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**PARTS AND WHOLES
IN ARISTOTLE'S CONCEPTION OF SUBSTANCE**

DOCTORAL THESIS

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Subfield: Theories of Mind and Cognition

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Abstract

The dissertation "Parts and Wholes in Aristotle's Conception of Substance" shows that the distinction of several senses of 'part' and 'whole' solves the problem of unity of substance (*οὐσία*). Although both the problem and the solution are Aristotle's, he himself has not provided a separate exposition devoted specifically to this topic. The dissertation offers a dissection of the problem of unity of substance with instruments shaped by Aristotle's remarks on parts and wholes, i.e. mereology (from *μέρος*, 'part'). The investigation pertains to the composite (sensible or material) substance. The author has defended various claims that are controversial in Aristotelian scholarship (the plurality of the senses of the part-whole relation; the idea that form and matter are proper and real parts; the complexity of form), which have been unfolded by providing evidence in Aristotle's corpus and by discussing the views of various commentators.

Keywords: Aristotle, part, whole, substance

Anotācija

Disertācijā "Daļas un veselumi Aristoteļa substances koncepcijā" autore parāda, ka vairāku 'daļas' un 'veseluma' nozīmju nošķīrums atrisina substances (*οὐσία*) vienības problēmu. Lai gan problēma un arī risinājums ir Aristoteļa, viņš šim jautājumam nevelta atsevišķu izklāstu. Disertācija piedāvā detalizētu substances vienības problēmas analīzi, izmantojot instrumentus, kas darināti, ņemot vērā Aristoteļa piezīmes par daļām un veselumiem, t. i., mereoloģiju (no *μέρος* – 'daļa'). Izpētes centrā ir salikta (sajūtama vai vieliska) substance. Autore aizstāv vairākus Aristoteļa pētniecībā strīdīgus apgalvojumus (uzskatu, ka daļas-veseluma attiecībai (*part-whole relation*) ir vairākas nozīmes, priekšstatu par veidolu un vielu kā par īstenām (*proper*) un reālām (*real*) daļām, veidola saliktību), kuri tiek pamatoti, aplūkojot Aristoteļa darbu korpusa fragmentus un iztīrējot dažādu komentētāju viedokļus.

Atslēgas vārdi: Aristotelis, daļa, veselums, substance

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List of Abbreviations

Aristotle	Arist.
Categories (<i>Categoriae</i>)	<i>Cat</i>
Eudemian Ethics (<i>Ethica Eudemia</i>)	<i>EE</i>
Generation of Animals (<i>De generatione animalium</i>)	<i>GA</i>
History of Animals (<i>Historia animalium</i>)	<i>HA</i>
Interpretations (<i>De interpretatione</i>)	<i>Int</i>
Metaphysics (<i>Metaphysica</i>)	<i>Met</i>
Nicomachean Ethics (<i>Ethica Nicomachea</i>)	<i>NE</i>
On Generation and Corruption (<i>De generatione et corruptione</i>)	<i>GC</i>
On the Heavens (<i>De caelo</i>)	<i>Cael</i>
On the Soul (<i>De anima</i>)	<i>DA</i>
Parts of Animals (<i>De partibus animalium</i>)	<i>PA</i>
Physics (<i>Physica</i>)	<i>Phys</i>
Politics (<i>Politica</i>)	<i>Pol</i>
Posterior Analytics (<i>Analytica posteriora</i>)	<i>An. Post</i>
Prior Analytics (<i>Analytica priora</i>)	<i>An. Pr</i>
Sophistical Refutations (<i>Sophistici elenchi</i>)	<i>SE</i>
Topics (<i>Topica</i>)	<i>Top</i>
Albertus Magnus	Alb. Mag.
<i>Metaphysica</i> (Borgnet)	<i>In Met</i>
Alexander of Aphrodisias	Alex.
On the Metaphysics (<i>In Aristotelis metaphysica commentaria</i>)	<i>In Met</i>
On the Topics (<i>In Aristotelis topicorum libros octo commentaria</i>)	<i>In Top</i>
Ammonius	Amm.
<i>In Aristotelis analyticorum priorum librum i commentarium</i>	<i>In An. Pr</i>
<i>In Aristotelis categorias commentarius</i>	<i>In Cat</i>
<i>In Porphyrii isagogen sive quinque voces</i>	<i>In Isag</i>
Aquinas	
Commentary On The Metaphysics (<i>In duodecim libros Metaphysicorum Aristotelis expositio</i>)	<i>In Met</i>
Aristotle's De Anima (<i>Sententia libri De anima</i>)	<i>In DA</i>
Commentary on Aristotle's Physics (<i>Commentaria in octo libros Physicorum Aristotelis</i>)	<i>In Phys</i>
Asclepius	
<i>In Aristotelis metaphysicorum libros A–Z commentaria</i>	<i>In Met</i>
Boethius	Boeth.
<i>De Divisione</i>	<i>De Div</i>
<i>Categoriae vel Praedicamenta: Translatio Boethii</i>	<i>Cat. Tr</i>
<i>In Categorias Aristotelis libri quatuor</i> (Migne)	<i>In Cat</i>

In Librum Aristotelis De Interpretatione libri duo (Migne)

Porphyry

On Aristotle's Categories (*In Aristotelis categorias expositio per interrogationem et responsionem*)

Introduction (*Isagoge sive quinque voces*)

Simplicius

On Aristotle's Categories (*In Aristotelis Categorias commentarium*)

On Aristotle's On the Heavens (*In Aristotelis quattuor libros de caelo commentaria*)

On Aristotle's Physics (*In Aristotelis physicorum libros quattuor priores (1–4) commentaria*)

In Int

Porph.

In Cat

Isag

Simpl.

In Cat

In Cael

In Phys

0. Introduction

The introduction offers an explanation of the subject-matter of the dissertation, explains the methodological framework employed, and includes a survey of the sources and secondary literature.

0.1. The Subject-matter of the Dissertation

The dissertation is devoted to a mereological solution of the problem of unity of substance (*οὐσία*) in Aristotle. Although Aristotle realizes the problem, he has not provided a separate exposition dedicated specifically to this topic. The problem has to be reconstructed and the solution has to be articulated as it is implicit in the texts.

Aristotle does not devote a separate treatise to the theory of parts and wholes but the corpus is loaded with mereological remarks. Especially the *Metaphysics* *A* 6, 9, 12, 16, 23, 24, 25, 26, 27, 28, *Z* 10–12 and 17, *H*, *I* 1, *M* 2, 7, 9, the *Physics* *A* 2 and *A* 3, the *Topics* *Z* 13, and the *Categories* 2 are saturated with profound mereological reflections. Passages devoted to mereology are not just side notes of minor importance, but tools of a meta-categorical tool-kit necessary for any systematic project.

0.1.1. The Main Research Question

The investigation pertains to the problem of unity of the composite substance (*σύνθετος* or *συνθέτη οὐσία*)¹ or compound (*σύνολον*),² or sensible substance (*αἰσθητὴ οὐσία*)³ or, as the ancient commentators call it, the material (enmattered) substance (*ἐνυλος οὐσία*),⁴ i.e. the enmattered form (*ἐνυλον εἶδος*).⁵

¹ *DA* 412a16; *Met Z* 13 1039a17; *H* 3 1043a30; 1043b29; *A* 3 1070a14. Cf. Alex. *In Met* 206.29; 422.35; 423.3–4; Pseudo-Alex. *In Met* 497.5; 517.2–18 *passim*; 523.19; 527.3; 530.5; 535.8; 545.38–556.5 *passim*; Simpl. *In Cat* 8.46.24 *et passim*; *In Phys* 9.191.19 *et passim*; Amm. *In Cat* 35.18 *et passim*. Asclepius *In Met* 349.14; 375.17–394.5 *passim*; 406.8–442.3 *passim*.

² *Met B* 1 995b35; 3 999a33; 4 999b16; b24; *Z* 3 1029a5; 8 1033b17; 10 1035a6; a21; b19; b22; b29; b32; 1036a2; 11 1037a8; a26; 14 1039b20; *I* 9 1058b8; *K* 2 1060b24; *M* 2 1077b8; *DA A* 5 409b31. Cf. Alex. *In Met* 178.22–31 *passim*; 211.18–215.20 *passim*; Pseudo-Alex. *In Met* 508.13; 516.1; 529.32; 530.3; 640.37–9; 675.37; Asclepius *In Met* 146.35; 185.17; 189.6; 422.20.

³ *Met H* 2 1043a27; *A* 1 1069a30; 1069b3; Pseudo-Alex. *In Met* 551.6; 554.31; 670.26f; 671.15f; 676.5; Asclepius *In Met* 173.36; 382.23; Simpl. *In Cat* 8.81.9f; 8.90.20; 8.96.3f; 8.115.32; *In Phys* 9.144.10; 9.207.31.

⁴ Aristotle does not use the phrase *emulos ousia*. This designation is to be found in, e.g.: Alex. *In Met* 400.16–17; Pseudo-Alex. *In Met* 516.13; Simpl. *In Cat* 8.99.25; *In Phys* 9.144.10. The Latinized 'material substance' is a direct translation of *emulos ousia*.

⁵ *Emulon eidos*, like *emulos ousia*, is a term coined by the commentators: Alex. *In Met* 178.18ff; 360.4ff; 375.34ff; *In Top* 17.14; 558.20; Pseudo-Alex. *In Met* 497.9; 516.13ff; 639.12ff; Amm. *In Isag* 11.28; 12.12; Asclepius *In Met* 375.20; 382.20; 413.32; 440.27; Simpl. *In Cat* 8.130.15; *In Phys* 9.191.19 *et passim*.

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In a simplified way, the problem of unity can be expressed thus: 'How that which has parts can be a unity?' or 'How many things can be one?' The problem of unity becomes complex with regard to the composite substance. The cause of the complexity lies in the assertions to which Aristotle is committed:

- (a) the composite substance has parts (*Met Z* 10 1035a17–21);
- (b) whatever has parts must be unified by a unifier (*H* 6 1045a8–12; cf. *Z* 13 1038b14–15);
- (c) form is the unifier (*A* 6 1016b12–16);
- (d) the unifier must not have parts (*I* 1 1052a33–4);
- (e) form has parts (*A* 24 1023a35–6; *Z* 10 1034b34);
- (f) form is a part of the composite substance (*A* 25 1023b19–22).

There is an obvious tension among these assertions. Firstly, there is a discord among (a), (b), (c), (f). This combination creates a vicious regress. If whatever has parts, i.e. composite substance, must be unified by a unifier, and if form is the unifier and is itself a part of what is to be unified, i.e. the composite substance, there arises the need for another unifier, which unifies the original parts with the form, and so *ad infinitum*. In order to stop the regress, Aristotle should drop one of these assertions, but, in fact, he does not proceed in this way.

Secondly, (b), (c), and (e) also create a vicious regress. If form is the unifier and form itself has parts, and if that which has parts, in this case – the form, must be unified by a unifier, there arises the need for another unifier, and so *ad infinitum*. Similarly, in order to stop the regress, Aristotle should drop one of these assertions. Again, he does not quite follow this path.

Thirdly, there is a discord among (c), (d), and (e). If form is the unifier and the unifier must not have parts, then the form must not have parts. But the form does have parts, thus the form cannot be the unifier. But the form is the unifier, and as a unifier, the form must not have parts. Aristotle should choose between two horns of a dilemma: either the form is a unifier and does not have parts or the form is not a unifier and has parts. However, he does not make such a choice.

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In light of this conundrum, the problem of unity of substance can be formulated as follows: 'How is it possible that the composite substance, which has parts, is a unity, if its form, which is the unifier of the substance, has parts, and is itself a part of that substance, which is being unified?'

0.1.2. *The Aim and the Tasks*

I claim that the problem of unity can be solved, once Aristotle's remarks on the ambiguity of mereological terms are taken seriously. The aim of the dissertation is to show that ***the distinction of several senses of 'part' and 'whole' solves the problem of unity of substance***. As a result, the split of the substance into parts and the unity of these parts can be achieved in different ways and require different accounts of the part–whole relation that operate in each case.

There are the following steps which are necessary to justify the contention that the solution to the problem of unity lies in the distinction of various senses of the part–whole relation:

- (i) to set the stage for Aristotle's theory of parts and wholes by reviewing divergent tendencies in contemporary mereology; (Chapter 1)
- (ii) to show that Aristotle has various senses of the part–whole relation; (Chapter 2)
- (iii) to show that different Aristotelian senses of the part–whole relation obey different mereological principles; (Chapter 3)
- (iv) to present the problem of unity and the solution thereof. (Chapter 4)

Step (i) gives an introduction to two divergent tendencies in mereology: the extensionalistic and the non-extensionalistic approach. These tendencies each in their own ways mark the birth of interest in parts and wholes in contemporary thought thereby inviting and offering different conceptual tools to study mereology as an independent topic also in Aristotle.

Step (ii) describes the various senses of the part–whole relation in Aristotle's substance theory by describing general considerations that apply to parts and wholes, ways of division of a whole into parts and ways of being one.

