

# Parts, Wholes, and the Elements in Some Medieval Philosophers

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## 1. *Elemental Mixture vs. Elemental Bonding*

We have our elements—those on the Periodic Table—and Medieval Aristotelian had theirs—earth, air, fire and water. Not only was the list of elements much smaller way back then; the four the old thinkers listed were not even elements in the modern sense. It's intuitive to think of the elements, old or new, as the basic building blocks, or *parts*, out of which all the ordinary *wholes*, or *substances* (people, dogs, cats, etc.) are composed. But ancient and medieval proponents of the four-elements theory had theoretical reasons for denying that the elements exist as actual parts of substances. From Aristotle to Albert the Great, the dominant view was that elements can be actual parts of substances, only if they undergo some chemical change which causes the elements to exist in a substance in *diminished*, *impaired*, or *intermediate* state. And from Aquinas onward, the dominant view was that elements cannot in any sense be actual parts of substances. This essay contributes to our understanding of medieval theories of parts and wholes by showing why the elements were not regarded as the sorts of things that could be parts of substances.

One way to appreciate just how different the old theory is from the contemporary is to consider the basic concepts used to explain the relations between elements when they combine to form more complex substances. At the colloquial level, we might talk about the elements in the modern sense, as I have already done, as “building blocks,” and of complex wholes as “built up” from these basic things. At a more sophisticated level, we talk about the elements forming *bonds*, where a bond involves being appropriately spatially related and either sharing or transferring parts. Whether we access what the theory tells us about how elements are related through the concept of building or the concept of bonding, both concepts can be gathered under the more general (albeit very colloquial) concept of *being stuck together*. But on the old theory, from Aristotle onwards, anyway, the basic concept used to explain the relations between elements when they combine to form more complex substances is *mixture*.

For Aristotle and all who did natural philosophy in his wake, the building-block model of elemental composition (elements *stuck together* to form complex substances) entailed reductionism (*all there is* to the complex substance is its elements) and was therefore a philosophical nonstarter. By contrast, The theory of mixture was supposed to be that model of elemental composition which prevented reductionism. But mixture turned out to be a problematic notion. Do the ingredients of a mixture continue to exist when they are mixed together? If so, how is the thing mixed from them one thing “over and above” rather than just “reducible to” its ingredients? If not, how is mixture different from ordinary cases of generation and corruption whereby the generated comes to be from the corrupted? The tall order for proponents of the theory of elemental mixture, then, was to offer an account of how a mixture could be a thing distinct from its elements which avoids treating the elements simply as the *termini a quibus* of ordinary generation. Most accounts involve some sort of attribution of *potential* or *virtual* existence to the elements in a mixture, but authors offered many different accounts of what this sort of existence amounts to.

An additional problem, and the one which will occupy the bulk of this essay, concerns the relationship between hylomorphism and the theory of elemental mixture. Hylomorphism tells us that a material substance is a composite of two metaphysical parts, form and matter. The theory of elemental mixture tells us that a material substance is a mixture of elements. What have these theories to do with each other? Moreover, the elements were themselves taken to be hylomorphic compounds, composites of prime matter and substantial forms together with characteristic accidental forms of quality.<sup>1</sup> Those who, like Aquinas and Buridan, thought that no material substance could have more than one substantial form had to characterize the potential or virtual existence of the elements in a material substance in some way that entails their not really being parts of the substance whose ingredients they are. Those who, like Scotus and Ockham, thought that some material substances can and do have more than one substantial form seem *prima facie* to have the philosophical resources to let a material substance have both its substantial form and have, as parts, the elements and their substantial forms. Yet these two concurred with Aquinas and Buridan in rejecting the thesis that elements actually exist in and are really parts of, a mixture.

In this essay I examine the responses of four scholastic thinkers—Thomas Aquinas (1225–1274), John Duns Scotus (1265–1308), William Ockham (ca. 1287–1347), and John Buridan (ca. 1300–1361)—to the questions, Do the elements exist in a mixture, and if not, why not? I examine their responses in the light of their respective versions of hylomorphism. It will become clear that a thinker’s version of hylomorphism—and specifically what each version has to say about the number of substantial forms in a material substance and the ontological status of prime matter—determines to a large extent one’s views about the ontological status of the elements in a mixture. All deny that the elements actually exist in a mixture, but they deny this for different reasons. Aquinas, Ockham, and Buridan offer reasons that have to do with their understandings of the metaphysics of composition. Scotus’s reasons have to do with specific features of the chemical theory of the four elements (features discussed in due course). For the first three thinkers, howsoever we update our theory of elements or our theory of elemental composition (e.g., from mixing to bonding), we will not get substances which have elements as actual parts. For Scotus, however, one could easily envision a chemical theory which would allow us to have substances with elements as parts. Before examining these scholastic views, however, I will first offer a selective history of the development of the theory of elemental mixture from Empedocles to Albert the Great, focusing on Aristotle.

## 2. *Elemental Mixture before Aquinas*

### 2.1 *Aristotle contra Empedocles*

Empedocles (ca. 492–432) is credited as the first philosopher to posit the four basic physical elements, earth, water, air, fire. Familiar substances were supposed to be compounds of portions of two or more of these elements.<sup>2</sup> The elements themselves are never generated or corrupted, but the generation and corruption of everything else could be explained by the combination and recombination of these elements as these are influenced by the cosmic forces of Love and Strife. Aristotle adopted Empedocles’ four elements, but criticized his account of composition.

But flesh, too, and marrow come-to-be out of [the elements]; how do they come-to-be? What manner of coming-to-be is ascribed to them by those who hold such a view as that of Empedocles? They must maintain that the process is composition, just as a wall comes-

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<sup>1</sup> Earth is cold and dry, Water is cold and wet, Air is hot and wet, Fire is hot and dry.

<sup>2</sup> Empedocles of Acragas, *Fragments* 14.19, 14.49, in Richard D. McKirahan, *Philosophy Before Socrates: An Introduction with Texts and Commentary* (Indianapolis: Hackett, 1993), 235–237, 242.

to-be from bricks and stones; moreover, this “mixture” will consist of the elements preserved intact but placed side by side with one another in minute particles. This, supposedly, is what happens in the case of flesh and each of the other compounds. The result is that Fire and Water do not come-to-be out of any and every part of flesh; for example, while a sphere might come-to-be from one part of a piece of wax and a pyramid from another, yet it was possible for either shape to have come-to-be out of either part of the material. This, then, is how coming-to-be occurs when both Fire and Water come-to-be out of any part of the flesh. But for those who hold the above view [i.e., Empedocles’] this is impossible, but the process can only take place as stone and brick come-to-be out of a wall, that is, each out of a different place and part.<sup>3</sup>

Aristotle’s concern is that on Empedocles’ view an element in a compound substance is at best “side by side with another in minute particles,” similar to the way in which “bricks and stones” exist “side by side” or *juxtaposed* in the building they compose. A result of this kind of composition is that the compound lacks *uniformity*; one could extract water from only the water-parts of a compound, and fire only from the fire-parts. By contrast, wax is a uniform substance and for this reason a wax sphere or a wax pyramid can be shaped out of any part of a piece of wax. Aristotle imagines that natural compound substances like flesh are in the relevant respect like wax rather than like a building: whatever has the potential to be generated from the flesh should be able to be generated from any part of the flesh, just as whatever has the potential to be generated from the piece of wax (e.g., a wax sphere, a wax pyramid) can be generated from any part of the piece of wax. So if the elements combine in such a way as to produce a new, natural substance (e.g., flesh) any kind of element that went into the original combination—fire and water are listed in the quoted text—should have the potential to be generated from any part of the compounded substance. At the back of Aristotle’s insistence that a substance like flesh is in the relevant respect more like wax than a building is, I presume, the thought that flesh is a natural substance, a substance having its own nature not reducible to the natures of the things it is made of. A building, by contrast, is an artifact, and in at least one text Aristotle seems to indicate that artifacts as such do not have natures—only their natural components do:

Some identify the nature or substance of a natural object with that immediate constituent of it which taken by itself is without arrangement, e.g. the wood is the nature of the bed, and the bronze the nature of the statue. As an indication of this Antiphon points out that if you planted a bed and rotting wood acquired the power of sending up a shoot, it would not be a bed that would come up, but wood which shows that the arrangement in accordance with the rules of the art is merely an accidental attribute, whereas the substance is the other, which, further, persists continuously through the process.<sup>4</sup>

So if flesh were as Empedocles makes it out to be, its nature would be the natures of the elements from which flesh is compounded; flesh would in this respect be more like an artifact than a natural substance, more like a bed than a tree. But it is a natural substance. So we need a different account of how it comes from the elements, Aristotle posits mixture (*mixis* or *krasis*) rather than composition (*synthesis*) as the preferred account, and defines mixture in the following text:

We must not say that the ingredients, if they are preserved in small particles, are mixed (for this will be “composition” [*synthesis*] and not “blending” [*krasis*] or “mixing” [*mixis*], nor

<sup>3</sup> Aristotle, *De Generatione et Corruptione* II.7 334a 25 – 334b 1 (Loeb Classical Library, v.400), trans. E.S. Forster (Cambridge, MA: Harvard University Press, 1955), 301.

<sup>4</sup> Aristotle, *Physics* II.1 193a 10–16, in *The Complete Works of Aristotle: The Revised Oxford Translation*, v.1, ed. Jonathan Barnes (Princeton: Princeton University Press, 1984), 329–330.

will the part show the same ratio between its constituents as the whole; but we say that, if mixing has taken place, the mixture ought to be uniform [*homoiomeres*] throughout, and, just as any part of water is water, so any part of what is blended [*krathentos*] should be the same as the whole. But if mixing is a composition of small particles, none of these things will happen, but the ingredients will only be mixed according to the standard of sense perception, and the same thing will be a mixture to one man, if he has not sharp sight, but to the eyes of Lynceus will not be mixed.)<sup>5</sup>

So a genuine mixture is uniform or homoiomeric; every part of flesh is flesh, just as every part of water is water. This uniformity condition does not of itself entail that the elements in a mixture have been corrupted, that they no longer exist. Later philosophers would marshal additional premises to argue that the elements in a mixture have been corrupted, but Aristotle himself seems to have opted for a different theory. He asserts that the elements in a mixture, along with the qualities of the elements in a mixture, exist in an “intermediate” or “mean” state, such that hot elements (fire and air) are cooled by their proximity to the cold elements (earth and water), while the cold elements are warmed, producing a state in which the elements are “equalized” and in which, therefore, the mixture itself is uniform. Thus, “it is in virtue of being in a ‘mean’ condition that the dry and the moist and the like produce flesh and bone and other compounds.”<sup>6</sup> And Aristotle says that it is in this sense that the elements have merely potential existence in a mixture.<sup>7</sup> Neither the elements nor their qualities have been corrupted; instead these exist in an intermediate state and, under the right conditions, can resume their natural states.

