively ascribe the same view to Marmodoro (2017), since she speaks of actual gunk, though when characterizing it she refers to an "unceasing division" (160) and states that "the constituent parts of unlimitedly divided bodies are infinite series of parts converging on zero extension or point-size, without ever reaching this limit" (161); here "unceasing division" can be taken to be in a *potential* sense.

49 Marmodoro (2017), 163, gives the same answer, though as noted in the previous footnote, it is unclear whether she intends a constructive-potential reading of it.

50 I would like to thank Andreas Anagnostopoulos, Gábor Betegh, Reier Helle, and Vladimir Mikes for their extensive comments on earlier versions of this paper.