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Step (iii) is an evaluation which mereological principles can be attributed to Aristotle, based on textual evidence and compatibility of the implications of these principles with Aristotle's ideas. It will be shown that the different senses of the part–whole relation involve different notions of 'proper part', i.e. a part which is not identical to the whole. If these parts were not proper parts, the question of their unity would become futile.

Step (iv) unveils the problem of unity and solves it. It is shown how the unity of parts of the composite substance is achieved via form. Further problems of unity are disclosed: the unity of form and matter, and the unity of parts of the form. Here I provide additional arguments for the claim that form and matter are proper parts of the substance, and show how their unity is achieved. Finally, the complexity of form is described. It is shown how the complexity of form does not undermine the unity of the substance. Thus, the unity of substance is preserved despite its multifaceted complexity, i.e. despite the fact that it has parts, it has form as a part, and the form itself has parts.

0.1.3. *The Main Propositions to be Defended in the Dissertation*

The analysis of relevant fragments in Aristotle and of commentaries (v.i. **0.3.1**) leads to the following main propositions:

- There are various types of entity which are said to be parts or wholes;
- There are various distinct senses of the part–whole relation;
- The distinction between the senses of the part–whole relation solves the problem of unity.

0.1.3.1. There Are Various Types of Entity Which Are Said to Be Parts or Wholes

Aristotle's part–whole theory is inseparable from his metaphysics (viz. ontology). The primary task of metaphysics is to study being *qua* being ($\tau\acute{o} \delta\upsilon\nu \tilde{\eta} \delta\upsilon\nu$), i.e. what it means for each thing to be or to exist. It involves the study of substances – beings *par excellence*. But the same discipline undertakes to study also tools that allow the characterization of the entities it studies. The tools are, among others, the notions of part and whole (*Met F* 2 1005a13–18). But such abstract terms as 'part' and 'whole' have content in conjunction with the entities which stand in for 'part' and 'whole'. For this reason one must pay attention to *what* is said to be a part or a whole. The following types of entity in Aristotle's ontology are central to the present endeavor:

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- Composite substance (*συνθέτη* sive *σύνολος οὐσία*), e.g. Socrates, man, horse, syllable 'β α ', flesh, bronze circle, etc. Strictly speaking, the term 'substance' is reserved for biological organisms or forms of these organisms.
- Form (*εἶδος*), e.g. the soul, the cause of the arrangement of parts (α and β in $\beta\alpha$), the cause of the ratio of fire and earth, circularity. Form is the substance of the composite substance: "I call *form* the Essence of each thing and the Primary Substance" (*Met Z 7 1032b1–2*); "the substance is the form within /./, 'out of' which and the matter the composite substance is said to be (*Z 11 1037a29–30*).
- Matter (*ἕλη*), e.g. the body, 'grammatical' elements (β or α), 'chemical' elements (fire, air, water, earth), bronze. Aristotle defines matter as "that primary underlying thing /i.e. subject/ in each case, out of which as a constituent and not by virtue of concurrence something comes to be" (*Phys A 9 192a31–2*). Matter is in itself unknowable (*Met Z 10 1036a8–9*) and can only be captured in relation to a certain form.
- Differentia (*διαφορά*), e.g. two-footed, four-footed, circular. Differentia is a quality in the substance (*Met K 12 1068b18–19*; *Phys E 2 226a28*; *Met A 14 1020a33*; 1020a35–20b1; 1020b15), "as for instance a man is an animal qualified in a certain way because he is two-footed, a horse because it is four-footed; and a circle is a figure qualified in a certain way because it is without angles" (1020a34–5). Differentiae make various forms out of the genus and are expressed in the definitions (*ὀρισμός*) of these forms (*Z 12 1038a6–9*). By means of a differentia one form is subordinated to another: 'two-footed' subsumes 'man' under 'animal'.
- Genus (*γένος*), e.g. animal, plane figure. Genus underlies various forms, for it is "that same thing which both of the different things /i.e. the differentiated forms/ are called in respect of substance" (*Met I 3 1054b30–1*; cf. *I 8 1057b37–58a2*). Genus is expressed in the definition of these forms (*Z 12 1037b29–30*). Genus is a super-ordinate form (cf. Porph. *In Cat 83.18–23*).

In most of English translations *eidōs* is rendered as 'form' when *eidōs* is contrasted with matter and as 'species' when the relation of *eidōs* to genus is operative. Since Aristotle himself does not draw such a contrast, I will not either.⁶

⁶ Boethius might be responsible for the tradition to translate *eidōs* as 'species', viz. *species* in Latin. For instance, in Boethius' translation of Aristotle's *Categories* *εἶδος* is consistently rendered as *species* (*Cat Tr 03*: Arist. *Cat 1 1b17*; *Cat Tr. 05*: Arist. *Cat 5 2a14f*, etc.; cf. *In Cat 159D*; 166C; 167CD; 172BC; 174B; 176CD; 177BC, etc.), and never as *forma*. The terms *forma*

0.1.3.2. There Are Various Distinct Senses of the Part–Whole Relation

The composite substance, form, matter, differentia, and genus (and other entities skipped to alleviate messiness) stand in part–whole relations, of whom the most central are the following:

- The composite substance is a whole that contains composite substances as parts.
- Genus is a whole that contains forms as parts.
- The composite substance is a whole that contains form and matter as parts.
- Form is a whole that contains genus and differentia as parts.

I argue that these are distinct senses of the part–whole relation. The part–whole relation is divisible into *integral* part–whole vs. *subjective* part–*universal* whole; *substantial* part–whole vs. *quantitative* part–whole; *real* part–whole vs. *conceptual* part–whole. These divisions are different divisions of the same genus of relational attributes (*πρός τι*, *Met Δ* 15 1020b26; *Cat* 4 2a1), i.e. the so-called 'relatives' and their converses – 'correlatives', to which *part* and *whole* belongs (*Cat* 7 8a27–9; cf. 8a16; Amm. *In Isag* 91.4ff).⁷ The number of the possible senses of the part–whole relation varies, depending on the way these divisions are combined with one another. According to the classification proposed in Aristotle's *Met Δ* 25, Alexander's *In Met* 423.33–425.4, and Aquinas' *In Met* 5.21.13, there are four main senses, which correspond to the senses listed above and are also pertinent to the solution of the problem of unity of the composite substance:

- quantitative integral part–whole;
- subjective part–universal whole;
- real substantial integral part–whole;
- conceptual substantial integral part–whole.

Aquinas' *In Met* 5.21.13, which is a commentary on Aristotle's *Met Δ* 25, provides the terms 'universal whole' (*totum universale*, cf. *In Met* 5.20.27; 5.21.15; 5.21.26; *In Phys* 1.1.9), 'subjective part' (*pars subiectiva*), 'integral whole' (*totum integrale*, cf. 5.20.27; 5.21.15; 5.21.17; *In Phys* 1.1.9; 10), 'integral

and *figura* are reserved for *σχῆμα* and *μορφή*, treating both as interchangeable (*Cat Tr* 08: Arist. *Cat* 8 10a11–12, 11a5; *Cat Tr*. 05: Arist. *Cat* 5 3b14). In his commentary to that work Boethius tends to use *forma* in contexts where matter (*materia*) is mentioned (*In Cat* 172C; 173C; 192C), however, he also uses *species* in relation to matter (*In Cat* 184A).

⁷ Relatives also include the double, the half, the triple and the third (*Met Δ* 15 1020b26–7), the same (1021a10).

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part' (*pars integralis*, cf. *In Met* 5.21.15; 7.9.3; 7.12.10). Aquinas in all likelihood borrowed the terminology from his teacher Albertus Magnus, who uses it in his commentaries on Aristotle's, Porphyry's, and Boethius' logical treatises.⁸ In his commentary on the *Met* Δ 26 (but not on Δ 25) Albertus Magnus uses *totum integrale* and *totum universale* (*In Met* Lib. 5, tract. VI, cap. III, p. 359B; cap. IV, p. 360A–B).

The terms 'quantitative part' (*pars quantitatis*, also *pars quantitativa*, cf. Aquinas *In Met* 7.9.12; *In Phys* 1.6.10; Alb. Mag. *In Met* Lib. 5, tract. VI, cap. II, p. 358A), 'substantial part' (*pars substantiae*, cf. Aquinas *In Met* 5.21.4; 5.21.33; 7.9.17; 7.10.2; 7.11.29), 'real part' (*pars rei* sive *secundum rem*, cf. 1.4.3; 5.1.7; 5.1.13; 5.21.4; 7.6.32; 7.8.2; 7.9.1; *In Phys* 4.3.8), and 'conceptual part' (*pars rationis* sive *secundum rationem*, cf. *In Met* 5.21.12) are translations of $\mu\acute{\epsilon}\rho\omicron\varsigma\ \tau\omicron\upsilon\ \pi\omicron\sigma\sigma\acute{\omicron}\nu$ (cf. *Met* Δ 25 1023b14), $\mu\acute{\epsilon}\rho\omicron\varsigma\ \tau\eta\varsigma\ \omicron\upsilon\sigma\acute{\iota}\alpha\varsigma$ (*Z* 10 1035a20), $\mu\acute{\epsilon}\rho\omicron\varsigma\ \tau\omicron\upsilon\ \pi\rho\acute{\alpha}\gamma\mu\alpha\tau\omicron\varsigma$ (1034b22), and $\mu\acute{\epsilon}\rho\omicron\varsigma\ \tau\omicron\upsilon\ \lambda\acute{o}\gamma\omicron\upsilon$ (1034b21).

The distinction between 'integral part–whole' and 'subjective part–universal whole' is based on the predication that obtains from the whole to the parts. A universal whole is predicated of its subjective part: the part is the subject and the whole is the predicate; but an integral whole is never predicated of its integral part (Aquinas *In Met* 5.21.15).

The distinction between 'real part–whole' and 'conceptual part–whole' is based on the predication that obtains from the parts to the whole. A conceptual part is predicated of its whole: the part is the predicate and the whole is the subject (*In Met* 7.9.3–4).⁹ On grounds of this I argue that the conceptual part behaves like a universal whole and the whole, of which the conceptual part is predicated, behaves like a subjective part. In this respect, conceptual part–whole relation is translatable into subjective part–universal whole relation. In contrast, a real part is never predicated of its whole.

The distinction between 'quantitative part–whole' and 'substantial part–whole' is based on whether or not the part is such that there is reference to it the definition of the thing. Quantitative part or 'what measures [a thing] in respect of quantity' ($\tau\omicron\ \mu\epsilon\tau\rho\omicron\upsilon\acute{\nu}\ \kappa\alpha\tau\grave{\alpha}\ \tau\omicron\ \pi\omicron\sigma\sigma\acute{\omicron}\nu$, *Z* 10 1034b33) is close in meaning to 'material

⁸ *Super Porphyrium De V universalibus* Tract. III, cap. I, p. 44A; tract. IV, cap. VII, p. 78A; *De praedicamentis* Tract. II, cap. III, p. 169A; *De sex principiis* Lib.1, tract. I, cap. VI, p. 315A; *Peri hermeneias* Lib. 2, tract. II, cap. V, p. 450A; *Analytica priora* Lib.1, tract. I, cap.III, p. 461B *et passim*; *Analytica posteriora* Lib. 1, tract. IV, cap. IV, p. 99B *et passim*; *Topica* Lib. 1, cap. II, p. 236B *et passim*; *De sophisticis elenchis* Lib. 1, tract. II, cap. II, p. 540A *et passim*; *Liber divisionum* Tract. III, cap. 8, p. 63 *et passim*.

⁹ Aquinas in *In Met* 7.9.3 says that no integral part is predicated of a whole. This seems to be a slip, since according to the classification of parts in 5.21.13 conceptual parts are integral parts (cf. *In Phys* lib. 1.1.10).

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part' or 'part of matter' – terms used not by Aristotle himself but by the commentators.¹⁰ Material parts do not enter into the definition. 'Substantial part' is used by Aristotle consistently to designate items which have to be mentioned in the definition (a21; cf. *H* 1 1042a18–21). Substantial parts enter into the definition as the principles without which the thing would not be what it is.

0.1.3.3. The Distinct Senses of the Part–Whole Relation Solve the Problem of Unity

The analysis of the senses of the part–whole relation leads up to the following general acknowledgements which directly address the problem of unity and solve it:

- If the senses of the part–whole relation are indeed distinct, i.e. what is a part or a whole in one sense is not a part or a whole in another sense, then parts or wholes in one sense are not combinable with parts or wholes in another sense. ***Parts achieved by one division must not be unified with parts achieved by a different division.***
- ***Not all parts are of such a nature that they need a unifier.*** The only parts which need a unifier are quantitative integral parts.

If we take it seriously that parts in one sense must not be unified with parts in a different sense and that not all parts need a unifier, then the solution to the problem of unity becomes trivial. It can be expressed in a very crude manner as follows.

Firstly, the substance can be split into quantitative integral parts, which then themselves are composite substances. These parts are of such a nature that they need a unifier. Form is their unifier. Upon this splitting form is not a part of the substance and form does not have any parts.

Secondly, the substance can be divided into real substantial integral parts: matter and form. These parts are of such a nature that they do not need a unifier. Upon this division form is a part of the substance along matter, and form does not have parts. It would be preposterous to try to unify form with quantitative parts, since they are achieved by a different division.