## 2.2 John Philoponus

John Philoponus (ca. 490–570) seems to have endorsed Aristotle’s account of mixture but added nuance to the sense in which the elements have potential existence in a mixture. Imagine a geometer; she has the potential to do geometry in at least two senses: first, she is a rational creature and any rational creature is the sort of thing able to learn geometry; but second, she has learned geometry and so she can do geometry whenever she wants to. Now imagine a drunken geometer. It’s not quite right to say that she has forgotten how to do geometry, but neither is it quite right to say that she can do geometry if she wants to. Her drunkenness impairs her from exercising her ability to do geometry. For Philoponus, the sort of potentiality the ingredients of a mixture have while they are in a mixture is like the potentiality a geometer has while she is drunk.

For in the blended wine there are both water and wine in potentiality, but not in potentiality in the first sense, I mean in the sense of suitability as water is in potential to mist; but neither simply in the second sense, I mean the one according to the state only, as it is with the sleeping geometer. But rather it is in the manner of the drunken geometer, trying to do geometry, acting according to his state but not uncorruptedly, that also the water and wine remain in the blend. For each acts in the mixt in a limited way. So, on the one hand, both are preserved in potentiality, but neither is in actuality such as it was at the beginning.<sup>8</sup>

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<sup>5</sup> Aristotle, *De Generatione et Corruptione* I.10 328a 8–15, 259. Lynceus, according to Forster’s note, was “one of the Argonauts, famous for his keen sight (Apollonius Rhodius i. 153 ff.).”

<sup>6</sup> Aristotle, *De Generatione et Corruptione* II.7 334b 28–30, 305.

<sup>7</sup> Aristotle, *De Generatione et Corruptione* II.7 334b 9–17, 303.

<sup>8</sup> John Philoponus, *In Aristotelis libros De generatione et corruptione* 188.17–25, ed. H. Vitelli (Berlin: Reimer, 1897), trans. Neil van Leeuwen in Rega Wood and Michael Weisberg, “Interpreting Aristotle on Mixture: Problems about Elemental Composition from Philoponus to Cooper,” *Studies in History and Philosophy of Science* 35 (2004), 681–706, 688.

The idea is that the wine in the mixture of water and wine will be just as much wine as it ever was; but its ability to exercise its distinctive powers will be impaired due to its being mixed with water (and *vice versa*: water's ability to exercise its powers will be impaired due to its mixture with wine). As for water and wine so for the elements, according to one prominent interpretation of Philoponus on mixtures: "The claim is that when acted on by water, fire will not burn as effectively as it does by itself. It will not be as hot and dry as elemental fire, but will rather be colder and wetter than unmixed fire."<sup>9</sup> And, again, *vice versa*: water will be warmer and drier in the mixture than it is in its unmixed state.

It is not clear that Aristotle's own theory about how flesh comes to be from the elements, as presented in *De Generatione et Corruptione* II.7 or as nuanced by John Philoponus, satisfies all the criteria Aristotle thinks a satisfactory theory of mixture should satisfy. On the one hand, every portion of each element in a mixture is *qualitatively uniform* in the sense that, e.g., the fire in the mixture is indistinguishable, even by Lynceus, from the water in the mixture. On the other hand, it is not *actually uniform* because, after all, the mixture still has bits of fire and bits of water and so on, all existing in a mean or (following Philoponus) an impaired state. And this seems to entail that one could not extract or recover Fire from just any part of the mixture—or at least not in the same way. One could extract Fire from the parts that are Fire, of course (because they are Fire), but one could only extract Fire from the parts that are Water, Earth, or Air by transforming them into Fire. But we could recover Fire in exactly these ways if the mixture were a mere juxtaposition. So in what way has Aristotle or Philoponus in fact improved upon Empedocles? Arguably, Empedocles himself denied that the elements themselves could undergo transformation into elements of different kinds, and Aristotle seems to have understood Empedocles in this way.<sup>10</sup> So in an Empedoclean composition of elements one could only ever extract Fire from the parts that are Fire. However modified or impaired the other elements are in such a composition, they could never become Fire, according to Empedocles. So Aristotle, by permitting the transformation of elements of one kind into elements of another kind, permits in some sense the extraction of Fire from any part of a mixture, even the parts that are Water, Earth, and Air. Still, an additional problem remains, namely that Aristotle seems to have failed to give a satisfactory account of how a mixed substance such as flesh really has a nature of its own. Is not the nature of flesh *really, after all*, on Aristotle's account reducible to the (potential or impaired) natures of the elements?

Suppose we posit for Aristotle that, whatever the status of the elements in a mixture, the natures of the elements are not solely constitutive of the nature of the mixture. Suppose we say, for example, that in addition to the elements (however their status in the mixture is construed) there is, irreducibly, *flesh*. The hylomorphic analysis of material substances would then let us infer that there is, irreducibly, a *substantial form of flesh*. This would give us the genuine uniformity Aristotle seeks: the whole mixture is under the form of flesh and therefore every part of the mixture is flesh, despite the fact that what is informed is some merely qualitatively uniform mixture of elements whose natural properties have been modified to produce some mean state. But inasmuch as these elements continue to exist in a mixture, however impaired, flesh is not the whole story of what some fleshy substance is: it is flesh throughout but it is also fire, air, water, earth. If the elements exist next to one another then one part of the fleshy substance will be flesh and fire, another part will be flesh and earth, and so on, and then we would have the failure of genuine uniformity over again, plus the additional un-Aristotelian scenario in which two bodies (e.g., flesh and fire) occupied exactly the same place.<sup>11</sup> If the elements all occupy the same place, such that each and every part of the fleshy substance has all the elements from which it is mixed, then we recover

<sup>9</sup> Wood and Weisberg, "Interpreting Aristotle on Mixture: Problems about Elemental Composition from Philoponus to Cooper," 685.

<sup>10</sup> Empedocles, Fragment 14.19, ll. 26–35, in McKirahan, *Philosophy Before Socrates*, 236; Aristotle, *De Generatione et Corruptione* II.7 334a 15–27, 299–301.

<sup>11</sup> Aristotle assumes that co-location of bodies is impossible in *Physics* IV.1 209 5–7.

genuine uniformity but still face the problem of the co-location of bodies. These considerations push in favor of simply denying that the elements continue to exist in a mixture and searching for some non-*ad hoc* account of their *potential* existence in a mixture in some thin way that lets us preserve Aristotle's *desideratum* that any element that goes into a mixture should be recoverable from any part of the mixture. Doing so would give us a meaningful distinction between mixture and ordinary generation: the ingredients of a mixture are recoverable from a mixture while the subject corrupted in the generation of a new substance is not recoverable from the generated substance.

### 2.3 Stoic Mixtures

It is a very tall order to get a theory of mixture that preserves both uniformity and recoverability, as the foregoing reflections should have made clear. Until Aquinas, broadly Aristotelian theories of mixture tended to emphasize recoverability at the expense of uniformity. From Aquinas on, it was uniformity at the expense of recoverability. One interesting way to see what a tall order Aristotle bequeathed his followers is to consider an alternative ancient account of mixture. Alexander of Aphrodisias (fl. late 2<sup>nd</sup> c. – early 3<sup>rd</sup> c.) reports that the Stoic philosopher Chrysippus (ca. 280–206) distinguished three senses of mixture, which Long and Sedley take to be representative of general Stoic doctrine:

[Juxtaposition] “[...] Mixtures occur by juxtaposition of two or more substances put together in the same place [...] as occurs, one may say, with beans and grains of wheat when they are placed side by side.

[Fusion] Other mixtures occur by through-and-through fusion of the substances themselves [...] which are destroyed together, as he says happens in the case of medical drugs when the things mixed together undergo mutual destruction and another body is generated out of them.

[Blending] Other mixtures occur [...] when certain substances and their qualities are mutually coextended through and through, with the original substances and their qualities being preserved in such a mixture [...] the capacity to be separated again from one other is a peculiarity of blended substances.”<sup>12</sup>

Stoic juxtaposition is exactly the same as Aristotelian juxtaposition. The theory of mixture Aristotle offers in *De Generatione et Corruptione* II.7 is obviously not juxtaposition. However, neither is that theory equivalent either to Stoic Fusion or Stoic Blending. Stoic Fusion gives us uniformity but not recoverability. Stoic Blending gives us both uniformity and recoverability, but at the cost of co-located bodies. Aristotle's theory of mixture, in spite of himself (so I have argued), gives us recoverability but not uniformity. Earlier medieval theories of mixtures tended to resemble, more or less, Aristotle's own theory. Later medieval theories of mixture (from Aquinas on) really seem to amount to Stoic Fusion, as we will see. I do not know of any broadly Aristotelian medieval philosopher who believed there could be a Stoic Blending of the elements in a mixture. Even among those who thought that bodily co-location was possible, Stoic Blending of elements was rejected on other grounds, as we will see.

### 2.4 Averroës and Avicenna

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<sup>12</sup> Alexander of Aphrodisias, *On Mixture* 216,14–218,6, trans. A.A. Long and D.N. Sedley in *The Hellenistic Philosophers, Volume I: Translations of the Principal Sources, with Philosophical Commentary* (Cambridge: Cambridge University Press, 1987), 290.

The idea that the elements continue to exist in a mixture, albeit in some modified form, persisted, in rather different ways, in the thought of Avicenna (c.980–1037) and Averroës (1126–1198), the two thinkers whom Thomas Aquinas would later take as foils in developing his own highly influential theory of mixture.<sup>13</sup> Avicenna thought that the substance of the elements were “fixed and permanent” in a mixture, but their qualities were “changed and converted.”<sup>14</sup> Averroës dissented, holding that an element could not exist without its qualities. He held instead that both the elements and their qualities remained in a mixture, but in a diminished way, such that the mixture itself is a medium between the elements and their qualities.<sup>15</sup> Averroës thought both that one substance could be more or less intense than another of the same species, and that numerically the same substance could change in its degree of intensity, and it is specifically the second claim that is operative in his account of the existence of the elements in a mixture. Averroës holds that the substantial forms of elemental substances are diminished and become as it were a medium between a substantial form and a qualitative form. The qualities of the elements are also diminished, such that a mixture of these diminished elements exhibits a more or less uniform complexion—the fire in the mixture becomes cooler and moister, the water in the mixture becomes warmer and drier, and so on. For our purposes, we can emphasize what Avicenna and Averroës agree on: the elements continue to exist in a mixture and a mixture fails to be uniform for pretty nearly exactly the same reasons as Aristotle’s theory. This basic view that the elements continued to exist in a mixture, side by side but in some moderated or diminished way, was adopted by important early scholastic commentators on Aristotle such as Albert the Great and Richard Rufus of Cornwall.<sup>16</sup> After Aquinas, however, the view that the elements continued to exist in a mixture was considered old-fashioned.<sup>17</sup>

### 3. *Elemental Mixture after Aquinas*

#### 3.1 *Systematic Considerations*

The four later medieval theorists of mixture examined in the remainder of this essay agreed that the elements do not exist in a mixture, but their reasons for holding this view differ from each other. It is part of my thesis that the ways in which these reasons differ is partially determined by these thinkers’ different metaphysics of substance, such that getting clear about their reasons for denying the existence of the elements in a mixture requires clarity about their metaphysics of substance. Accordingly, I turn now to examine these four different versions of the hylomorphic

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<sup>13</sup> The brief discussion of Avicenna and Averroës offered here closely follows Thomas M. Ward, *John Duns Scotus on Parts, Wholes, and Hylomorphism* (Boston and Leiden: Brill, 2014), 128–129.

<sup>14</sup> Avicenna, *Sufficientia* I. c.10 (Venice 1508, I, f.19rb), Et harum formae essentiales sunt fixae et permanentes, sed accidentia earum...mutantur et convertuntur. Quoted in Duns Scotus, *Opera Omnia* (Vatican XIX, 139).

<sup>15</sup> Averroës *De caelo* III com. 67. [D]icemus quod formae istorum elementorum substantiales sunt diminutae a formis substantialibus perfectis, et quasi suum esse est medium inter formas et accidentia. Quoted in Duns Scotus, *Opera Omnia* (Vatican XIX, 143).

<sup>16</sup> Albert the Great, *De generatione et corruptione* I, tr.6, c.5 (Cologne ed. V.2), 172. For relevant texts of Richard Rufus, along with discussion of how his view differs from Averroës’, see Wood and Weisberg, “Interpreting Aristotle on Mixture: Problems about Elemental Composition from Philoponus to Cooper,” 698–704.

<sup>17</sup> Thus Peter Aureole, in the first quarter of the fourteenth century, distinguishing the three major views about the ontological status of the elements in a mixture, could label them Avicenna’s, Averroës’, and the Moderns’. Peter Aureole, *Commentarium in secundum librum Sententiarum*, d.15, a.1 (Rome: ex Typographia Vaticanae, 1596), p.206.

theory of substance, before going on to examine the reasons why the thinker associated with each version denies the existence of the elements in a mixture.

Any hylomorphist thinks a material substance is a composite of matter and substantial form. Some, who we will call *unitarians*, think that one substance can have one and only one substantial form. Others, the *pluralists*, think that some substances have more than one. Pluralism about substantial form was a widespread medieval view, and for a season enjoyed the status of theological orthodoxy.<sup>18</sup> Pluralists disagreed among themselves about just why pluralism was true, just how many substantial forms belonged to a substance of some kind, and just how a plurality of substantial forms of a substance were related to each other when they composed a substance. Any version of pluralism, however, shares the basic assumption that *material substances can be parts of material substances*. So any version of pluralism is committed to *part-substances*:

part-substance =<sub>def</sub> a substance that is a part of a substance

A composite of matter,  $m_1$ , and substantial form,  $f_1$ , just is a substance,  $x$ , whether or not  $m_1$  is itself a composite which has at least two parts of its own, matter,  $m_2$ , and form,  $f_2$ , and whether or not  $x$  is itself a (proper) part of a material substance,  $y$ . Many pluralists (every pluralist I know of) added restrictions to this basic assumption, to avoid the mereological free-for-all that *any* material substance can be a part of *any* material substance, and some of these restrictions will be discussed in what follows. One restriction worth mentioning now and on which everyone (at least implicitly) agreed is that if a material substance,  $x$ , can be a part of another material substance,  $y$ ,  $x$  can do so only by being or being part of the *matter* of  $y$ . A substance composed of more than one substantial form is supposed to be just one substance because there is some one substantial form relative to which prime matter and all the other substantial forms together are matter. As far as I know, no pluralist thought that there could be genuinely one substance that did not have one “final” or “perfecting” substantial form relative to which all other substantial forms were matter. Another way to put this is that no one thought that there could be one material substance if there were not one substantial form to which all other substantial forms were somehow related as potency to act. A form all by itself is not in potency to anything—that’s just not the sort of thing it is. But a *substance*—so the pluralists insist—can be in potency to a perfecting substantial form (under appropriate restrictions). So the sorts of forms that can be parts of a complete substance can be so only by being the substantial forms of part-substances.

Pluralism about substantial forms allows for many different varieties, but any version of pluralism must fall under just one of two basic kinds of pluralism: what I will call *layered pluralism* [LP] and *branching pluralism* [BP].<sup>19</sup>

[LP] For any substance,  $w$ , part-substances of  $w$ ,  $x$  and  $y$ , if  $x \neq y$  then either  $x$  is a part-substance of  $y$  or  $y$  is a part-substance of  $x$ .

[BP] For some substance,  $w$ , part-substances of  $w$ ,  $x$  and  $y$ , such that  $x \neq y$ ,  $x$  is not a part-substance of  $y$  and  $y$  is not a part-substance of  $x$ .

As an example of BP, suppose that a heart, a femur, and the marrow of the femur are all part-substances of a human being. Then the marrow is a part-substance of the bone but not a part-substance of the heart, the bone is not a part-substance of the heart, and neither the heart of the bone. By contrast, in LP, part-substances are never such as to be able to enter into the kinds of

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<sup>18</sup> John Wippel, *The Metaphysical Thought of Godfrey of Fontaines: A Study in Late Thirteenth-Century Philosophy* (Washington, DC: The Catholic University of America Press, 1981), 314–319.

<sup>19</sup> LP and BP are the labels I use here for the theories labeled, respectively, *standard pluralism* and *Scotistic pluralism*, in Ward, *John Duns Scotus on Parts, Wholes, and Hylomorphism*, 166.



branching relations that hold between BP-related part-substances. For example, the LP-defender would deny that the organic parts of an organism have their own substantial forms but might hold instead that a human being has a total of four substantial forms: a substantial form of the body, a vegetative soul, a sensitive soul, and a rational soul. On this view of the metaphysical composition of a human being, a human body would be a composite of prime matter and exactly one substantial form, the form of the body, and the whole body would be informed by the vegetative soul. The sensitive soul would inform the whole composite of body and vegetative soul, and the rational soul would inform the whole composite of sensitive and vegetative body. Figures 1 and 2 below may help to make BP and LP more intuitive:

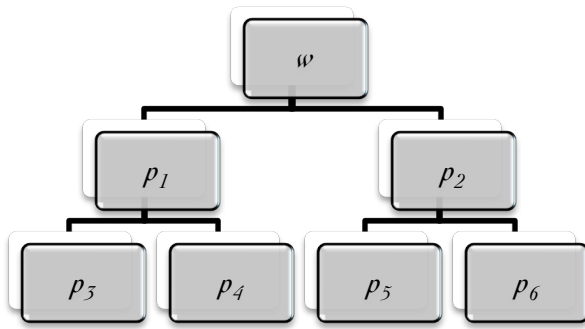


Figure 1: Branching Pluralism

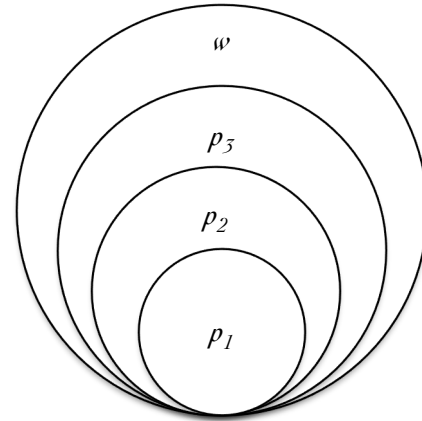


Figure 2: Layered Pluralism

In Figure 1, nodes  $p_{1-6}$  represent part-substances and  $w$  represents the whole or complete substance which has  $p_{1-6}$  as parts. The lines connecting the nodes on one row to the node(s) above them represent parthood relations. Thus,  $p_3$  and  $p_4$  are parts of  $p_1$ , and  $p_1$  is a part of  $w$ , but  $p_3$  is not a part of  $p_4$  or *vice versa*. In Figure 2, circles  $p_{1-3}$  represent part-substances and  $w$  represents the whole or complete substance which has  $p_{1-3}$  as parts. Being contained in a larger circle represents the parthood relation. Thus,  $p_{1-3}$  are parts of  $w$ ,  $p_{1\&2}$  are parts of  $p_3$ , and  $p_1$  is part of  $p_2$ .