¹⁰ For instance, *μέρος τῆς ὅλης* occurs in Pseudo-Alex. *In Met* 515.4–17 *passim*; 545.18; 554.14; Amm. *In Cat* 27.31; 28.1. Aquinas mentions both *pars materiae* and *pars materialis* (*In Met* 5.2.2.; 7.9.20; 7.9.21; 7.11.21. 8.3.10; 10.4.10).

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Thirdly, the form can be divided into parts. If form is divided into conceptual parts, genus and differentia, these parts are of such a nature that they do not need a unifier. Upon this division form is not a part of the composite substance but form has parts. Form is not a part of the substance because, according to the division into conceptual parts, form is not a part of the thing, i.e. form is not a real part.

In light of these considerations, the assertions to which Aristotle is committed ((a) – (f)) can be qualified in such a way that the solution to the problem of unity of the composite substance becomes manifest:

- (a') the composite substance has parts in different senses: the composite substance as an integral whole can be divided into quantitative parts or substantial parts;
- (b') whatever has quantitative parts must be unified by a unifier;
- (c') form is the unifier of the quantitative parts of the integral whole;
- (d') the unifier must not have parts in the same sense as the item which is unified by it;
- (e') form has parts: form as an integral whole can be divided into conceptual parts, and form as a universal whole can be divided into subjective parts;
- (f') form is a real substantial integral part of the composite substance.

By admitting distinct senses of the part–whole relation I offer a formulation of the problem of unity of substance and a version of the solution to the problem which I have not encountered in this exact shape in the secondary literature.¹¹ There is a tendency among contemporary scholars (e.g. Koslicki 2008, p. 158; 2007, pp. 138–9; cf. Haslanger 1994, p. 135 n. 12) to squeeze different kinds of parts and wholes into a single sense of the part–whole relation. As a result, there is a one-dimensional portrait of the unity of substance, according to which either the composite substance is not in fact composite (e.g. Ackrill 1972–

¹¹ Similar in spirit is Herbert Granger's (1977) dissertation "A Problem in Aristotle's Ontology: Substance as Both Simple and Complex". There the problem of unity is seen as a tension between two conflicting conditions: a definable basic item (i.e. substance) must be simple, if it is a basic existent, and it must be complex, if it is definable (p. 1; cf. *Met Z* 13 1039a14–20). Granger argues that Aristotle's solution "consists in reconciling the two conditions" so that "the definable substance is both simple and complex" (p. 161; p. 174; cf. *Met H* 6). I have also arrived at the conclusion that for Aristotle the substance is both simple and complex, although the path I have taken is different. I have treated the problem of unity as a conundrum of six assertions and put emphasis on the ambiguity of mereologically nested items: substance is 'one' *in one way* and 'many' *in a different way*.

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3, pp. 124–5; Scaltsas 1994, p. 108–9; Sellars 1967, pp.117–18), or the form of the substance is not composite (e.g. Koslicki 2006, p. 731–2 n. 36; Harte 1996, p. 293–4). Both options are unacceptable as they contradict what Aristotle actually says. However, the solution (i.e. the attentiveness to the different senses of parts and wholes in Aristotle's text) which I have presented seems to be trivially clear to the old Aristotelians with whom I greatly sympathize (v.i. **0.3.1**).

0.2. The Methodological Framework

0.2.1. Mereology and Metaphysics

Since in my dissertation I want to elucidate a mereological solution to the problem of unity of the composite substance, it is necessary to have an idea of what mereology is, and how it is related to metaphysics (ontology).

Mereology (from *μέρος*, 'part') has come into philosophical focus as a proper discipline relatively recently, at the beginning of the 20th century.¹² Edmund Husserl (1859–1938) developed a general theory of part and whole in the third of his *Logical Investigations* (1900–1901). He elaborated it as a subdivision of an all embracing formal ontology, a discipline which, analogously to logic, does not confine itself to a restricted domain of objects, but in contrast to logic, deals with objects and their formal properties, not with truths and inference rules. Independently of Husserl, Stanislaw Lesniewski (1886–1939) worked out a rather different theory of part and whole in the *Foundations of a General Theory of Manifolds* (1916) and in his treatise *On the Foundations of Mathematics* (1927–1930).¹³ He called his theory 'Mereology' and expressed it in the formal language of the general logic bearing the name 'Ontology' or the "logic of being". Lesniewski's ideas were inaccessible to non-speakers of polish. A theory similar in spirit but different in logical style became widely known owing to Henry S. Leonard's (1905–1967) and Nelson Goodman's (1906–1998) article "The Calculus of Individuals and Its Uses" (1940) which expresses the theory in the familiar guise of first order predicate logic and set theory. A nominalistic version of the theory, where sets are substituted with predicates, appears in Goodman's *The Structure of Appearance* (1951; revised edition 1977). It is now the prevailing theory often referred to as the 'standard' mereology

¹² Bibliography since 1900 is to be found in Smith (1982, pp. 481–552).

¹³ Simons (1987, p. 82) points out that probably Whitehead had elaborated a similar theory even earlier.

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or the Classical Extensional Mereology (CEM) that is extensively applied to many areas of philosophy, where formal rigor is possible.

The branch of contemporary mereology, which includes versions of CEM, is committed to two basic assumptions: (i) the theory ranges over a single type of entity (individuals such as the Eifel tower or president's hand); (ii) "entities have exactly one part structure" (Moltmann 1997, p. 1), viz. there is only one way how to understand the part–whole relation (e.g. as the relation 'less than' supplemented by some other mereological principles).¹⁴ These assumptions underlie the prioritization of logical systems, which with a claim to ontological neutrality are used to describe parts and wholes in terms of formal mereological principles of composition and decomposition.

Aristotelian part–whole theory diverges significantly from the understanding of mereology that has been prominent in recent literature. It shuns both assumptions mentioned above. Firstly, Aristotle's theory clearly applies to more than one type of entity. Composite substance, form, matter, genus, and differentia are different types of entity. Secondly, there are several ways how to understand the part–whole relation: integral part–whole vs. subjective part–universal whole; substantial part–whole vs. quantitative part–whole; real part–whole vs. conceptual part–whole. Moreover, these different part–whole relations can apply to one and the same entity, e.g. form as an integral whole can be divided into conceptual parts, and form as a universal whole can be divided into subjective parts. These divergences render it impossible to make an unqualified claim to ontological neutrality.

According to Aristotle, to investigate the nature of parts and wholes is to be engaged in metaphysics. The investigation of the nature of being requires a simultaneous study the conceptual frame of the study itself.

"It is therefore plain: that it falls to one discipline to study that which is *qua* thing-that-is /τὸ ὄν ἢ ὄν – being *qua* being/, and those things that hold good of it *qua* thing-that-is; and that the same discipline undertakes the study not only of substances but of whatever holds good of them also, both the things mentioned /i.e. what is the *contrary* or *complete*, or *one*, or *thing-that-is*, or *the same*, or *other* (1005a11–12)/ and *prior* and *posterior* and *genus* and *form* /εἶδος/ and *whole* and *part* and the others of that kind." (*Met Γ 2* 1005a13–18)

¹⁴ Moltmann (1997) develops a mereology for analyzing part structures in the semantics of natural language, where he rejects the assumption that entities have exactly one part structure and instead argues, among other things, that "one and the same entity may have different part structures in different situations or under different perspectives" (p. 2).

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Ontology feeds into mereology and mereology feeds back on ontology. When we say that an object is part of another or that some objects make up a whole, we must mention *which objects* are under consideration and *in what way* they are *parts* or *wholes*.

In my thesis I raise questions which involve metaphysical considerations lying outside (or lying at the basis of) mereology as a logical system: Under what conditions something is a part or is a whole? What kind of parts and wholes are there? In what ways is a whole divided into parts? In what ways does a plurality compose a whole? At the same time it should be emphasized that a metaphysical stance towards mereology in no way excludes the possibility to state mereological principles and definitions of mereological terms.

My approach accords with the perspective taken by Arlig (2005, p. 2–3; cf. p. 14–15) in his dissertation on medieval mereology:

"The/ logic of parts and wholes must be explanatorily posterior to the metaphysics. In other words, the formalization of the part-to-whole relation cannot occur until we have settled the metaphysical issues."¹⁵

My reconstruction of Aristotle's theory of parts and wholes cannot be ontologically neutral, if the formulations of mereological principles and definitions cannot be detached from the array of objects to which these principles and definitions are applied. But it does not mean that the theory does away with neutrality completely. Mereological considerations can be generalized within a defined field of application. It will be shown that Aristotle's account is to a certain extent comparable with mereological principles (such as irreflexivity, asymmetry, transitivity, overlap, disjointness, supplementation principles, and summation). However, these principles will not hold equally for each sense of part or whole.

0.2.2. Research Methods

The research methods include textual analysis of relevant fragments of Aristotle's works by consulting commentaries and secondary literature. I have attempted to follow the methodology offered by scholars of ancient philosophy in the analytic tradition, which involves exposition of arguments and conceptual

¹⁵ This approach somewhat contrasts with the perspective set out by Harte in her book on Plato's mereology where the author wants to focus on "the nature of the theory of composition itself rather than on the nature of the objects to which the theory is applied" (2002, p. 6). Harte seems to be willing to attribute a metaphysically neutral mereology to Plato, although she does not offer a formal theory.

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analysis of terminology. I have also followed the idea that we can use (albeit cautiously) contemporary conceptual instruments in approaching ancient texts on the supposition that ancient philosophers are not remote and isolated thinkers totally alien to us. Aristotle's biology, chemistry, physics and cosmology might be outdated, but the method and overall strategy of research is worthwhile considering. There are ideas and questions that cannot possibly grow old or become irrelevant, as, for instance, part–whole theory. In general, the comprehensibility and convertibility of the reconstruction of Aristotle's ideas would be impaired, if the research were confined to Aristotle without the help of modern theories. The usefulness of the results is directly proportionate to the ability to interpret them in a readily available philosophical terminology, even if it is not entirely adequate. The inadequacies can be beneficial, if they help to crystallize the unique aspects of Aristotle's theory that do not fit neatly into a familiar framework. Some of the inadequacies may serve as a basis for questioning one's biases and preconceptions and prevent the theorist from devising an anachronistic interpretation of ancient texts.

The research has to face several methodological difficulties. There are hardships concerning the question how to delineate the object of study within Aristotle's corpus and how to deal with the enormous amount of commentaries and secondary texts, all of which have to say something of interest but few of which say something that directly pertains to my investigation. There are problems arising due to the ambiguity of Aristotle's language and his elliptical expression, which gives freedom of interpretation and opens opportunities to many alternative translations.

It is legitimate to ask – how can one decide which fragment is included in the scope of analysis? What are the criteria for including or excluding a particular passage from the so-called theory of parts and wholes? The easiest way is to inspect every occasion of use of 'part', 'whole', and related terms with the help of Bonitz's *Index Aristotelicus* (1870) or *Thesaurus Linguae Graecae* (2009). Such a simple approach often will be insufficient, since the terms have wide application in various contexts without carrying any burden of theory. Instead of this empirical gathering of meanings, I have attempted to delineate the core of the theory based on several fragments, in which the concentration of mereological remarks is the highest and the most explicit: *Met A* 24 investigates the meanings of 'out of'; *A* 25 contains the many senses of 'part'; *A* 26 is devoted to the meanings of 'whole', *Met Z* 10–12 and 17 elaborates on the part–whole relation within the conceptions of substance. I take the concluding passage in *Z* 17 1041b11–19 to be the acme of the crossover of mereology and substance theory.

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It should also be pointed out that in my study I have ignored the order of Aristotle's works. There are scholars who argue that Aristotle's thought has evolved over the course of his philosophical career and it is reflected also in his writing. Werner Jaeger (1948) has argued that Aristotle initially was a Platonist, gradually became critical of his master and turned to empirical investigations. G. E. L. Owen (1965a), on the contrary, defends the view that the young Aristotle criticized Plato (as in the *Categories*), but later became a Platonist himself (as in the *Metaphysics*). Yet others argue that the *Categories* might not be an early work, but a work for beginners, which gives a general outlook to ontology and omits subtle distinctions present in the *Metaphysics* (Furth 1988; Gill 1989; Burnyeat 2001), or it might be pre-explanatory with respect to substance in contrast to the explanatory strategy of the central books of the *Metaphysics* (Loux 1991; Wedin 2000).¹⁶

The reflections on the development of Aristotle's thought do not impact Aristotle's theory of parts and wholes.¹⁷ Whether or not Aristotle was a Platonist at any period of his philosophical career does not affect his approach to mereology. Koslicki (2008) and Harte (2002) suggest that Aristotle's and Plato's mereologies have a lot in common. There is no work for 'beginners' devoted to mereology, since it is scattered across the corpus.

0.3. The Review of the Sources and Literature Explored in the Dissertation

The literature to which I have referred in my thesis falls into two groups: primary sources, i.e. ancient authors' texts and translations, and secondary literature on ancient authors' texts, and on mereology and metaphysics in general. The latter, while not devoted specifically to the exploration of Aristotle's thought, provides methodological tools of analysis and raises puzzles relevant to my topic.