Unitarianism about substantial form was also a widespread medieval view, despite the fact that it was for a while a condemned view.<sup>20</sup> It rejects the possibility of a single substance composed of more than one substantial form, and therefore rejects the possibility of part-substances. The most important difference among versions of unitarianism concerns the ontological status of prime matter. Some unitarians thought that the whole actuality of a material substance is or is due to its one substantial form (leaving accidents and accidental forms aside for present purposes). Others thought that prime matter is an actual entity and therefore that one material substance is a composite of two actual things: exactly one substantial form and prime matter. The first sort of unitarianism I label One Actuality Unitarianism [OAU] and the second, Two Actualities Unitarianism [TAU]:

[OAU] The whole actuality of any material substance (ignoring its accidents) is or is due only to its one and only substantial form.

<sup>20</sup> John Wippel, *The Metaphysical Thought of Godfrey of Fontaines: A Study in Late Thirteenth-Century Philosophy*, 314–319.

[TAU] The whole actuality of any material substance (ignoring its accidents) is or is due to its prime matter and its one and only substantial form.

Prime matter is just that theoretical entity posited to explain how substances can undergo change, how they can come to be, and how they can cease to be. It is the potentiality of a material substance, where the potentiality of *x* is best analyzed as *x*'s capacity to undergo change and to be corrupted. Since medieval Aristotelians divided being into actuality and potentiality, for them a thing's being nonactual does not entail its being nonexistent or unreal. A nonactual thing may be a real or existing *potential* thing, and prime matter is just such a thing according to OAU. So even for OAU we can say that prime matter belongs in an account of the ontology of a material substance, but it belongs there as a potential thing. According to TAU, prime matter cannot be the potentiality of a substance unless it is actual in some way. The basic metaphysical insight here is that powers must be rooted or located in actualities, that substantial form is the wrong sort of actuality to explain a substance's capacities to undergo change and cease to exist, and therefore that *some other actuality*, partially constitutive of a substance, must explain these capacities. For TAU-defenders, 'prime matter' designates exactly that *other actuality*. A substance has these capacities because it has an actual part, prime matter, the nature of which is to give a substance just these capacities.

There is a not-too-vague sense in which TAU is *closer* to pluralism than OAU. TAU holds that two actual entities can compose one material substance just in case they are of the right kinds: substantial form and prime matter, according to TAU, are two actual entities that were literally made for each other. BP and LP similarly think that two or more actual entities can compose one material substance just in case they are of the right kinds. According to BP, a heart, a femur, bone marrow, etc., are just the sort of parts a substance needs in order to be a member of the kind, human being, so these, their substantial forms and prime matters, along with a human soul (and whatever other substantial forms some version of BP might posit), can together compose one substance. And according to LP, a human body and (depending on one's preferred version of LP) at least one soul are just the sort of parts something needs in order to count as a human being, so the body, its substantial form and its prime matter, along with at least one soul, can together compose one substance. The difference between TAU on the one hand and BP and LP on the other hand is, of course, that TAU denies while BP and LP affirm that there are or can be part-substances.

So far I have sketched BP, LP, OAU, and TAU in a way that is independent of the historical context in which these views developed. In the following sections I will identify each of these four views with a prominent medieval thinker and argue that his side in the unitarianism/pluralism debates determines to some extent how he develops his account of the ontological status of the elements in a mixture. To foreshadow: John Duns Scotus supports BP, William Ockham supports LP, Thomas Aquinas OAU, and John Buridan TAU. To these theorists I now turn.

### 3.2 Thomas Aquinas

I will proceed chronologically. Aquinas is a OAU. The classic text for his unitarianism is *Summa theologiae* Ia, Question 76, Article 4.<sup>21</sup> He thinks that prime matter depends on form for its actuality.<sup>22</sup>

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<sup>21</sup> Adams remains the best philosophical introduction to the unitarian/pluralism debate I know of. For discussion of Aquinas's position in relation to Scotus and Ockham, see Marilyn McCord Adams, *William Ockham*, vol.2 (Notre Dame, IN: Notre Dame University Press, 1987), 633–670.

<sup>22</sup> Aquinas, *Quaestiones disputatae de potentia dei* q.3, a.5, ad.3 (Turin, 1953). For more texts and discussion see, Robert Pasnau, *Thomas Aquinas on Human Nature: A Philosophical Study of Summa theologiae Ia 75–89* (Cambridge: Cambridge University Press, 2002), 40–44.

In *De Mixtione Elementorum* Aquinas criticizes the Avicennan and Averroistic theories of mixture before offering his own theory.<sup>23</sup> Against Avicenna Aquinas reasons that, since no substance can have more than one substantial form, and since the elements were taken to be composites of prime matter and substantial form, at best a mixture of elements could be an aggregate of very tiny bodies.

For it is impossible for the same matter to sustain diverse forms of elements. If, therefore, in the mixed body the substantial forms of the elements are preserved, it will be necessary for them to be in different parts of the matter. But it is impossible for matter to have different parts unless quantity is already understood to be in matter, for having taken away quantity the substance remains indivisible, as is clear from *Physics* I. But from matter existing under quantity and the arriving substantial form a physical body is constituted. Therefore the parts of matter subsisting under the forms of the elements take on the character of several bodies. But it is impossible for [one body] to be many bodies at once;<sup>24</sup> therefore the four elements will not be in every part of the mixed body. And thus it will not be a true mixture, but an apparent one, as happens in an aggregation of bodies that are imperceptible on account of their smallness.<sup>25</sup>

Aquinas begins from the assumption that a plurality of elemental substances could not share exactly the same substantial form. This assumption is not equivalent to a rejection of the possibility of co-located bodies, since two co-located bodies would involve, if possible, the co-location of *two prime matters* and two (or more) substantial forms. Aquinas's assumption here seems rather to be motivated by his unitarianism about substantial form. One bit of prime matter, *m*, informed by several substantial forms, *f*<sub>1</sub> ... *f*<sub>4</sub>, would either involve all four informing *m* at once and in the same way, or would involve something like LP, e.g., *f*<sub>1</sub> informs *m*, *f*<sub>2</sub> informs the composite of *f*<sub>1</sub> and *m*, and so on. Aquinas, of course, would reject both disjuncts. So if the elements continue to exist in a mixture, the forms of the elements each have their own prime matters and therefore the elements exist, at best, side by side or juxtaposed. Aquinas denies that such an arrangement of bodies could ever compose one substance. Aquinas denies this because he denies the other version of pluralism, BP. BP allows that for some pair of substances, *s*<sub>1</sub> and *s*<sub>2</sub> such that one is not a part of the other—as would be the case if, for example, two elemental bodies were next to each other—*s*<sub>1</sub> and *s*<sub>2</sub> would be part-substances of a third substance, *s*<sub>3</sub>, if there was some substantial form of *s*<sub>3</sub> and if *s*<sub>1</sub> and *s*<sub>2</sub> were (parts of) the matter of *s*<sub>3</sub>. So by Aquinas's lights, Avicenna's theory entails that no mixture is genuinely one substance—every mixture is at best a juxtaposition of tiny elemental substances.

Averroës' theory of mixture holds that the elemental substances themselves and not just their qualities are diminished in a mixture, and that elemental substances can be so diminished because by nature they are not fully-fledged substances. Against Averroës Aquinas asserted the authority of Aristotle: for two extremes to form a medium, they must be opposites within the same genus. For example, white and black are the extremes of an intermediate quality (grey) because

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<sup>23</sup> My discussion of Aquinas and Scotus on the elements closely tracks the discussion in Ward, *John Duns Scotus on Parts, Wholes, and Hylomorphism* (Leiden and Boston: Brill, 2014), 125–144.

<sup>24</sup> This clause follows Paul Vincent Spade's translation: <http://pvspade.com/Logic/docs/mixture.pdf>.

<sup>25</sup> Aquinas, *De mixtione elementorum*, *Impossibile est enim materiam secundum idem diuersas formas elementorum suscipere; si igitur in corpore mixto formae substantiales elementorum saluentur, oportebit diuersis partibus materie eas inesse. Materie autem diuersas partes accipere est impossibile nisi preintellecta quantitate in materia, sublata enim quantitate substantia indiuisibilis permanet, ut patet in I *Physicorum*; ex materia autem sub quantitate existente et forma substantiali adueniente corpus phisicum constituitur: diuerse igitur partes materie formis elementorum subsistentes plurium corporum rationem suscipiunt. Multa autem corpora impossibile est esse simul; non igitur in qualibet parte corporis mixti erunt quatuor elementa: et sic non erit uera mixtio, sed secundum sensum, sicut accidit in aggregatione corporum insensibilium propter paruitatem. Translation mostly mine; see fn.24, above. All subsequent translations of Latin are mine.*

they are both colors. Because a substance or substantial form and an accident do not belong to the same genus, they cannot make something intermediate between them.<sup>26</sup> Moreover substances do not come in degrees and therefore do not admit of intermediaries.<sup>27</sup>

According to Aquinas, the elements do not actually exist in a substance. But the characteristic qualities of the elements interact in such a way that some intermediary quality is generated, and this intermediary quality disposes the matter of the elements to receive the form of the mixed body. When the form of the mixed body is received, the elements themselves are corrupted. But the elements continue to exist virtually due to the existence in the mixture of the intermediary quality.

It is necessary therefore to come up with some other way, by which both the truth of mixture is preserved, and by which the elements are not totally corrupted, but remain somehow in the mixture. It must be considered therefore that the active and passive qualities of the elements are contrary to each other, and are receptive of more and less. But from contrary qualities that receive more and less, there can be constituted a middle quality that shares in the nature of both extremes, just as pallor between white and black, and warm between hot and cold. So, therefore, the excellence of the qualities of the elements remitted, there is constituted from these a certain middle quality that is the proper quality of the mixed body, differing however in diverse bodies according to a diverse proportion of the mixture, and this certain quality is the proper disposition for the form of the mixed body, as a simple quality is for the form of a simple body. Therefore, just as extremes are found in the middle that participates in the nature of both, so the qualities of the simple bodies are found in the proper quality of the mixed body. But the quality of the simple body is something other than its substantial form; nevertheless it acts by the power of the substantial form; otherwise, heat would only heat, while through its action the substantial form would not be educed in the action, since nothing acts beyond its species. So, therefore, the powers of the substantial forms of the simple bodies are preserved in the mixed bodies. There are then forms of the elements in mixed bodies, not in act but in power.<sup>28</sup>

Aquinas' theory surely gives us uniformity, since a mixture has just one substantial form and therefore is just one substance. However many elemental substances went into the mixture, they have been corrupted and one new substance has been generated from them. As for recoverability, the elements in a mixture have merely *virtual* existence, and Aquinas glosses virtual existence in this context as the persistence of *qualities* that are intermediate between the qualities of the elements that were mixed together. Left unexplained in Aquinas's account, however, is just how the newly

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<sup>26</sup> Aristotle, *Metaphysics* X, 1057a18-34 (Barnes II, 1670).

<sup>27</sup> Aristotle, *Categories* V, 3b24-4a7 (Barnes I, 7).

<sup>28</sup> Aquinas, *De mixtione elementorum*, Oportet igitur alium modum inuenire, quo et ueritas mixtionis saluetur, et tamen elementa non totaliter corrumpantur, sed aliquantulum in mixto remaneant. Considerandum est igitur quod qualitates actiue et passiue elementorum contrarie sunt ad inuicem, et magis et minus recipiunt. Ex contrariis autem qualitatibus que recipiunt magis et minus, constitui potest media qualitas que sapiat utriusque extremi naturam, sicut pallidum inter album et nigrum, et tepidum inter calidum et frigidum. Sic igitur remissis excellentiis qualitatium elementarium, constituitur ex hiis quedam qualitas media que est propria qualitas corporis mixti, differens tamen in diuersis secundum diuersam mixtionis proportionem; et hec quidem qualitas est propria dispositio ad formam corporis mixti, sicut qualitas simplex ad formam corporis simplicis. Sicut igitur extrema inueniuntur in medio quod participat naturam utriusque, sic qualitates simplicium corporum inueniuntur in propria qualitate corporis mixti. Qualitas autem simplicis corporis est quidem aliud a forma substantiali ipsius, agit tamen in uirtute forme substantialis; alioquin calor calefaceret tantum, non autem per eius actionem forma substantialis educeretur in actum, cum nichil agat ultra suam speciem. Sic igitur uirtutes formarum substantialium simplicium corporum in corporibus mixtis saluantur. Sunt igitur forme elementorum in corporibus mixtis, non quidem actu sed uirtute.

generated substance is able to retain intermediary elemental qualities. The theory requires that numerically one and the same accident, for example a qualitative accident of warmth, can first be an accident of one substance and then be an accident of a different substance, for example an elemental substance and then a mixed substance—a possibility he elsewhere rejects, holding that accidents cannot jump ship.<sup>29</sup> So Aquinas’s view yields a thin account of recoverability, since the elements simply no longer exist when they are mixed together; still, Aquinas held that a corrupted substance (e.g., a corpse) naturally tends toward “dissolution” to the elements,<sup>30</sup> so he would likely hold that some agent could bring about any element from any part of the mixed substance by acting on it in accordance with whatever its nature happens to be, heating, cooling, desiccating, or saturating it in the right degrees and in the right proportions.

### 3.3 John Duns Scotus

I turn now to Duns Scotus. Scotus adopts BP. He thinks that certain kinds of substances—paradigmatically organs of organisms—are naturally generated for the sake of the organisms whose parts they naturally are. He thinks that some plurality of substances are made to be part-substances of one and the same complex substance, *s*, just in case they all together exist for *s*’s sake and just in case there is some substantial form of *s* relative to which all those part-substances are matter.<sup>31</sup> Since Scotus carves out a philosophically defensible way for substances to have substances as parts, it is at first glance surprising that he follows Aquinas in rejecting the basic Aristotelian view that the elements continue to exist in a mixture. Analysis of his arguments for this rejection will reveal, I trust, why despite endorsing BP he sided with Aquinas on this issue. In the following I analyze a select few of the arguments given in *Lectura* II, Distinction 15, sometimes drawing on other texts.

In one argument, Scotus reasons from the premise that every material substance has its own quantitative form:

[E]very positive accident has for its proper subject a composite substance, and consequently no quantity is in prime matter as in its proper subject; similarly, there is no quantity which follows a form that is prior to the form of an element (because one posits that as the first), but flesh [a kind of mixture] is quantified and has its proper quantity. Either therefore the forms of the elements have their proper quantities, or not. If not, then there would be some generable and corruptible form without its proper quantity, which I hold to be unfitting. But if each one has its proper quantity, then there will be several quantities at once, because ‘every part of the mixed is mixed’.<sup>32</sup>

A mixture is a material substance, so it has its own quantitative form. If the elements remain in a mixture, then they have their own quantitative forms since they too are substances in their own right. But it is a feature of any true mixture that “every part of the mixed is mixed.” So if the elements remain in a mixture, then for any quantitative part of a mixture, each element present in that mixture exists in that part—every part is fire and every part is earth and so on. Therefore the

<sup>29</sup> Aquinas, *In De Generatione et Corruptione* I, l.10, n.6

<sup>30</sup> Aquinas, *In De Generatione et Corruptione* I, l.10, n.3; *Summa theologiae* III, q.50, a.5, corp.

<sup>31</sup> The most important text for Scotus’s understanding of BP is Duns Scotus, *Quaestiones super Libros Metaphysicorum Aristotelis* VII, q.20 (Bonaventure ed., VI, 381–394).

<sup>32</sup> *Lectura* II, d.15, q.un, n.22 (Vatican XIX, 144–145), Praeterea, omne accidens positivum habet pro subiecto proprio substantiam compositam, et per consequens nulla quantitas est in materia prima ut in proprio subiecto; similiter, nulla quantitas est quae consequitur formam priorem forma elementari (quia illam ponit primam), sed caro est quanta et habet propriam quantitatem. Aut igitur formae elementares habent suas proprias quantitates, aut non. Si non, tunc esset aliqua forma generabilis et corruptibilis sine propria quantitate, quod habeo pro inconvenienti. Si autem quaelibet habeat propriam quantitatem, tunc erunt plures quantitates simul, quia ‘quaelibet pars mixti est mixta’.

quantities of these elements exist in every part as well. In Wadding's *Ordinatio* version of the argument, Scotus explains that the problem of several quantities existing in every part of the mixture is equivalent to the problem of co-located bodies.<sup>33</sup> Scotus does not draw an explicit conclusion about what is supposed to be problematic about co-located bodies, but from context it is clear that the conclusion is supposed to be unwelcome.

In the *Reportatio* II-A, d.15, q.un version of the argument Scotus writes,

The rationale [for denying that the elements remain in a mixture] is that quantity follows the composite, as a property of substance follows body. But the same property does not follow several suppositis at once. Therefore it would be necessary that there would be as many quantities in act there as there are elements, and then there will be a juxtaposition of elements and not a mixture.<sup>34</sup>

*Reportatio* II-A takes for granted that elements never exist without their proper quantities, but modifies what is supposed to be problematic about a genuine mixture of several quantified bodies. Scotus assumes that if several bodies could occupy the same extended place, then they would all share numerically the same quantitative form. But several bodies cannot share numerically the same quantitative form ("the same property does not follow several suppositis at once"). Therefore the elements cannot be truly mixed. At best there is just a juxtaposition of elements—many tiny bodies existing in close proximity to each other, but not composing one bodily substance.

The arguments taken together generate the following dilemma: if the elements remained in a mixture, either they would be co-located, or they would be merely juxtaposed. Exactly what is supposed to be problematic with these options is not totally clear, given some of Scotus's other commitments. Co-location may be counter-intuitive, but Scotus argues that it is possible, if only for God.<sup>35</sup> Scotus's worry must be, then, that since no *natural* agent can bring it about that several bodies exist in the same place at once, any mixture of the elements (a paradigm of natural change) would be miraculous.

Mere juxtaposition would be problematic, since nothing made from the elements would be genuinely one substance. But why not think that juxtaposed elemental bodies are in potency to a perfecting substantial form (such as the form of the mixture), analogous to the way in which Scotus thinks that several organic part-substances are in potency to the soul? In Wadding's *Ordinatio* II, d.15, q.un, Scotus reasons,

If there are several forms of the elements in a mixed body, each one constitutes a supposit. Thus in every mixed there would be several suppositis, because there will be a supposit of water, and a supposit of fire [etc.] of which each one subsists per se by nature—which is unfitting. Likewise it is unfitting that one subsistent thing could have two specifically different forms, *of which one is not naturally perfected by the other*—but this would be the case, if the elements were posited in the mixture according to their forms.<sup>36</sup>

<sup>33</sup> Duns Scotus, *Ordinatio* II, d.15, q.un, n.5 (Wadding VI.2, 753).

<sup>34</sup> *Reportatio Parisiensis* II-A, d.15, q.un, n.5 (Wadding-Vivès XXIII, 64–65), Item rationale est quod quantitas consequatur compositum, sicut passio substantiae corpus; sed non sequitur eadem passio plura supposita immediata; igitur oportet quod sint tot quantitates in actu ibi, quot elementa, et tunc erit juxtapositio elementorum et non mixtum.

<sup>35</sup> See Marilyn McCord Adams's discussion in *Some Later Medieval Theories of the Eucharist* (Oxford: Oxford University Press, 2010), 111–138, and especially 120–127. Also, *Ordinatio* IV, d.10, p.1, q.2 (Vatican XII, pp.77-109), especially n.159 (p.101).