0.3.1. Primary Sources: Ancient Authors' Texts and Translations

Primary sources comprise editions of Aristotle's texts in Greek,¹⁸ translations in English,¹⁹ as well as editions of Greek commentaries and their translations if extant. I am indebted to the commentaries of

¹⁶ The account on how scholars regard the order of Aristotle's works is largely borrowed from Gill 2005, pp. 223–4.

¹⁷ Cf. Morales (1994). Despite the changes in Aristotle's philosophical system, Morales (1994, p. 255) has found no evidence which supports variation in Aristotle's theory of relational attributes.

¹⁸ I have used the following Greek editions of Aristotle's works: Bywater 1962; Minio-Paluello 1949; Ross 1958; 1961; 1966; 1970.

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Alexander of Aphrodisias,²⁰ Boethius,²¹ Porphyry,²² Simplicius,²³ and St. Tomas Aquinas.²⁴ Additional commentators to which I have referred include Ammonius Hermeiou,²⁵ Asclepius (Hayduck 1888), Albertus Magnus.²⁶ The main sources are organized in this table:

Titles of Aristotle's works	Editions of Aristotle's texts in Greek	Translations in English	Ancient commentators and their works	Editions of ancient commentators' texts in Greek or Latin	Translations in English
<i>Cat</i>	Minio-Paluello 1949	Ackrill 1963	Porph. <i>In Cat</i>	Busse 1887	Strange 1992
			Simpl. <i>In Cat</i>	Kalbfleisch 1907	Chase 2003 (Simpl. <i>In Cat</i> 1–4)
<i>Top</i>	Ross 1970	Tredennick & Forster 1960	Alex. <i>In Top</i>	Wallies 1891	
<i>Phys</i>	Ross 1966	Charlton 1970 (<i>Phys A–B</i>) Hussey 1983 (<i>Phys Γ–Δ</i>)	Simpl. <i>In Phys</i>	Diels 1882	Urmson 1992 (Simpl. <i>Phys Δ</i> 1–5 and 10–14)
			Aquinas <i>In Phys</i>	Leonina 1884	Blackwell & Spath & Thirlkel 1995
<i>Met</i>	Ross 1958	Kirwan 1971 (<i>Met Γ–E</i>) Furth 1985 (<i>Met Z–I</i>) Annas 1976 (<i>Met M and N</i>) Armstrong & Tredennick 2006 (<i>Met K and Λ</i>)	Alex. <i>In Met</i>	Hayduck 1891	Dooley 1993 (<i>Alex. In Met Δ</i>)
			Aquinas <i>In Met</i>	Cathala & Spiazzi 1971	Rowan 1961

Unless noted otherwise, in quotations I have used the translations represented in the table above. Italics and square brackets are original. My corrections, additions and elisions are marked by slashes (/./). This table does not include those Aristotle's works, commentaries, and their translations, which are mentioned

¹⁹ I have used the following English translations of Aristotle's works: Ackrill 1963; Annas 1976; Armstrong & Tredennick 2006; Barnes (ed.) 1984; Bostock 1994; Charlton 1970; Furth 1985; Hicks 1907; Hussey 1983; Irwin 1999; Kirwan 1971; Lennox 2001; Peck 1942; Tredennick & Forster 1960; Wicksteed & Cornford 1996; Williams 1982; Woods 1992. I have occasionally consulted Boethius' Latin translation of Aristotle's logical works: Minio-Paluello (ed.) 1961.

²⁰ The Greek editions of Alexander's works which I have used are: Hayduck 1891; Wallies 1891. The English translation which I have used is that of Dooley (1993).

²¹ I have taken a look into Migne's (1891) Latin edition and Magee's (1998) critical edition.

²² I have consulted with Busse's (1887) Greek edition, and Barnes' (2003) and Strange's (1992) English translations.

²³ The Greek editions of Simplicius' works which I have used are the following: Diels 1882; Heiberg 1894; Kalbfleisch 1907. I have availed of English translations: Chase 2003; Urmson 1992.

²⁴ The Latin editions are the following: Cathala & Spiazzi 1971; Leonina 1884; 1984. The English translations that were of avail are: Blackwell, Spath, & Thirlkel 1995; Foster & Humphries 1951; Rowan 1961.

²⁵ I have cast a glance at Busse's (1891; 1895) and Wallies' (1899) editions.

²⁶ I have consulted Borgnet's (1890a; 1890b; 1890c) and De Loë's (1913) editions to look up Albertus' use of terminology.

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on occasion to illustrate a point or to provide additional information aiding to explain a particular passage, a term or an idea more fully. When quoting these texts, I have provided reference to the translator in parentheses. If I have quoted works, which are not central to my research, I have referred solely to their English translations. I have occasionally used Boethius' *De Divisione* (Magee 1998). Although *De Divisione* is not a direct tribute to Aristotle, it contains indirect references and suggestions of ways to understand a certain sense of part–whole within Aristotle's conception of substance. I have not explored the medieval commentaries to Aristotle except Aquinas' commentaries. It might have been beneficial to investigate the medieval heritage but in that case this project would never come to an end.²⁷ The same applies to the Renaissance commentaries.

0.3.2. Secondary literature

Secondary literature includes monographs and articles devoted to Aristotle's metaphysics, and works written by scholars in the area of mereology and metaphysics, which pertain to specific questions explored in the dissertation. I appreciate greatly the work of Kathrin Koslicki (1997, 2006, 2007, 2008), Allan Bäck (2011), Sally Haslanger (1994), Herbert Granger (1977), and Kit Fine (1992, 1996). It is Koslicki's work that is discussed a lot in my thesis, especially with respect to the question of parthood of form and of unity of the composite substance. To orient myself in mereology I have consulted the work of Edmund Husserl (in J. N. Findlay's translation, 1970), Nelson Goodman (1977), Nicholas Rescher and Paul Oppenheim (1955), Peter Simons (1982, 1987), Achille Varzi (2011), Kathrin Koslicki (2008), Lothar Ridder (2002), and Friederike Moltmann (1997).

In general, Aristotle's account on parts and wholes is a topic which has gained relatively little attention in comparison to the vast amount of literature which is produced on Aristotle's *Metaphysics* (see Radice & Davies 1997). At the same time it has to be admitted that mereology is increasingly becoming aware of its history²⁸ and there are serious neo-Aristotelian tendencies in mereology, e.g. Kit Fine (1992, 1994, 1996), Kathrin Koslicki (2004a, 2004b, 2006, 2007, 2008); Barry Smith (2005); Peter M. Simons (1987). There

²⁷ To get an idea of the amount of Medieval Latin commentaries on Aristotle, see: Lohr 1967–1974.

²⁸ For more on this topic, see Simons (1991). The central authors whose historical work is being studied are the polish logicians and more recently – Edmund Husserl. Important studies on Husserl include Fine, K. (1996); Ginsberg (1982); Null (1983); Simons (1987, 1982); Mulligan & Smith (1982). Not long ago scholars have started to shift their attention toward older theories. There has been interest in medieval mereology (see Arlig 2005; Henry 1991). Verity Harte (2002) has profoundly studied Plato's conception of parts and wholes.

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are also detailed but partial mereological studies (articles and book chapters) of some of Aristotle's texts.²⁹ A considerable amount deals with mereological themes in passing by addressing other related issues, e.g. hylomorphism³⁰ (i.e. the doctrine that there are form–matter compounds), the separation of form,³¹ multiplicity of being,³² individuation and identity,³³ substance and predication,³⁴ etc. The project which I have started to pursue has good opportunities to grow further and to transform into a more serious examination. A comprehensive monograph devoted solely to Aristotle's mereology is not written yet, while there is, for instance, a book on Plato's part–whole theory by Verity Harte (2002).

²⁹ See, e.g. Bäck 2010, Barnes, J. 1986; Bogaard 1979; Charles 1994; De Castro 2003; Fine, G. 1980; Fine, K. 1992, 1994, 1996; Frey 2007; Furth 1987; 1988; Gill 1989, 1995; Halper 1984; 1985; 1987; 1989; Harte 1996; 2002; Haslanger 1994; Koslicki 1997; 2004b; 2006; 2008; Lewis, F. 1982; 1994; 1996; Lloyd 1962; Mansion 1979; 1984; Matthen 1987; Mayhew 1997; Mesch 1996; Mignucci 2000; Modrak 1983; Morrison 1989; 1995; 1996; Runggaldier 1989; Scaltsas 1993; 1994a; 1994b; Schickling 1936; Steinfath 1996; White, D. 1985; White, N. 1971.

³⁰ See, e.g. Kirby 2008; Kosman 1994; Loux 1991; Matthen 1987; Reeve 2000; Sellars 1967; Sokolowski 1970; Wedin 1988; 1996; 2000; Williams, B. 1986; Williams, D. C. 1958; Witt 1987; 1989; 1994; Woods 1991; 1994; Yu 1997; 2003.

³¹ See, e.g. Ackrill 1972; Addis 1972, Albritton 1957; Fine, G. 1984; 1985; Ferejohn 1994; Ryan 1973.

³² See, e.g. Berti 2001; Blyth 1994.

³³ See, e.g. Barnes, K. 1977; Charlton 1994; Code 1978; Gill 1994; Miller 1973; Mariani 2000; Pelletier 1979; Regis 1976; White, N. 1971.

³⁴ See, e.g. Gill 1995; Lewis, F. 1983; 1991; Loux 1979.

1. Approaches to Mereology

Chapter 1 sketches the foundations of mereology both historically and content-wise. Two wide branches are distinguished: (1) extensional mereology, and (2) non-extensional mereology. The work of Nelson Goodman, who is a prominent representative of the former branch, and of Edmund Husserl, Paul Oppenheim and Nicholas Rescher, who are representatives of the latter, has turned mereology into a separate field of study.

1.1. Extensional Mereology and its Limits

This chapter offers a brief survey of extensional mereology, presenting Goodman's Calculus of Individuals as an example. It also touches upon some of the difficulties extensional mereology encounters.

1.1.1. Calculus of Individuals

One of the most prominent versions of extensional mereology is the Calculus of Individuals. It was devised as a nominalistic system to partially substitute set theory (or the calculus of classes).³⁵ The aim of a nominalistic theory is to talk about properties and relations without any reference to universals, i.e. sets or classes.³⁶ Nelson Goodman in his nominalistic version of Calculus of Individuals emphasizes that the talk is of 'wholes' (not classes): "The species of dog may be regarded as certain discontinuous wholes composed of dogs" (1977, II 3, p. 29).

Every such 'whole' is an 'individual'. All the variables of the system take individuals as their only variables. Every variable of a system is assigned the value of the lowest ontological type or category.³⁷

The commitment to individuals does not involve claiming that only individuals exist but, according to Goodman, it saves the theorist from postulating "ethereal, platonistic, pseudo entities" (1977 II 3, p. 26).

³⁵ Ridder (2002, S. 6–8) points out four tenets of Lesniewski's general theory of manifolds, in contrast to set theory: (i) there are only concrete particular objects; (ii) classes are collective wholes that are concrete objects themselves; (iii) the membership of elements is replaced with the part-whole relation; (iv) the theory is expressed in predicate logic; (v) there are only individual variables; there is no existential commitment in quantification; (vi) the concept of a set is replaced with the concept of a sum or fusion, and the principle of summation is accepted instead of the axiom of comprehension.

³⁶ Not all extensionalist theories are nominalistic. David Lewis' *Parts of Classes* (1991), in contrast to Goodman's (1951; 1977) approach, gives a mereological analysis of sets.

³⁷ Goodman (1977, p. 22): "I shall confine myself as far as I can to language that speaks of no entities other than individuals."

Individuality has nothing to do with indivisibility, or homogeneity, continuity, compactness, or regularity (II 4, p. 33).

The concept of 'individual' is secured in terms of the two-place predicate 'overlaps', which is taken as the sole primitive of the system, i.e. of the latest version of Goodman's Calculus of Individuals (1951; 1977). 'Overlaps' is symmetric and reflexive but not transitive. The primitive of the earlier version (Leonard & Goodman 1940) is the converse of overlap, i.e. 'disjoint' (or 'discrete'): ' x is disjoint (discrete) from y ' means ' x and y do not overlap' (cf. Goodman 1977, D2.041). The predicate 'disjoint' is symmetric, irreflexive, non-transitive. Whatever overlaps something is an individual. Goodman posits as an axiom the existence of an individual that arises due to two overlapping individuals.

Existence of an Overlap Individual: x and y *overlap* if and only if there is some z such that everything which overlaps z also overlaps both x and y . (1977, Postulate 2.41; II 4, p. 34)

"Two individuals overlap if they have some common content, whether or not either is wholly contained in the other." (1977, II 4, p. 34)

There are no individuals in the absolute sense. Just as anything can constitute a class, so anything can be an individual:

"Nominalism is defined not by independent standards of what constitutes an individual but by independent standards of what constitutes taking entities as individuals." (1977 II 3, p. 28)

The decision of what is an individual is entirely dependent on the system in which the individual is included:

"*./.* the universe of individuals consists of everything that satisfies the predicate 'overlaps', and *./.* the universe of individuals *for such a system* consists of everything that satisfies the predicate 'overlaps' under the restricted interpretation of it provided for that system." (1977 III 11, p. 85)

The restriction of 'overlaps' is dependent on other primitive predicates admitted in the system. An individual is a basic unit of a system, if it satisfies a primitive predicate. If the basic unit does not have others as parts it is a minimal basic unit or an atom. All individuals under a finite system (such as the Calculus of Individuals) are sums of one or more of its atoms (1977 III 11, p. 85).