<sup>36</sup> *Ordinatio* II, d.15, q.un, n.5 (Wadding VI, 753), Item, forma elementaris nata est cum materia constituere suppositum per se subsistens in genere Substantiae: ergo si sint plures formae elementares in mixto, quaelibet constituet suppositum: & sic in omni mixto essent plura supposita, quia ibi erit suppositum aquae, & suppositum ignis, quorum quodlibet natum est per se subsistere: quod est inconveniens, inconveniens etiam

The reason why the elements cannot exist in a mixed body is not, according to this text, because no substance (or supposit) can be composed of substances (or supposits). Instead, it is because elemental substances are not naturally perfected by the substantial forms either of the other elements or of the mixed body. But organic parts are so perfected. A heart and brain and so on come into existence for the sake of contributing to the overall functioning of an organism. In arguing that some substances have a plurality of substantial forms, Scotus reasoned that the single *esse* of a composite substance can be constituted by several substantial forms, provided there is some final form whose special role it is to complete the substance.<sup>37</sup> Scotus therefore thinks that no conjunction of elemental bodies is ever in potency to a further substantial form, and therefore thinks that they cannot both exist and be part-substances of a more complex substance. And this must be why he says that if elements were actual in a mixture, they would be *supposits*, rather than substances, where a supposit is a substance that is not a part of another substance and is of a complete specific kind.

But why think that the elements are never thus in potency? Perhaps Scotus is assuming that the elements are never suitably ordered to one another to be together in potency to a perfecting substantial form. This hypothesis is corroborated by an additional argument Scotus offers for his theory of elemental mixture, an argument which reasons from the different natural places of each element and each element's natural tendency to move toward its natural place:

Next, if an element remained in a generated mixture, so that an element of one kind and an element of a different kind remain in the mixture—which you might be tempted to hold given that it seems that the distinctive qualities of each of these elements remains in the mixture—then, since the elements do not have the same place, only one element would be there naturally, and the other [would be there] violently, and consequently the parts of the mixed would be violently in the mixture. But this is false, because a part has natural existence in the whole.<sup>38</sup>

Suppose two elements remained in a mixture, and that the mixture occupied the natural place of one of the elements. For example, suppose a mixture of earth and fire were very close to the center of the earth. Then the fire in that mixture would be there violently rather than naturally—its natural tendency would be to move closer to the moon, whereas the earth in the mixture would stay put. In this case the mixture itself would be unnatural since its parts are together unnaturally. The problem however is that every material substance other than the pure elements are mixtures or are composed of mixtures. So if the elements remained every material substance would be unnatural. This is false, as Scotus says in the above quotation, “because a part has natural existence in the whole.”<sup>39</sup> Presumably Scotus means something like, “A part has natural existence in the whole, if the whole is a natural substance, that is, a substance with a specific nature.” So the reason why elements cannot exist in a mixture in a BP-structure, is *not* that they are substances but that their natural motions are opposed to one another.

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est, quod subsistens possit habere duas formas específicas, quarum una non est nata perfici ab alia: hoc autem poneretur, si elementa ponerentur in mixto secundum formas suas. (Italics mine.) This text is not printed as part of *Ordinatio* in the Vatican edition. Likely it is part of one or more versions of Scotus's “Reports” which were used in John Major's edition of Scotus, and via Major, found their way into Wadding's.

<sup>37</sup> *Ordinatio* IV, d.11, p.1, a.2 q.1, nn.251-254 (Vatican XII, 255–256).

<sup>38</sup> *Lectura* II, d.15, q.un, n.7 (Vatican XIX, 139), Praeterea, si elementum maneret in mixto generato, quia ratione unum elementum ibi maneret, et aliud, quia ita est ibi qualitas unius elementi sicut alterius; igitur cum non habeant elementa eundem locum, tantum unum elementum esset ibi naturaliter et alia violenter, et per consequens partes mixti violenter essent in mixto—quod falsum est, quia pars habet naturale esse in toto.

<sup>39</sup> *Ibid.*

If the elements do not actually exist in a mixture, why do we call mixtures mixtures of elements? Scotus argues that if the elements do not remain in a mixture, they cannot be the efficient causes of a mixture, since at the moment the mixture comes to be, *ex hypothesi* no element is there bringing it into being.<sup>40</sup> Nor can a mixture be produced through any action of the elements on one another. Take two elements, fire and water, where it is supposed that a mixture is generated from their mutual interaction (*mutuo agentibus*):

I ask: either fire remains when it corrupts water, or not; if not, therefore that which is nothing, corrupts another; if it remains, therefore after the corruption of water fire will remain.<sup>41</sup>

Scotus is therefore led to give an analysis of the generation of a mixture from the elements roughly in terms of ordinary cases of generation and corruption: an agent operates on a patient (one or more elemental bodies), educing a new substantial form (the form of the mixture) from the potency of the matter.<sup>42</sup> He notes, however, this peculiar feature of the generation of mixtures: the mixture is more like the elements from which it is generated, than it is like its efficient cause.<sup>43</sup> This entitles the elements to some sort of presence in a mixture, so Scotus says that they remain in the mixture *sicut in effectu communi*<sup>44</sup> and also (though less frequently) *virtualiter*.<sup>45</sup> As far as I can tell, all that Scotus means by the virtual presence of the elements in a mixture is that the dominating quality of a mixture specifically resembles a mean quality of the elements from which the mixture is generated. Scotus does not attempt to explain why generation from the elements has this peculiar feature. Since he holds that both the substantial forms and qualities of the elements perish when the mixture is generated, he cannot explain the similarity of the mixture and the elements as a sharing of numerically the same qualities—with a new substance come new accidents. Perhaps surprisingly, however, he thinks that the new qualities of the new mixture must also be *specifically* different from the qualities of the elements—the heat or coolness or moistness or dryness of a mixture is both *numerically* and *specifically* different from the four qualities of the four elements.<sup>46</sup> Since Scotus does not in general hold that qualitative accidents of a certain kind can inhere in only one kind of substance, his denial that elemental qualities can inhere in mixtures must be rooted in the idea that the elemental qualities are *properties* of the elements in the strict sense that they are necessary accidents belonging to one and only one kind of substance, in just the way that risibility is a property of a human. Just why it is that a mixture has qualities that resemble one or more of the elemental qualities is left unexplained, but the similarity of these qualities is the extent to which it is correct to describe a mixture as having a dominating element, whose characteristic activities are similar to those of the characteristic activities of the element. Thus, like Aquinas, Scotus's account of mixture gives us a strong account of uniformity but a thin account of recoverability.

### 3.4 William of Ockham

I turn now to Ockham, who endorsed LP. In a human being, for example, he distinguished at least three substantial forms: sensitive and rational souls and a form of the body. Non-human

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<sup>40</sup> Ibid., n.32 (Vatican XIX, 147).

<sup>41</sup> Ibid., n.30 (Vatican XIX, 147), [Q]uaero: aut ignis manet quando corrumpit aquam, aut non; si non igitur illud quod nihil est, corrumpit aliud—si maneat, igitur post corruptionem aquae remanebit ignis.

<sup>42</sup> Ibid., n.35 (Vatican XIX, 148).

<sup>43</sup> Ibid., n.38 (Vatican XIX, 149).

<sup>44</sup> Ibid., nn.27, 38 (Vatican XIX, 146, 149-150).

<sup>45</sup> Ibid., n.38 (Vatican XIX, 150).

<sup>46</sup> Ibid., n.39 (Vatican XIX, 150).



animals and plants were endowed with at least two: one soul and a form of the body.<sup>47</sup> In *Quodlibet* III, Question 6, he asks whether organic parts of organisms, such as flesh and bone, have their own substantial forms, but does not deliver a determinate answer, claiming that neither *a priori* nor *a posteriori* considerations can establish a yea or nay answer.<sup>48</sup> So strictly speaking he does not reject BP but was simply agnostic about it.

Ockham addresses the question whether the elements remain in a mixture in *Quodlibet* III, Question 5. The *quod sic* asserts the intuitive claim that being a mixture entails having parts or ingredients that are mixed. Ockham responds to this claim later in the question. The *contra* advances three separate arguments for the claim that the elements do not actually exist in a mixture; here I will discuss two.

The first argument reasons that (i) for all *x*, if *x* is an individual of some species, then *x* is not an essential part of an individual of another species. But (ii) each of the four elements is an individual of some species. Therefore (iii) no element is an essential part of an individual of another species.<sup>49</sup> According to Ockham, being an *individual of some species* is not exactly the same thing as being an *individual* in the sense that he recognizes individuals which do not belong to a real or complete species. For example, Ockham holds that if a rational soul were separated from the organism whose soul it is, the result would be (under the right conditions) a sensitive, animate substance that belonged to no species. This is because that composite of matter, the form of corporeity, and the sensitive soul, is naturally ordered to be an essential part of a human being. It is possible that it exist and not be an essential part of a human being, Ockham thinks, but under such circumstances, given its nature, it would belong to no species:

It is not a complete being existing *per se* in a genus, but is by nature an essential part of something existing *per se* in a genus. And no such thing is in the genus of substance or of animal *per se*.<sup>50</sup>

So the first premise of the argument leaves it open that some individuals are essential parts of other individuals and other individuals of some species, but denies that an individual *of some species* is or can be an essential part of an individual *of some species*. As far as I can tell, the premise expresses what by Ockham's lights is a trivial truth: the antecedent implies the consequent because *not being a part* is part of the definition of *belonging to a species*. The second premise is uncontroversial. Aristotle himself lists the four elements, along with animals and plants, as among the things that have natures.<sup>51</sup> From the second premise alone it is not clear whether an element such as fire has or can have numerically distinct instances—many fires—or whether every fire is really just numerically one elemental substance—fire. But this issue is not relevant in the present context. The conclusion follows deductively. Opponents of Ockham's view therefore either have to deny the second premise—which no one did until the seventeenth century<sup>52</sup>—or reject the first and define *being of a species* in some other way.

The second argument is more complex. It begins: (i) for any mixture, *m*, if the elements remain in *m*, then either (A) one and the same part of the matter of *m* would be informed by the

<sup>47</sup> Ockham, *Quodlibet* II, qq.10–11 (*OTH* IX, 156–164).

<sup>48</sup> Ockham, *Quodlibet* III, q.6, ll.10–14 (*OTH* IX, 225).

<sup>49</sup> Ockham, *Quodlibet* III, q.5, ll.5–8 (*OTH* IX, 220–221), *Contra*: Illud quod est individuum alicuius speciei, non est pars essentialis individui alterius speciei; sed elementa sunt huiusmodi; igitur non sunt pars essentialis alicuius quod est *per se* in genere.

<sup>50</sup> Ockham, *Quodlibet* II, q.10, ll.111–114 (*OTH* IX, 161), Et tota ratio est, quia non est ens completum existens *per se* in genere, sed est natum esse pars essentialis alicuius existentis *per se* in genere. Et nullum tale est in genere substantiae vel animalis *per se*.

<sup>51</sup> Aristotle, *Physics* II.1 192b 9–11 (Barnes I, 328).

<sup>52</sup> Robert Pasnau, *Metaphysical Themes 1274–1671* (Oxford: Clarendon Press, 2012), 481–484.

form of every element in *m*, or (B) one part of *m*'s matter would be informed by one form of an element in *m*, another part would be informed by a form of a different element in *m*, and so on. (ii) If A, then two or more material substances of distinct species would share numerically the same matter. But (iii) it is impossible for two or more material substances of distinct species to share numerically the same matter, so (iv) not A. (v) If B, then *m* would not be a *mixture* of elements but a *juxtaposition* of elements, but (vi) *m* is a mixture, so (vii) not B. Thus, (viii) the elements do not remain in *m*.<sup>53</sup>

Premise (ii) is the key premise of the sub-argument against disjunct-A. Here the sense in which Ockham intends *species* must be exactly the same as in the first argument: a natural kind, rather than any old sortal.<sup>54</sup> Earth, fire, air, and water are natural kinds and therefore each individual elemental substance is an individual *of some species* in the quasi-technical sense in which being an individual *of some species* rules out, by definition, being a part-substance. He must intend to use *species* in this strict sense in the second premise because Ockham *does* think that for at least some kinds of material substances, two or more material substances can share exactly the same matter. For example, according to Ockham a human body and a human being share exactly the same prime matter. But a human body is by nature an essential part of a human being and therefore is not an individual of some species. So Ockham's point in the second premise is not that it is impossible for a plurality of substances to share exactly the same prime matter, but rather that it is impossible for a plurality of substances each of which is a member of a complete species to share exactly the same prime matter. As in the first argument, therefore, the critic of the sub-argument against disjunct-A would either deny that individual elemental substances count as individuals of some species, or deny that species-membership entails not being a part of a substance.

Premise (v) is the key premise of the sub-argument against disjunct-B. For Ockham as for others, *juxtaposition* is a technical term used to describe things that are merely adjacent to one another. What is philosophically interesting about the sub-argument is not that we are told that a juxtaposition is not a mixture—this is a trivial point; instead it lies in the assumption about what is supposed to be problematic about juxtapositions of elements. The idea is that if each elemental substance had its own prime matter, such that they were merely adjacent to one another, they could not together form one substance but at best a tightly bound bundle of substances. Ockham is here relying on an assumption he is elsewhere agnostic about. Recall that Ockham endorses LP but does not actually reject BP—he just claims there is not enough evidence to decide either for or against it. Now one key difference between BP and LP is that BP holds that two part-substances could be adjacent to each other while they are part-substances of one and the same substance. For example, a BP-supporter who held that the organs of an organism were part-substances would say that in a human being the liver and a kidney were adjacent to each other but were nevertheless part-substances of a human being. Thus, it would be open for a BP-supporter to hold that two or more elemental substances could be merely juxtaposed but still be part-substances together of one and the same material substance. Such a substance would of course fail to be a mixture in the strict sense, but it would still be a substance composed of elemental substances. So as I understand it, the reason why Ockham takes (v) and (implicitly) (vi) to be premises entailing the negation of disjunct-B is that a mixture of elements, whatever else it might be, is one substance, and a juxtaposition of elements, whatever else it might be, cannot be one substance.

<sup>53</sup> Ockham, *Quodlibet* III, q.5, ll.10–18 (*OT* IX, 221), Ad quaestionem istam dico primo quod elementa non manent actualiter in mixto, nec formae elementorum; quia si sic, aut eadem pars materiae mixti informatur qualibet forma elementari, aut una pars materiae informatur una forma elementari et alia pars materiae informatur alia forma. Non potest dari primum, quia tunc diversa composita distincta specie simul haberent eandem materiam numero. Nec secundum potest dari, quia tunc in mixto non esset ibi nisi iuxtapositio elementorum.

<sup>54</sup> Examples of natural kinds include any species of biological organism and any of the four kinds of elements.

The *quod sic* of *Quodlibet* III, Question 5 asserts that nothing in which there are no elements counts as a mixture. In Ockham's arguments for the claim that the elements do not remain in mixtures, he of course assumes that there are in fact mixtures, so he is left with the task of explaining the sense in which a substance which has no elements in it as parts is nevertheless really a mixture of elements. He offers two senses: first, mixtures have some qualities that resemble the qualities of the elements. The water in a rose is not water but rosewater, and rosewater contains no water, but rosewater resembles water in many ways.<sup>55</sup> Those qualities with respect to which rosewater resembles water are *equivalent* to the qualities of water, and rosewater *virtually contains* the qualities of water, but neither the rosewater nor its rose has any water as a part, and these points can be generalized for all mixtures.<sup>56</sup> So there is an attenuated and non-literal sense in which the elements do remain in a mixture. Second, while the elements strictly speaking do not remain in a mixture, they are the substances from which all mixtures are generated and therefore are the subjects or patients on which an efficient cause acts so as to produce a mixture. So a mixture is a mixture of elements in the sense that it is made from elements.<sup>57</sup> Once again, we have robust uniformity but thin recoverability.

### 3.5 John Buridan

I turn now to Buridan, our holder of TAU. Like Aquinas, he thinks that each material substance has just one substantial form,<sup>58</sup> unlike Aquinas, he thinks that prime matter is an actual entity.<sup>59</sup> The natural condition of prime matter is to be united with substantial form, such that no natural agent can bring it about that some prime matter exists with no form at all, but for Buridan this is consistent with the view that prime matter is an actual entity, not depending on substantial form for its existence.<sup>60</sup>

In the main body of his *quaestio* on whether the substantial forms of the elements remain in a mixture, Buridan offers several arguments for his negative answer that they do not. Here I will consider just one of them. It is a long argument which reasons in the following way: if *p*, then (*q* or *r*); not *q*; not *r*, so not *p*. Buridan begins by asserting a conditional with an implied antecedent: if the elements remain in a mixture, then either the mixture has a substantial form in addition to the forms of the elements, or it does not. Then he asserts that *inconvenientia* follow from either disjunct, implying that we should reject both and hence reject the antecedent.<sup>61</sup>

He offers two arguments against the second disjunct, that there is no additional form added to the mixture of the elements. In the first, taking iron as his illustration, he reasons that if there were no additional form, then the form of iron would be nothing more than the forms of the elements impaired (*remissae*) and temporarily proportioned to each other (*ad invicem temporaliter proportionatae*). Supposedly bizarre consequences follow:

<sup>55</sup> Ockham, *Quodlibet* III, q.5, ll.92–94 (*OTh* IX, 224).

<sup>56</sup> *Ibid.*, ll.41–45 (*OTh* IX, 222).

<sup>57</sup> *Ibid.*, ll.67–82 (*OTh* IX, 223–224).

<sup>58</sup> John Buridan, *Quaestiones super libros De Generatione et Corruptione Aristotelis* I, q.8, ed. J. M. M. H. Thijssen, J. J. M. Bakker, Michiel Streijger (Leiden: Brill, 2010), 80–89.

<sup>59</sup> John Buridan, *Quaestiones super libros De anima* II.1.17, ed. P. Sobol, trans. G. Klima (unpublished). I would like to thank Gyula Klima and the members of The 'De Anima' Project for granting me access to drafts of the critical edition and translation of Buridan's commentary on Aristotle's *De Anima*, which will eventually be published by Fordham University Press. Information about the Project's efforts can be found at [www.buridanica.org](http://www.buridanica.org).

<sup>60</sup> John Buridan, *Quaestiones super libros De generatione et corruptione Aristotelis* I, q.7, ll.20–21, 77

<sup>61</sup> John Buridan, *Quaestiones super libros De Generatione et Corruptione Aristotelis* I, q.22, ll.4–6, 167. Quarto. Inquirendum esset utrum in mixto, verbi gratia in ferro, esset aliqua forma substantialis addita formis quattuor elementorum vel non. Et quodcumque horum dicatur, videntur sequi invonvenientia.

But if this were said, then it will be seen at once that cold marble and cold iron would be nearer to each other in their substantial existence than cold iron and fiery iron, since it will be seen immediately that in the fiery iron there will be a great deal of fire, and thus the proportion of the elements in the fiery iron will be different from the proportion of the elements in the cold iron, and therefore they will be even more different in their substantial existence, and thus it would be incorrect to say that they were of the same species in the genus of substance.<sup>62</sup>

Buridan takes for granted that marble and iron are two different kinds of substance; so a good metaphysical account of marble and iron has got to be able to account for this difference. But if the form of a compound substance is reducible to the forms of its constituent elements, we cannot get such an account. Plausibly, according to the chemical theory under examination, the colder a bit of iron or marble is the more earth or water there is in each. The colder each is, the greater is the proportion of earth and water to the other elements in each. But then the overall proportions of the elements in each would resemble each other more than the proportions of elements in a very cold and a very hot bit of iron. And on the reductive view against which Buridan is here arguing, it should therefore follow that if any two things belong to the same kind, it is cold-iron and cold-marble rather than cold-iron and hot-iron. Since no one is willing to grant this, we can conclude that this reductive, no-added-form view is false.