Goodman (1977 II 4, p. 37) assumes as an axiom that sums exist. If anything is a Dalmatian, there is the sum of all Dalmatians. Existence of a Sum: If any individual is F , then there is an individual that is the sum of all F s.³⁸

The sum of all the individuals satisfying a certain predicate is defined: The sum of all F s is the individual that overlaps all and only those individuals which overlap at least one F .³⁹ Accordingly, "the sum of all Dalmatians is that individual which overlaps all and only those individuals which overlap some Dalmatian" (II 4, p. 37).

Goodman's system yields the theorem that every two individuals have a sum: There is a z such that it is a sum of x and y . (Postulate 2. 45; II 4, p. 36.)⁴⁰ The definition of binary sum is as follows: The sum of x and y is that individual z that overlaps all and only those individuals w which overlap at least one of x and y . (D2.047; II 4, p. 36)

Given that two things are identical if and only if they overlap exactly the same individuals (1977, D2.044; II 4, p. 35) and that x is a (proper or improper) part of y if and only if whatever overlaps x also overlaps y (D2.042; II 4, p. 35), a theorem can be deduced that two individuals are identical if and only if they have the same parts. It means that the whole is identical with the sum of its parts. As Goodman (1977 II 3, p. 26) puts it, there is "no distinction of entities without a distinction of content".

The predicate 'is a proper part of' is transitive, but asymmetric and irreflexive, in contrast to the predicate 'is part of' which is transitive, non-symmetric (i.e. anti-symmetric), and reflexive. Hence every individual is a part of itself. Thus, x is a *proper part* of y if and only if x is a part of y and y is not a part of x . (1977, D2.043; II 4, p. 35.)

The sequence, arrangement or structure of the elements of the sum is utterly irrelevant. Just as in set theory, also here the existence and identity of an object is not influenced by the order of the members of the sum or the structure of the parts of the object. Thus any collection of objects is itself an object.

³⁸ I have taken this formulation, as well as the subsequent formulations where F occurs, from Ridder (2002, S. 93). Instead of the predicate expression " F " Goodman uses "...".

³⁹ Lewis has a stronger definition of sum/fusion than Goodman: "Something is a *fusion* of some things iff it has all of them as parts and has no part that is distinct [i.e. disjoint] from each of them" (1991, p. 73, quoted from Harte 2002).

⁴⁰ For the proof of the theorem see Ridder (2002, S. 97).

The last axiom in Goodman's (1977) system affirms the existence of a maximal overlapper or a product (taken from Ridder 2002, p. 94): Existence of a Product: If there is at least one individual that is a part of all the *F*s, then there is the product of *F*s.

The product of all the individuals satisfying a certain predicate is defined: The product of all *F*s is the individual that has as parts all and only those individuals that are parts of all the *F*s (1977, II 4, p. 37). Binary product is defined as follows: "The product of *x* and *y* is that individual which exactly contains all /i.e. every part/ that is common to *x* and *y*" (D2.045; II 4, p. 35).

1.1.2. The Counter-intuitiveness of Extensional Mereology

Summation is the only kind of relation among objects, and the only kind of objects allowed in the system are individuals, so that any sum of individuals is a further individual. Kathrin Koslicki (2008, p. 4) has aptly illustrated the extravagance of this outlook:

"...the American President's left hand together with the Eiffel Tower compose a further object, their mereological sum, fusion or aggregate, which is partially located in the White House and partially located in Paris. This object is just as real and respectable from the point of view of standard mereology as the President's left hand or the Eiffel Tower taken individually; from the point of view of the theory, there is no difference in ontological status between them."

The concession that sums exist does not itself lead to absurdity. The admission of discontinuous, irregular, disorganized or non-uniform individuals does not constitute an objection to the theory. Goodman (1977 II 4, p. 36), for instance, has easily warded off such demurs:

"If the Arctic sea and a speck of dust in the Sahara are individuals, then their sum is an individual. /../ The supposition that bizarre instances demonstrate that two individuals can fail to have a sum betrays a misunderstanding of the range of our variables."

Extensional mereology implies consequences that oppose our intuitions when our aim is to include "ordinary objects"⁴¹ in the theory. The things that *we* regard as individuals have conditions of existence and identity whose boundaries are rather vague and have to be specified differently in different contexts.⁴²

⁴¹ Many metaphysicians think that we should not waste time with ordinary objects, since they do not really exist at all. E.g. Terry Horgan (2008.05.21) emphasizes that "the right ontology will be one that eschews ordinary objects". For a defense of a contrary position see Thomasson (2007).

⁴² Cf. Simons (1987, p. 110); Ridder (2002, S. 109); Thomasson (2007, p. 47; p. 106).

As Peter Simons (1987, p. 110) has noticed: "It is not the formal theory which is suspect, but its uncritical application to the world."

Extensional mereology presumes an elegant but somewhat simplistic approach to the world. It fits with mathematical systems but some of its results are incompatible with common-sense. The theory is elegant because it posits few primitives and axioms. However, the principles are insufficient to describe the richness of our world.

The principle whose application is especially dubious is the Existence of a Sum. For any number of individuals there is always a sum of these individuals, and the sum is uniquely determined. The sum is the smallest individual that contains the aggregated individuals as their parts. Every whole is additive in the sense that it is the sum of its individual parts and nothing else. The unrestricted existence of summary individuals should be either rejected for reasons of ontological economy or restricted to a particular domain of objects.

Extensionalistic theories have to face other serious problems that have to do with the way we are accustomed to treat wholes. Extensionalistic theories exclude the option (i) that two distinct wholes share all the same parts, and (ii) that one and the same whole can change parts (cf. Harte 2002, p. 15), because these theories neglect the importance of the structure or organization of the parts of a whole (cf. Ridder 2002, S. 105-107).

If an object (*qua* sum of its parts) changes its parts, it cannot be identical with the sum of its parts. Yet there are objects that preserve their identity although their parts change (cf. Simons 1987, p. 1–2).

Wiggins (1979) and Simons (1987, p. 115–16) put forth the following example:

"A cat, Tibbles, consists of a body, Tib, and a tail, Tail. But we cannot identify Tibbles with Tib + Tail because Tibbles could, through an accident, lose her Tail, but still exist, while Tib + Tail cannot lose Tail and continue to exist. ...if Tibbles remains intact throughout her life, this is a case where every part of Tibbles is a part of Tib + Tail and vice versa, yet Tibbles \neq Tib + Tail /.../ Two distinct material objects can then coincide spatially for their whole lives, yet not be identical."

One apparent solution is to accept the Theory of Temporal Parts (Lewis D. 1986), according to which objects are four-dimensional processes which in addition to spatial parts have temporal parts. Suppose that Tibbles is a four-dimensional cat-process. If Tibbles does not lose her tail, then Tibbles = Tib + Tail, but if Tibbles loses her tail, then it appears that Tibbles \neq Tib + Tail. But it is not the case that Tibbles \neq Tib +

Tail, since the sum, Tib + Tail, still exists despite the fact that its parts, Tib and Tail, are disconnected. What has happened is that the cat is not identical with Tibbles anymore. The cat is still called "Tibbles" (out of convenience?) but "Tibbles" is not identical with Tibbles. The cat that is called "Tibbles" is a proper part of Tibbles, the sum, Tib + Tail, since after the tail loss "Tibbles" = Tib.

"The cat/ will be a proper part of this sum whose earlier temporal parts (before tail loss) are identical with the earlier temporal parts of the sum, and whose later temporal parts leave out the later temporal parts of the disconnected tail." (Simons 1987, p. 116)

But there still remains a question: Is a four-dimensional cat-process indeed identical with a sum of cat-part-processes? Simons and Wiggins point out that identity does not hold here, because the four-dimensional cat-process and the sum of cat-part-processes have different conditions of existence and identity and thus different modal properties. The sum can exist, when its parts are disconnected, and if they are not, they could have been so dispersed, while the cat-process cannot be disseminated throughout the world. The four-dimensional cat-process and the sum of cat-part-processes are modally distinct objects that may coincide spatio-temporally (Simons 1987, p. 116).

Cats can change some of their parts, although their parts cannot be disconnected, while sums cannot change their parts, although their parts can be disconnected. Hence, contrary to the declarations of extensional mereology, not all objects are sums. There are objects that differ from sums at least with respect to their modal properties.

1.2. Non-extensional Mereology

Rescher and Oppenheim (1955, p. 90), among others, offer an alternative approach. They specify three intuitive underlying requirements that have to stay fixed in their applicability to every talk of composite wholes throughout a wide range of domains:

- (1) The whole must have an *attribute* relative to some decomposition of the whole into the parts and the attribute must be unshared by the parts belonging to the decomposition.
- (2) The parts of the whole must stand in some relation of *dependence* with one another.
- (3) The whole must have *structure*.

I will explain the three requirements, but I will not confine the exposition merely to Rescher's and Oppenheim's ideas. I will relate their ideas to Husserl's notion of 'moment' or 'dependent part', and 'foundation', Simons' definition of 'structure', and Koslicki's restrictions on composition. It has to be pointed out immediately that these requirements apply only to *integral wholes* and are devised as the conditions which tell us when a composite is a "genuine whole" as opposed to being a mere sum or aggregate.

1.2.1. The Attribute of the Whole and the Relativity of Decomposition

Rescher and Oppenheim (1955, p. 91) suggest that "a property peculiar to a whole as such" is an attribute which is *unshared* by any part of it, where something counts as a part relative to some specific relation in virtue of which the decomposition of the whole into such parts obtains. What is crucial is that the whole can have *different decompositions* under different specifications of the part–whole relation.

Rescher and Oppenheim's example of an unshared attribute is the conicity of a pile of round stones. Rescher and Oppenheim do not elaborate on the possibility that the whole may have different decompositions, but we can easily imagine such a case. A conical pile of stones can be broken down either into its chemical ingredients or divided in half, in each case having a different specification of the part–whole relation.⁴³ Thus, there is a decomposition of a material object either into constituents or spatial parts. What is important (although not explicitly stated by Rescher and Oppenheim) is that the whole loses the attribute which is characteristic to it as a whole in contrast to its parts under some decomposition but not under another. For instance, a half of a cone is not conical, whereas all of the stones of which the conical pile of stones is composed have the same chemical structure. The latter is not an unshared attribute of the whole, whereas the former is unshared.

Some attributes of a whole are *underivable* by logical means alone from the attributes of the parts, if a suitable theory is not provided, e.g. the weight of a pile of stones relative to the weights of the constituent stones is underivable without a suitable physical theory (Rescher & Oppenheim 1955, p. 92). Some

⁴³ The idea that a whole can be decomposed into parts in various ways is elaborated by Moltmann (1997) in exploring how parts and wholes operate in natural language semantics. Moltmann argues that the part structure of an entity can be contextually determined, for instance, "an entity may have *different sets of parts* in different dimensions" (p. 4). This is exemplified (p. 5) by expressions that refer to the parts of an event, e.g. the expression 'simultaneously' in the sentence 'John praised and criticized Ann and Sue simultaneously'. In the dimension of the event type, 'simultaneously' compares the subevents of praising and criticizing. In the dimension of the participants involved, 'simultaneously' compares Ann and Sue. Thus, the event can either be divided into subevents or into participants.

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attributes are underivable, even if such a theory is provided; these are *emergent* properties that are not *reducible* to the properties of the parts (p. 93). An example is Christian von Ehrenfels *Gestaltqualitäten*, whence comes the slogan "The whole is more than the sum of its parts".

Interestingly, such attributes are also admitted within the Calculus of Individuals. Despite Goodman's conviction that "all that can be said about a class of individuals or of sequences or even about a single couple is what can be said by speaking only of the individuals involved (1977 I 5, p. 22)", he also recognizes differences among attributes that are similar to those provided by Rescher and Oppenheim. It would be naïve to suppose, according to Goodman, that the attributes of a sum are always reducible to the attributes of its parts. A predicate does not have to be either *dissective* from the whole to its parts or *expansive* from the parts to the whole. A one-place predicate is *dissective* "if it is satisfied by every part of every individual that satisfies it" (1977, II 4, p. 38). If the whole is *F* then every part of it is *F*. Goodman notes (ibid.) that dissectiveness works only under systematic limitations: not every part of a silver block is silver, since atoms are not silver, but every *metallic* part of a silver block is silver. 'Being silver' is dissective from the whole block to its metallic parts. "A one-place predicate is *expansive* if it is satisfied by everything that has a part satisfying it" (ibid.). If a part is *F* then the whole is *F*. The predicate 'is large' is expansive from a part to the whole: if a part is large then the whole is large.