The second argument against the second disjunct reasons that if there were no additional form, the elements could not form a genuine substantial unity, or something *unum per se*. The argument appeals to features of the old chemical theory that have not yet been mentioned. For each element, the theory distinguishes between its primary and its secondary qualities, with one unique primary quality for each element. Thus, earth's primary quality is dry and its secondary quality is cold, water is primarily cold and secondarily wet, air is primarily wet and secondarily dry, and fire primarily hot and secondarily dry. These primary qualities combine in two pairs of contraries: hot and cold and dry and wet. Buridan reasons that while the contraries hot and dry can combine to produce a medium quality that is neither hot nor cold, the contraries wet and dry cannot so combine. This makes intuitive sense. There does seem to be a quality that is neither hot nor cold but somewhere in the middle, the quality Goldilocks found inhering in Baby Bear's porridge in the old story. But there does not seem to be a quality that is a medium between wet and dry. We might say that a sponge that has been wrung out is less wet than a submerged sponge, but it is still wet. And if the clothes in the drier are almost dry, they are still wet. Moreover, there is no medium quality between warm and dry or between warm and wet; they are, as Buridan calls them, *diverse contraries*. Due to these diverse contraries, any collection of the forms of the four elements will not be able to mix and diminish so as to produce a uniform medium; some parts of the compound will remain of one kind of element and other parts of other kinds. "Thus, these four forms would not be able to constitute a form that is one *per se* in the genus of substance; neither would the mixture be called *per se* one."<sup>63</sup>

<sup>62</sup> Ibid., ll.9–16, 167. Modo, si hoc dicatur, tunc statim videbitur quod marmor frigidus et ferrum frigidum essent propinquiora ad invicem in esse substantiali quam ferrum frigidum et ferrum ignitum, quia statum videbitur quod in ferro ignito sit valde multum de igne; et sic proportio elementorum in ferro ignito distabit a proportione elementorum in ferro frigido; ideo valde distarent in esse substantiali; et ita non deberent dici eiusdem speciei in genere substantiae.

<sup>63</sup> Ibid., ll.17–26, 167. Item. Ferrum non esset aliquod unum per se, quia licet duo contraria remissa possint constituere unum medium, sicut caliditas et frigiditas remissae constituunt tepiditatem, quae est una qualitas media tamen contraria diversarum qualitatuum non constituunt unum per se, sicut ex colore et sapore non proenit una qualitas quae debeat dici per se una. Modo in mixto essent formae congregatae non solum unius contrarietatis, sed diversarum contrarietatum, quia forma ignis et forma aquae ponerentur unius contrarietatis, forma vero aeris et forma terrae alterius. Ideo hae quattuor formae non deberent constituere formam unam per se in genere substantiae. Ideo neque mixtum diceretur per se unum.

Buridan takes these two arguments to dispose of the second disjunct, so he turns to the first disjunct, that the mixture has a substantial form in addition to the substantial forms of the four elements.

But if we posit an added form, then it would follow that in iron there would be a plurality of specific and complete substantial forms. Therefore iron will be of several species in the genus of substance. Consequently, it will not be called something one *per se*. And I prove the first consequence thus: all concede that that added substantial form would be one specific and complete form; but also the collection of the forms of diminished water and diminished fire would be one complete and specific form in the genus of substance, since unique, diminished, contrary forms constitute one complete medium form in the same subject, just as in the genus of quality cold and heat constitute warmth, which is one quality (and just as extreme colors constitute medium colors which are complete and specific colors in the genus of quality).<sup>64</sup>

Here the by-now-familiar worry is that a mixture which had its own substantial form plus one or more of the forms of the four elements would be a composite of at least two distinct kinds of complete substances. Buridan thinks that no such combination of complete substances could produce something that was itself one complete substance. However, the argument quoted above is problematic because it fails to reason consistently on the assumption that the substantial forms of the elements remain in the mixture. He concedes here that the diminished forms of water and fire in a mixture would “constitute one complete medium form.” So the argument postulates one form which is a medium between contrary elements, and another form which is the “added form” referred to in the antecedent of the conditional expressed in the first sentence of the quoted argument. The trouble is that what Buridan sets out to argue against is the view that the forms of the elements remain in a mixture, not that a medium form remains in a mixture in addition to some additional form. Buridan’s argument could, however, be easily modified. Where Buridan actually asserts that the *medium* form would be a substantial form of a complete substance, he should have asserted that the forms *of the elements* would be substantial forms of complete (elemental) substances. *Mutatis mutandis* the argument would go through. Buridan proves only the first consequence and not the second because, I take it, it is true just by definition that if something is composed of several complete substances then it is not a complete substance. Buridan follows his tradition in taking it for granted that elemental substances are complete substances.

So the elements do not remain in a mixture, but like his tradition Buridan thinks that there is a legitimate sense in which a mixture is a mixture of elements. He explains that contrary elements act on each other so as to produce some medium quality before they are corrupted and a new substantial form is generated.<sup>65</sup> A mixture is aptly called a mixture despite the corruption of its

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<sup>64</sup> Ibid., ll.17–26 and 1–6, 167–168. Si vero ponamus formam additam, tunc sequeretur quod in ferro essent plures formae substantiales specifica et completae. Igitur ferrum erit plurium specierum in genere substantiae. Nec per consequens poterit dici aliquod unum per se. Et ego probo primam consequentiam quia: omnes concederent quod illa forma substantialis addita esset una forma specifica et completa; sed etiam congregatum ex forma aquae et forma ignis remissis esset una forma completa in genere substantiae et specifica, quoniam formae contrariae remissae et unicae in eodem subiecto constituunt unam formam mediam completam, sicut in genere qualitatis caliditas et frigiditas constituunt tepiditatem, quae est una qualitas [...]

<sup>65</sup> John Buridan, *Quaestiones super libros De Generatione et Corruptione Aristotelis* I, q.23, ll.11–18, 175.

elements because the mixture “retains some of their virtues.”<sup>66</sup> So we can say that a mixture is “virtually a composition” of elements.<sup>67</sup>

Buridan’s account of a mixture as virtually composed of elements echoes our three other medieval philosophers’ accounts of the elements’ virtually existing in a mixture. But Buridan’s account of just how a mixture retains the qualities of the corrupted elements is in at least one respect philosophically superior to his peers’ accounts. Elsewhere Buridan postulates that *prime matter* can be the immediate subject of accidents. One traditional problem for unitarians about substantial forms was the corpse objection: if, say, a human being is a composite of prime matter and exactly one soul, then when a human dies and leaves a corpse behind, whatever substantial form or forms are there in the corpse never belonged to the living man. If accidents depend on substance for their existence, how comes it that the corpse looks similar to the man? Buridan’s TAU provides an answer: some of the man’s features inhered directly in the man’s prime matter and depended on it for their existence. So these features are indifferent to the departure of the man’s soul; they carry on without him.<sup>68</sup> The upshot of this for our purposes is that Buridan has a principled explanation of how a mixture retains the *virtutes* of the elements when the elements are corrupted in the process of mixing: the mixture really truly does retain them, because their proper subject is prime matter, which persists through substantial change.

Summing up Buridan, then, he follows the others in explaining the uniformity of a mixture as the uniformity of one new substantial form, the form of the mixture, which begins to inhere in the prime matter of the elements at the moment those elements are corrupted. The *qualities* of the elements are recoverable from the mixture because they actually exist in the mixture; the *elements themselves*, however, compose the mixture only virtually, and thus they are recoverable in roughly the same way as Aquinas/Scotus/Ockham’s elements: the mixture is corruptible and the elements are candidates for the sort of substances that might be generated from the corruption of a mixture.

## 6. Outdated Chemistry vs. Outdated Metaphysics of Composition

Let’s take stock. OAU and TAU, coupled with the widely held thesis that the elements are hylomorphic substances, rule out the possibility that the elements can exist actually in a mixture, where a mixture is understood as *one substance*. Aquinas and Buridan both analyze mixture as the corruption of the elements and the generation of a new uni-formed composite substance which is qualitatively similar (at least) to some medium qualities of the elements from which it is composed. However, Aquinas leaves it a mystery just how the newly generated mixture takes on these medium qualities, while Buridan would hold that numerically the same medium qualities persist through the corruption of the elements and the generation of the new mixture.

Both BP and LP taken on their own make room for part-substances in a broadly Aristotelian ontology, but the widely held thesis that elements were not simply hylomorphic substances but hylomorphic substances of complete species made them ineligible to be part-substances. The natural rejoinder is that defenders of LP and BP should just give up the thesis that the elements belong to complete species. But Scotus and Ockham offer other reasons for denying the actual existence of the elements in a mixture. Ockham argues that the actual existence of the elements in a mixture would entail either that the elements all share exactly the same prime matter or that each has its own prime matter. They cannot share exactly the same prime matter because they belong to complete species. If they have their own prime matter, then (he implies) they are not co-located and so exist side by side in the mixture. And this is doubly problematic: first, such a mixture would

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<sup>66</sup> John Buridan, *Quaestiones super libros De Generatione et Corruptione Aristotelis* I, q.22, ll.16–20, 168.

<sup>67</sup> John Buridan, *Quaestiones super libros De Generatione et Corruptione Aristotelis* I, q.23, ll.5–7, 169. Tamen mixtum est compositius virtualiter, quia retinet virtutes elementorum a quibus corruptis ipsum est genitum.

<sup>68</sup> John Buridan, *Quaestiones super libros De Generatione et Corruptione Aristotelis* II, q.7, 224–228.

fail to be a genuine mixture and would be a mere juxtaposition; second, such a mixture would fail to be a substance. Ockham asserts in this context that no juxtaposition of substances could ever compose one substance; here he flies his LP colors against BP, for BP asserts exactly what Ockham here denies.

But Scotus too, BP-defender though he be, denies that the elements can exist in a mixture. First, he denies the natural possibility of co-located bodies and argues that genuine mixture, according to which “every part of the mixed is mixed,” entails overlapping bodies. If the elements exist in a mixture, then, they exist there not truly mixed but juxtaposed. Scotus’s BP permits him to hold that juxtaposed substances can compose one substance, but he denies that a juxtaposition of *elemental substances* ever could compose one substance. And here he turns from metaphysics to chemistry. The reason why the elements cannot together compose one substance is because the theory of the elements tells us that each kind of element has its proper sublunary place and the natural activity of each elemental substance is to reach its proper place. Any compound in which the elements actually exist, then, is susceptible to internal corruption as the elements attempt to move apart from each other and toward their natural places. The problem with the actual existence of the elements in a mixture, says Scotus, is due to facts from the chemical theory he inherited and took for granted rather than to the metaphysics of parts and wholes he innovated. Scotus would have welcomed the new chemistry, in which it is part of the nature of elements to form bonds and so to compose complex substances. His metaphysics of composition was ahead of his day!

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