1.2.2. Dependence and Different Types of Part and Whole

Rescher and Oppenheim mostly talk about *functional* dependence, although their initial characterization of a dependence relation is sufficiently broad to include all kinds of dependence forming a configuration, i.e. an organized whole:

"An ordered set of objects, p_1, p_2, \dots, p_n , which stand in the relation R to each other, i.e. for which $R(p_1, p_2, \dots, p_n)$ holds, will be said to form a *configuration of kind R*." (Rescher & Oppenheim 1955, p. 95.)

Wholes whose parts have properties which are functionally dependent attributes are *dependence systems*:

"A configuration is a φ -dependence system relative to a set G of attributes if each part of the configuration has some G -attribute which is φ -dependent upon (some or all of) the G -attributes of (some or all of) the remaining parts." (Ibid., p. 98.)

Dependence systems are, for instance, biological organisms whose parts reciprocally interact and cannot change without the whole changing. Parts of such integrated wholes cannot be studied in isolation and their attributes may not be derivable by means of some accepted theory.

Edmund Husserl in his III *Logical Investigation* talks about *ontological* dependence making a claim about the dependent *existence* of an object on another object.⁴⁴ It is characterized via the relation of foundation (*Fundierung*):⁴⁵

"An α as such requires foundation by a β = there is an essential law to the effect that an α cannot exist as such except in a more comprehensive unity which associates it with a β ." (Simons 1982, p. 123, my changes; cf. *LI III* §14, p. 463)

Husserl talks about foundation both as a generic relation among species and genera, and as a relation among individuals which belong to the species and genera. Individual foundation does not hold among individuals as such but only as individuals belonging to a certain species:

" s is founded on t = there are species α and β such that an individual object s in virtue of belonging to α is founded on an individual object t in virtue of belonging to β ." (Simons 1982, p. 137)

Due to foundation an item that consists of other items – its parts – is not a mere sum or aggregate but a whole, a unity in the proper sense of the word. Such wholes are "pregnant" (*LI III* §21, p. 475). The unity of such a whole is intrinsic as opposed to extrinsic. Parts are "interpenetrated" and not "mutually external" (*ibid.*) or "combinatory" (p. 476). In contrast to extensional mereology which posits just one kind of mereological relation – summation, Husserl has worked out a dependence relation that holds the parts of the whole together.

The parts of a whole are not all alike: some parts are relatively *independent* and some are *dependent* of or *founded* on other parts – they by their nature require a supplement and *cannot exist* without it. An object is called 'independent' if it, in its ideally graspable essence, is unconcerned with all other contents. It can be "presented by itself" so that "it would be what it is even if everything outside it were annihilated" (*LI III*

⁴⁴ Ontological dependence is often confused with notional dependence. Ganymede could not be described as Jupiter's largest satellite unless Jupiter existed (Ganymede is dependent on Jupiter notionally) but Ganymede might still exist even if Jupiter did not (Ganymede is ontologically independent from Jupiter) (cf. Simons 1987, p. 297). Notional dependence implies ontological dependence only if the description of the dependent object tells us what that object is essentially (cf. Simons 1987, p. 298).

⁴⁵ I understand the concept of foundation in a purely ontological sense, as distinct from the epistemological or logical connotations that are sometimes associated with the term 'foundation' in Husserlian studies.

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§6, p. 445), e.g. we can imagine a free floating head of a horse without imagining the rest of the horse (§3, p. 439). These objects can be conceived as existing by themselves alone.

Independent parts or *pieces* can exist without the whole in which they currently exist in the sense that, when separated, they preserve the same identity they had before, when they were not separated from the whole. A piece is separable from the whole and when separated it does not cease to exist, but merely ceases to be a part of that whole. Nonetheless the separated part, which has now become an independent whole, is never absolutely independent; it is always presented within some context or against some background (§ 6, p. 445).

But this non-independence is different from the dependence of *moments*, which are in their ideally graspable essence bound to other contents and cease to exist unless associated with them, e.g. color cannot be presented without extension and vice versa, and both a visual quality and extension are inseparable from the figure which bounds them (§4, p. 440). A moment is unthinkable as a non-part of the whole (§11, pp. 456–7), whereas a piece can be thought of as self-existent, despite its accompanying background (§ 6, p. 445).

1.2.3. Structure and Restrictions on Composition

For the first approximation we may say that structure is "the way in which the parts of a complex object are arranged or stand in relation to one another" (Simons 2010, p.1). It is very hard to give a more precise definition, since 'structure' applies almost to anything. The only thing to which it clearly fails to apply is an object which lacks proper parts, i.e. a mereological atom (*ibid.*).

A sum is also a structure, but a weak one, since there are no restrictions on summation apart from the intention of the theorist. If we are willing to apply the term 'unity' to a mereological sum at all, we have to recognize that it is merely an extrinsic unity and not a real one. As Husserl would characterize it, the objects that constitute an aggregate are "only held together in thought" (*LI III* §23, p. 480). In contrast to extensional mereology, which simply posits that composition *always* occurs, theories that do not take composition for granted ask the metaphysically interesting question 'When does a plurality of individuals

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compose another individual?"⁴⁶ Simons' speculative answer is that composition takes place "when the individual so composed has a structure" (p. 3), or more precisely (p. 6):

"././ when /the individuals P / are pairwise disjoint, and when there is a system of relations Q making $P;Q$ a connectivity system. Then there is an object $Wh(P;Q)$ wholly composed of P as structured by Q ."

The components have to be pairwise disjoint (any two of the components must not overlap with each other) and connected by a system of relations.⁴⁷ The ways in which these wholes are structured, i.e. the conditions that should be satisfied for composition to take place, should be left to local adjustments in given cases of composition.

Structure serves as the most important condition for the existence and identity of an integrated object. Due to structure the object can preserve its identity and existence while some of its parts may change. The postulate that arbitrary sums exist and that those sums *are* further individuals is not compatible with the idea that some objects might still exist and preserve their identity although their parts change. Any change in the parts generates a new sum and thus a new object. But it seems plausible to assume that we deal with the *same* objects through change without any need to posit a new object every time there is a different sum.

The structure may be taken to be a *part* of the object. Husserl thinks that the structure of the object is a dependent part (or moment) of the object:

"Every 'real' (*reale*) mode of association, e.g. the moment of spatial configuration, likewise counts as a proper part of the whole." (III §1, p. 437)

It is appropriate to say that the whole is not identical with the sum of its non-structured or material parts. But as far as extensional mereology goes, 'part' denotes exclusively a material part. When extensionalists say that the whole is identical with the sum of its parts, they mean 'material parts'.⁴⁸

In contrast to the extensional approach admitting solely the existence of additive wholes, a general formal requirement for a theory that focuses also on structured wholes is that it imposes restrictions on

⁴⁶ Van Inwagen (1995, p. 30–1) calls it "the Special Composition Question".

⁴⁷ Simons does not think that the system of relations that operates between the components is a part of the given object, but he does not say what it is either.

⁴⁸ Due to this narrow conception Rescher (who does not endorse CEM) objects to extensionality.

composition. The restrictions are dictated by the structure or the form of the object. More narrowly then, structure is that *part* of the object which restricts the summation of objects that compose the object in question. A general formulation of the restriction requirement is given by Koslicki (2008, p. 169):⁴⁹

"Restricted Composition Principle (RCP): Some objects, m_1, \dots, m_n , compose an object, O , just in case m_1, \dots, m_n satisfy the constraints dictated by some formal components, f_1, \dots, f_n ."⁵⁰

The formal components should not only determine *what* parts the object has but also *how* they stand to one another, i.e. how they are related to one another. Rescher and Oppenheim (1955, p. 100) have pointed out the importance of the "what" and the "how" questions in terms of three things that a "structured organization of elements" has to involve:

"A structured whole in this sense involves three things: (1) its *parts*, (2) a *domain of 'positions'* which these parts 'occupy' (this need not necessarily be spatial or temporal, but may have any kind of topological structure whatever), and (3) an *assignment* specifying which part occupies each of the positions of the domain."

A performance of a musical composition involves various tones (parts), the time-interval of the performance (domain of positions), and the score which fixes the distribution of the tones (assignment). The domain of positions and the assignment forms a topologically structured space, which is occupied by the parts. Rescher and Oppenheim (p. 100) point out that in many contexts we do not know about the individual parts and are more interested in part-types. That leads to the idea of a *complex*, i.e. a whole that consists of part-types. Such a complex can be decomposed into *two principal constituents*: a set of component-types and a topologically structured space. None of these constituents should be disregarded. If the structural arrangement of atoms of a molecule is disregarded, the molecule is indistinguishable from other dissimilar molecules. If, on the other hand, the types of atoms are disregarded, the remaining structure could be occupied by different types of atoms yielding a different molecule (p. 101).

Another important idea is that complexes can have the *same* structure, i.e. be isomorphic. Two isomorphic complexes must have domains of positions with the same topological structure (be homeomorphic), the sets of attributes of these complexes must be in a one-to-one correspondence or pairing, and the attributes that are paired must be assigned to the corresponding positions. An example would be a transposition of a

⁴⁹ Koslicki (2008, pp. 165–260) works out her own structure-based mereology based on this requirement.

⁵⁰ Later on Koslicki formulates subtler versions of RCP. An important specification is in the second version (2008, p. 173): the object O is such that it belongs to a kind K . Thus the formal components are of a certain kind.

musical composition where both pieces, the original and the transposed one, share structural similarities, e.g. have the same melody (p. 103) which remains an *invariant* attribute, i.e. a *complexial feature*. It may happen that the feature is underivable from the properties of the constituents of the complex (p. 104).

1.3. The Relevance of the Extensional and the Non-extensional Approach to Aristotle

The approach of extensional mereology undertakes to elaborate formal principles and to examine formal properties of parts and wholes. The path taken by Goodman is to form an ontologically "neutral" theory that consequently narrows down the number of objects, to which the theory can be applied, and presumes an elegant but somewhat simplistic approach to the world. Non-extensional mereology, however, focuses on parts and wholes in their diversity stressing the importance of the irreducibility of attributes pertaining to wholes, dependence of parts, and the structure of objects.

Both the extensional and the non-extensional approach are relevant to the analysis of Aristotle's mereological remarks. The extensionalistic approach outlines mereological principles and properties which can be used to formulate more exact concepts of parts and wholes. If these principles are applied correctly, viz. within a limited domain of items, the aspiration towards ontological neutrality can to a degree be achieved. Non-extensionalist approach, on the other hand, invites one to pay attention to metaphysical (or extra-logical) conditions of parthood and wholeness.

The endeavor to treat the part-whole relation formally arises from Goodman's example. This approach in no way is opposed to what Aristotle has to offer. It is an apparently fair objection to say that extensionalistic theories, as Goodman's proposal indeed is, are incommensurable with intensionalistic approaches, such as Aristotle's. However, it will become evident that a formal treatment of mereology does not presuppose extensionality, viz. it is not necessary to accept Goodman's style ontology in order to state formal mereological principles, if we are aware what domain of objects is under consideration. The acceptance of some of Goodman's principles does not turn a mereology into a version of the Calculus of Individuals.

For instance, the symmetric, irreflexive, non-transitive two-place predicate 'disjoint' can be applied widely. According to Goodman, two items are disjoint, if they do not have any common content. This characterization of 'disjoint' is completely innocuous and suits any mereology which does not shun discontinuity in the domain of objects of the theory. The predicate 'disjoint' as defined above fits the way

Aristotle describes both the separateness of composite substances and the different kind of separateness of forms of these substances. Some additional constraints have to be added in order to accurately describe separateness in each case, but the general framework still remains the same. Similarly, the theorem that two individuals are identical if and only if they have the same parts can be with ease admitted into Aristotle's conception, if the theorem is qualified in such a way that 'part' does not designate material parts or elements, but substantial parts instead. Many other mereological principles are compatible with Aristotle's remarks, unless these principles are treated with bigotry by preconceiving extensionalistic ontology that is often associated with them. In Chapter 3 it will be investigated to what degree it is possible to formulate the Aristotelian senses of the part–whole relation by formal properties and principles.

The non-extensional approach is in many ways more akin to Aristotle's proposal for the reason that this approach questions the conditions under which entities count as parts and wholes, viz. it questions the extra-logical basis instead of accepting a basis that fits a preconceived logical system.

Rescher and Oppenheim's idea that there is an unshared attribute which the whole has besides the parts under certain decomposition and the acknowledgement that a whole may have different decompositions under different specifications of the part–whole relation directly relates to the story Aristotle tells us in the *Metaphysics Z 17*: if the whole is divided into elements, the whole is 'more' than the parts (v.i. 4.1). Not under every but under a specific decomposition there is the attribute of the whole in contrast to the parts that in Aristotle's case can be associated with form. Certainly, there are vast differences between Aristotle's concern about the unity of the composite substance and Rescher and Oppenheim's exposure of gestalt concepts, where the attribute characteristic to the whole does not function as a unifier (at least not in the ontological sense) and the decompositions pertain only to integral wholes.

Similarly, Rescher and Oppenheim's concept of dependence between the parts and especially the idea endorsed by Husserl that there is an ontological dependence of parts governed by foundation and that, consequently, there are different types of part and whole resonates with Aristotle's different divisions of part (v.i. 2.2) and whole (v.i. 2.3) and the acknowledgement that there are parts which make up a unity simply by virtue of their nature (v.i. 4.2.4.2). However, the similarities are largely superficial mainly due to the peculiar status of form in Aristotle's ontology, viz. form may be both a universal whole or a conceptual whole and thus in both cases relatively independent, or form may be an integral part of the

composite substance and thus dependent, or form may be a unifier of an integral whole and thus not a part of that whole at all.

Finally, both non-extensional mereologists and Aristotle recognize the importance of structure and the role it plays in the restriction of composition. In contrast to CEM, where composition is unrestricted (the sum of the parts of the object serves as the only condition for the existence and identity of the object) for Aristotle something counts as an integral whole only if certain restrictions on composition are met (v.i. **2.3.3**). These restrictions may be weak but they have to be stronger than mere summation. Aristotle would not think that a sum of the Arctic sea and a speck of dust in the Sahara qualifies even as an aggregate.

Both for Aristotle and for non-extensional mereologists a general restriction on composition is structure. It is the structure (and not the sum of the parts) of the object that serves as the condition for its existence and identity. For Aristotle the strongest restrictions apply to composite substances. Form determines what material parts the object has and how they stand to one another (v.i. **4.1.1.3**). Aristotle's idea that form dictates the make-up of a substance has inspired Koslicki to formulate the Restricted Composition Principle. Aristotle's concept of composite substance closely resembles Rescher and Oppenheim's concept of complex, i.e. a whole that consists (i) of a set of component-types (cf. material parts) and (ii) a topologically structured space (cf. form), whose combination gives rise to an invariant attribute of a whole which (in cases that would concern Aristotle) is underivable from the properties of the constituents of the complex.

The mereological status of structure, or form, is what interests Aristotle more than later mereologists, for the reason that Aristotle wants to explain the unity of the substance and does not take the integrity of an object as a *datum*. As regards the later mereologists, if the moment of configuration of the parts (as Husserl would characterize it) is thought to be a proper part of the whole, it is not questioned whether the recognition of such a part might disturb the unity of the whole.

It has to be emphasized that issues concerning composition pertain merely to integral wholes, these being the only wholes with which both extensional and non-extensional mereologists occupy themselves. Aristotle is interested also in the nature of universal wholes, which are not considered to be wholes by the mereologists. Universal wholes, as opposed to integral wholes, can be decomposed into, but not composed out of, their parts because a universal whole is predicated of its part and the part is dependent on it, whereas an integral whole is not predicated of its part but is dependent on it (v.i. **2.3.1**).

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Chapter 2 of the dissertation provides a general framework which enables the pursuit of the main goal of the dissertation, i.e. to show that the unity of the substance is preserved in the face of its complexity. This chapter will provide justification of the idea that Aristotle has various senses of the part–whole relation. In order to start dealing with these issues, it is necessary to reconstruct a theory of parts and wholes in Aristotle's conception of substance.

By adding the qualification 'conception of substance' to Aristotle's part–whole theory I have considerably restricted the scope of the research, even though it will be sometimes indispensable to reach out beyond the confines of substance theory. I have not paid separate attention to Aristotle's remarks about the infinite⁵¹ in the *Physics* Γ 6, to his account of place (Δ 1–5) and the mereo–topological considerations that arise from it,⁵² of time (Δ 1–14) and of temporal wholes (EN K 4 1174a20ff). I have left aside mereological considerations in Aristotle's philosophy of mathematics⁵³ (*Met M* and *N*), semantics, epistemology and logic, and overlooked the subtle description of the parts of animals in the biological treatises (Furth 1988) and of mixture⁵⁴ in *De Generatione et corruptione*, favoring a schematic exposition of part–whole theory at the highest level of generality, i.e. within Aristotle's general ontology.⁵⁵

Psychology and philosophy of biology lingers somewhat on the verge: it is in the focus of interest in so far as it has ontological ramifications. The form of a composite substance, if the substance is a biological organism is its soul, which organizes and unifies the material bits into a functional whole. The present study turns to the soul–body relation merely to explore it as a special, even if prominent, case of form–matter relation. In order to preserve the formal interest in parthood, I will not go into the details of

⁵¹ See more on this: Hintikka 1966; Bostock 1973; White, D. 1985.

⁵² Cf. Morison (2002); Bostock (2006, pp. 128–34). Both Bostock's and Morison's interpretations of Aristotle's statement that a place of an object x is "the limit of the surrounding body [y] <at which it [y] is in contact with that which is surrounded [x]>" (212a6–7) are fleshed out in mereological terms. Morison (2002, p. 137–9) takes y to be the maximal surrounding body, which surely cannot be a single body but a *sum* of all the bodies in the universe that surround x . In contrast, Bostock (2006, p. 129) takes y to be the smallest (not the largest) body that surrounds x .

⁵³ See more on this: Annas 1975; 1976; Bostock 1973; Egger 1972; Hintikka 1966; Hussey 1991; Lear 1980; 1982; White, D. 1993.

⁵⁴ See more on this: Fine, K. 1996; Cooper 2004; Frede, D. 2004.

⁵⁵ Regarding the treatment of the object of Aristotle's first philosophy, Aristotelian scholars accept the distinction between *metaphysica generalis* and *metaphysica specialis*. The latter is concerned with theology or first philosophy that talks about forms as divine entities but the former deals with formal issues, presenting a general framework for any science, whose material should be mapped on to these formal considerations. I am interested in *metaphysica generalis* that might be also rephrased in Husserlian terms as "formal ontology" whose task is to be universally valid for any endeavor, also for *metaphysica specialis*.

philosophy of psychology, which investigates whether Aristotle is a materialist, a dualist or a functionalist.⁵⁶

There is another restriction which is not manifest but is also operative. I have avoided the broader (but not less interesting) issues present in the general theoretical setup elaborated in the *Categories*. To mention the two most important: (i) the division of being into ten categories or highest genera (*Cat* 4 1b25–2a4), which reflects the idea that being is not a genus (cf. *Met B* 3 998b22; *An. Post B* 7 92b14),⁵⁷ and (ii) the parallel division of being into four kinds of entity (*Cat* 2 1a20–1b10): universal substance (οὐσία καθόλου, Porph. *In Cat* 71.20–1), particular accident (συμβεβηκός ἐπὶ μέρος, 71.38), universal accident (καθόλου συμβεβηκός, 71.32–3), and particular substance (οὐσία ἐπὶ μέρος, 71.21).⁵⁸

The main reasons for avoiding these wider issues are two. Firstly, though Aristotle talks about division in the *Categories*, the subsuming of such talk under part–whole theory is far from obvious. On the basis of a fairly trivial consideration – if something is divided, there is *something* to divide – the theoretician would have to presuppose that being (all there is) is some kind of whole, but a whole of *what kind*? There is an instance in *Met A* 1 where Aristotle suggests that the universe is a whole divided into parts:

"Indeed if the universe is to be regarded as a whole, substance is its first part, and if it is to be regarded as a succession, even so substance is first, then quality, then quantity." (*Met A* 1 1069a19–21)

Since Aristotle does not develop this thought and does not give a clue of what kind of whole the universe is, I will leave this aside.

Secondly, and more importantly, Aristotle has not introduced hylomorphism in the *Categories*, which is of concern for my project. In the *Categories* the substance is a simple independently existing entity, e.g. a

⁵⁶ For a functionalist reading of Aristotle see: Nussbaum & Putnam 1995; Cohen 1995; Wedin 1988. For arguments in favor of the idea that Aristotle's psychology is incompatible with modern functionalism see Burnyeat 1995; Granger 1993; 1996.

⁵⁷ The items that are the members of the various categories concern "being in one's own right" (*Met A* 7 1017a22–7), they are the subjects of the verb 'to be'. The items that fall under each category are the referents of 'things said without any combination': (i) substance (οὐσία), (ii) quantity (πόσον), (iii) quality (ποιόν), (iv) relation (πρός τι), (v) where (ποῦ), (vi) when (πότε), (vii) position (κεῖσθαι), (viii) to have (ἔχειν), (ix) to do (ποιεῖν), (x) to suffer (πάσχειν). Aristotle rarely uses all ten of them. Usually he uses four: substance, quantity, quality, and relation.

⁵⁸ The distinction between the four kinds of entity is made by the contrast of two expressions 'in a subject' and 'said of a subject'. 'In a subject' distinguishes entities in non-substance categories or accidents (qualities, quantities, relations etc.) from substance. 'Said of a subject' distinguishes universals from particulars. This doctrine is traditionally represented in the Ontological Square (Boeth. *In Cat* 175CD). It by no means should be confused with the Logical Square (Arist. *Int* 6–7 17b17–26; Boeth. *In Int* 321AB; 471B), which governs the combination of sentences, not entities.

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man, Socrates, or a horse, Bucephalus. Aristotle calls it 'primary *ousia*' in opposition to a secondary substance, a form (*eidos*), e.g. 'man' or 'horse', or a genus, e.g. 'animal', to which primary substances belong. Primary substance is the subject of which contrary properties, e.g. pallor or darkness, are predicated. Thus Socrates is pale at one time and dark at another (*Cat* 5 4a17–21). The substance itself is devoid of any metaphysical complexity. What has complexity is the accidental compound, the pale man, but the substance, this man, remains uncompounded.

Mereology that might be developed on the basis of the world-view of the *Categories* would be targeted towards substance–accident compounds (cf. *Phys* Δ 3 210a25ff; *Met* Δ 6 1015b16ff), as opposed to the analysis of substances themselves as form–matter compounds later in the *Metaphysics*. In fact, already in the *Physics* in order to give an account of coming to be and passing away of a substance Aristotle splits it up into matter and form (*eidos*). Now matter is the subject which undergoes the replacement of forms (*eidē*) that are predicated of it (*Cat* 5 4a17–21). In a sense matter is also *ousia* (*Met* H 1 1042a26–7; a32; *DA B* 1 412a6–7).

2.1. General Considerations

Before we embark on the project of disentangling the many senses of part–whole, there are a few general considerations which should be laid out. I am talking about fundamental meta–theoretical assumptions on which Aristotle's part–whole theory rests, i.e. the specific nature of the ambiguity of the objects described by the theory (ironically, the objects not terms are called 'ambiguous'), interrelatedness of part, whole, and one, and relativity of unity and divisibility.

2.1.1. Ambiguity of Part, Whole, and One

Part, whole and one (and other cognates) are ambiguous. Aristotle uses the locution 'x is said in many ways' (*πολλαχῶς λέγεται*, *Met* Γ 2 1003a33). It does not mean that there is a single thing for which many words are used but that there is a single word which does not mean any single thing (Bostock 1994, p. 45).

One (*τὸ ἓν*) is said in many ways (*πολλαχῶς τὸ ἓν λέγεται*, *Met* Γ 2 1004a22; 1005a7; Δ 10 1018a35f; *I* 1 1052a15). The many senses of one are listed in Δ 6 and further explored in *I*. Aristotle tells us that *one* cannot be a substance in the sense of one thing existing alongside the many but only *a predicate*

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(κατηγορημα, *I* 2 1053b18–21).⁵⁹ He uses 'one' sometimes as a one-place and sometimes as a two-place predicate, i.e. 'x is one' or 'x is one with y'.

'One' as a one-place predicate means 'indivisible' or 'undivided' (*I* 2 1054a21–3) and thus 'whole'. But whatever is a whole is divisible into parts (*μεριστόν*, *Δ* 27 1024a12), unless it is unqualifiedly one (*ἐν ἀπλῶς*, *I* 1 1053b7). So 'one' implies both divisibility and indivisibility.

As a two-(or more) place predicate 'one' means either 'making up a whole' or 'the same'.⁶⁰ On occasion instead of 'one' Aristotle uses the word *ταυτόν* which is literally translated as 'the same' and functions solely as a two-place predicate. The *same* said in many ways (*I* 3 1054a32), as many as *one* (*Δ* 9 1018a4–5).

Sameness is a kind of oneness (*ἡ ταυτότης ἐνότης τίς*, *Met Δ* 9 1018a7) and wholeness (*όλότης*) is a kind of oneness (*Met Δ* 26 1023b36). The conflation of 'same' and 'whole' is justifiable, in so far as it is based on the idea that items which are "somehow" one and the same are parts of some whole.⁶¹ Aristotle seems to have the intuition that parts of a whole are "in some sense the same, *as each other*" (White, N. 1971, p. 186–7; cf. Charlton 1994, p. 46), i.e. they stand in the relation of "a special case of similarity in a certain special respect" (White, N. 1971, p. 193).

Aristotle explicitly states that *part* is said in many ways (*Met Z* 10 1034b33) and offers a list of types of objects which are parts in *Δ* 25. Aristotle does not say the same thing about *whole*, but due to its overlap with *one* and given that there is a list of types of whole in *Δ* 26, it is plausible that he takes *whole* to be similarly said in many ways.

⁵⁹ Further elaborations on the substantiality of 'one' and its relation to 'being' is to be found in Berti 2001; Halper 1985; Morrison 1995; Pakaluk 1995.

⁶⁰ Haslanger (1994, p. 133) also has made a similar point: "In a number of passages it is a substantive interpretative question whether in saying that X and Y are 'one', [Aristotle] means that X and Y are identical, or that X and Y are together parts of a composite whole."

'One' as a two-place predicate with the meaning 'the same' is used, e.g. in *Top A* 7 103a9–10; 31; *H* 1 151b30; 152a11; 27–8, and as 'making up a whole' is used, e.g. in *Met Δ* 26 1023b26–9; *H* 6 1045a15; 1045b18–19. Both uses overlap in *Met Δ* 6 and *I*.

⁶¹ I owe this idea to White, N. (1971).

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It has become common knowledge in Aristotelian studies that the ambiguity marked by the expression 'x is said in many ways' is not chance homonymy but the so called *pros hen* homonymy, where the items it affects are "referred to one thing" (*πρὸς ἓν*, *H* 3 1043a37).⁶²

In order to understand what these types of homonymy are, it is necessary to give a general definition of homonymous items and also of items to which these are contrasted – synonymous items.

Two items are synonymous, if the same name applies to both of them and their account is the same. Both man and ox are called by a common name 'animal' (*Cat* 1 1a6–12). Since man and ox belong to the same genus 'animal', they are synonymous with respect to that genus.

Two items are homonymous, if the same name applies to both of them but the account of why they share the name is different. Both a man and a picture of a man are called 'animals', but they are so called for different reasons (*Cat* 1 1a1–6). A functioning hand and a severed hand are called 'hands' but the latter is so called only because it looks like a hand or because it used to be a hand. These would be what Porphyry calls homonyms by similarity (*In Cat* 65.25–30).

Chance homonyms are "different things that have the same designation purely by chance and unintentionally: for example Alexander the son of Priam and Alexander the son of King Philip of Macedon" (65.22–4).

Pros hen homonymy occurs, if "different things get their common designation from some one thing" (66.2–4), viz. they share the same name (or a modification of it) and only partly share the account. For instance, that which is healthy has reference to health – something is called 'healthy', either because it is health preserving, health producing, health receiving or health displaying. Something is called 'medical', because it possesses medical art or is suited to medical art, or is an exercise of medical art (*Arist. Met* Γ 2 1003a34–b4). The origin, e.g. 'health', is the central point of reference, from which the reason why the other things are called 'healthy' is derived. The sharing of the account makes *pros hen* homonyms akin to synonyms.

⁶² Porphyry divides homonyms into chance homonyms (*ἀπὸ τύχης*, *In Cat* 65.18) and homonyms from thought (*ἀπὸ διανοίας*, 65.19). Homonyms from thought are from similarity, from analogy, and "those that derive from and are relative to a single source" (*ἀφ' ἑνὸς καὶ πρὸς ἓν*, 65.20). More on homonymy see Barnes 1971; Irwin 1981; Shields 1999.

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A prominent case of *pros hen* homonymy is 'being', more precisely, 'that which is' (*Met Γ 2* 1003a33; cf. *Phys A 2* 185a21). The origin with reference to which 'being' is so called is substance. The rest of the things are called 'beings' either because they are affections (*πάθη*) of a substance, a way (*ὁδός*) towards a substance, destructions (*φθοραί*) or privations (*στερήσεις*), or qualities (*ποιότητες*), or productive (*ποιητικά*) or generative (*γεννητικά*) or denials of these or of a substance (*Met Γ 2* 0103b6–10).

Gill (2006, p. 350) defines *pros hen* homonymy as follows: there is a primary item *x* and a secondary item *y* such that *x* must be mentioned in the account of *y* but not vice versa. At the same time, *y* is not reducible to *x* because the understanding of *x* determines only a part of what *y* is.

Shields (1999, p. 58) calls *pros hen* homonymy 'core-dependent homonymy' providing a more sophisticated definition:

"*a* and *b* are homonymously *F* in a core-dependent way iff: (i) *a* is *F*; (ii) *b* is *F*; and either (iii a) the account of *F* in '*b* is *F*' necessarily makes reference to the account of *F* in '*a* is *F*' in an asymmetrical way, or (iii b) there is some *c* such that the accounts of *F*-ness in '*a* is *F*' and '*b* is *F*' necessarily make reference to the account of *F*-ness in '*c* is *F*' in an asymmetrical way."

On the grounds of the fact that *one*, *whole*, and *part* are said in many ways, and also if we recognize that *one* implies *whole* and, wholeness, in turn, presupposes divisibility into parts, we can take the part–whole relation as subject to *pros hen* homonymy. We have to locate the central item that is *part* par excellence, to which other types of parts are connected. The result would be a general scheme of the structure of the various senses of the part–whole relation.

However, we will see that there is no focal sense of the part–whole relation subjecting the other senses to *pros hen* homonymy as defined either by Gill (2006) or Shields (1999). The senses are more loosely connected. There is no paradigmatic part–whole relation that unifies all of the other senses so that each of them makes reference to that primary sense and thus shares the same body of mereological principles. The sharing of any given principle has to be tested against the respective senses of part–whole. Moreover, it has to be stressed (and will be argued below) that, despite the overlap, distinct senses cannot be connected via a shared principle. Even if distinct senses are governed by one and the same principle, the placeholders of that principle cannot be instances of distinct senses, but only of each sense severally. Thus, the locution 'x is said in many ways' when applied to parts and wholes does not presuppose a prominent sense of part–whole. Nevertheless, this conclusion is insufficient for equating ambiguity of part and whole with plain

homonymy, since there is some connection among the different senses due to selective sharing of certain principles (yet to be laid out in 3).

2.1.2. Interrelatedness of Part, Whole, and One

On the one hand, *whole* is closely linked with *one* in so far as 'one' (τὸ ἓν) means 'indivisible' (ἀδιαίρετον) or 'undivided' (μὴ διηρημένον). In contrast, a plurality (τὸ πλῆθος) is linked with *part* in so far as *many* arise out of that which is divided (διηρημένον) or divisible (διαίρετόν) (*Met I 2* 1054a21–3).

On the other hand, *whole* implies divisibility into parts, for *part* and *whole* are interrelated in a pair-wise way. If something is a part, there is a whole of which it is a part. This remark refines *whole* beyond its link to oneness. An item that is separated from the whole is not a part of that whole; it used to be a part but it is not a part anymore. Moreover, "no part exists otherwise than potentially" (*Phys H 5* 250a24), i.e. as being capable of separation but not in an actually separate state.

The interrelatedness of *part* and *whole* is concisely expressed by Barnes (2003, p. 148) when commenting on Porphyry's *Introduction* (*Isag* 7.27–8.3): "'Part' is a relational term: an item is not a part period but a part of something. Again, if X is a part of Y, then Y is a whole—or rather, a whole so-and-so (a whole cake, a whole face)".⁶³ A similar thought is expressed by Henry's (1991, pp. 270–1) remark that "'part of...'

⁶³ The passage to which Barnes' commentary applies is this: "Thus an individual is contained by the species and a species by the genus. For a genus is a sort of whole, an individual a part, and a species both a whole and a part—but a part of one thing and a whole (not of another item but) in other items (for a whole is in the parts)" (7.27–8.3, tr. Barnes 2003). The interrelatedness of 'part' and 'whole', according to Barnes (p. 148), is manifest in the phrase "a species [is] both a whole and a part", viz. a part of genus and a whole containing individuals, which suggests that the most general item (i.e. genus) is not a part and the most particular item (i.e. an individual) is not a whole. I would like to add that interrelatedness of 'part' and 'whole' is manifest also in the most general whole and in the most particular part. For the most general item is a 'whole of' something and the most particular item is a 'part of' something. If there is no further item that contains the most general item, the latter is still a whole, since it has parts. Likewise, if there are no further items that are included in the most particular item, the latter is still a part, since it is included in a whole. What is confusing in this fragment is Porphyry's statement that species is "a whole (not of another item but) *in other items*" (my italics – L.M.). Barnes thinks that the locution 'in other items' is "at best vacuous and at worst confused" (2003, p. 150). I think that the confusion can be cleared by mitigating the expression as follows: "a whole (not [only] of another item but [also]) in other items". Upon this mitigation, form is not only a whole containing individuals but also an item which imbues these individuals with a nature that makes them belong to that form. Thus form is 'in' other items, the individuals. The same thing can, in fact, be said about genus, since genus is 'in' the form. Another reason why it is said that form is a whole 'in other items' could be this: if form were a whole only of other items, form would be an aggregate of individuals, which is false, since aggregates cannot lose their parts, while forms can lose their individuals.

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is a name forming functor /./ which calls for completion by the name of the whole to which the part is subordinate".⁶⁴

Part and *whole* (and their cognates) are relational predicates (*πρός τι*, *Cat* 7 8a27–9; cf. 8a16; Amm. *In Isag* 91.4ff), viz. relatives and the converses of relatives, i.e. correlatives (cf. Morales 1994, p. 254 n 1). Thus, *whole* is the correlative of *part*, and *part* the correlative of *whole*. In general, parthood implies wholeness and vice versa, since "relatives seem to be simultaneous by nature" (*Cat* 7 7b15), viz. a relative does not exist without its correlative.⁶⁵ Thus, a part is a part of a whole (Amm. *In Isag* 91.10) and the whole is the whole of its parts (91.12). As a part is in the whole, so the whole is in its parts (*Phys* Δ 3 210a16–17; Simpl. *In Cat* 46.9) – a face is in the eyes and the nose (Simpl. *In Phys* 551.21–2).

Relational predicates (relatives and correlatives) should not be confused with correlates or relata – the underlying entities that stand to each other into a particular relation: relata "are not in and of themselves relatives" (Arlig 2005, p. 29 n 21; cf. *Cat* 7 8b15ff; Amm. *In Cat* 77.24–6). At the same time, Aristotle "addresses these relata *in so far as* they possess relational predicates" (Morales 1994, p. 256). When considering the fact that the number 1 is a half of the number 2, and 2 is the double of 1, 1 and 2 are addressed in so far as they possess the relational predicates 'being the half of' and 'being the double of' (cf. *Top* E 6 135b24–6). Similarly, in the statement 'a head or a hand is a part of a substance' the relata of 'is a part of' are addressed in so far as they possess the relational predicate 'is a part of'. In some cases "a relational predicate may change without the entity itself changing" (Morales 1994, p. 271), viz. whatever was called 'part' can be called 'whole' depending on the circumstances. But in the case of a head or a hand this is not true, since a head or a hand is a part of a substance essentially, viz. a head or a hand cannot be defined without mentioning the whole organism. A cut off head or hand is not called 'head' or 'hand' except homonymously:

"For it's not a hand in just any and every old way that's a part of a man, but one that is capable of fulfilling its work, ergo, one that is 'ensouled'; but not ensouled, not a part." (*Met* Z 11 1036b30–2; cf. *Pol* A 2 1253a20–5, *DA* B 1 412b18–22, *GA* A 19 726b20ff).

⁶⁴ Henry's (1991) remark that 'part of' is a name forming functor is made about Aquinas' reflections on parts and wholes, which are the product of closely studying Aristotle's mereological considerations.

⁶⁵ Exceptions are things like the knowable, for the knowable is prior to knowledge, and the destruction of the knowable does not destroy the knowledge of it (*Cat* 7 7b22ff).

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Despite this principle (i.e. the so-called Homonymy Principle), the fact that a head or a hand is a relatum of 'part of' does not confine it to being nothing else than a part.

In the *Physics A 2* Aristotle stumbles upon a puzzle which he does not consider to be relevant to physics and which he postpones to a later point:

"There is a difficulty about parts and wholes, though perhaps it is a problem on its own and not relevant to the present discussion: are the parts and the whole one thing or several, and in what way are they one or several, and if several, in what way are they several?" (*Phys A 2* 185b11–14)

The answer to this puzzle is the acknowledgement that *there is no whole beyond the parts* (*Phys A 3* 210a16–17), i.e. a whole is a whole of its parts. This is voiced aptly by Simplicius:

"For, /Aristotle/ says, the whole is not something additional to its parts. For even if the form of the whole is something beyond the form of the parts, so that we speak of the whole and the parts with a formal antithesis /εἰδητικῶς ἀντιτιθέντες/, still the substrate /i.e. subject/ is the same; for the whole is not sundered from its parts." (*In Phys* 551.22–5)

We can distinguish the whole and its parts, so that the whole is one entity and the parts are another, but this does not mean that there are two *things* – the whole and (the collection of) the parts. The parts *qua* parts are something else than the whole they make up.

2.1.3. Relativity of Unity and Divisibility

In *Phys A 2* 185b25–186a3 Aristotle criticizes the beliefs of previous thinkers who run into pseudo-problems and pseudo-solutions in fear that things might be simultaneously one and many, which they thought was a contradiction. Surely, things cannot be one and many at the same time *in the same sense* or *in the same way*, or *in the same respect*, but nothing hinders them of being such in different senses (ways or respects). It is not accidental that Aristotle's Principle of Non-Contradiction includes the phrase "in the same respect":

"For the same thing to hold good and not to hold good simultaneously of the same thing and in the same respect is impossible." (τὸ γὰρ αὐτὸ ἅμα ὑπάρχειν τε καὶ μὴ ὑπάρχειν ἀδύνατον τῷ αὐτῷ καὶ κατὰ τὸ αὐτό, *Met Γ 3* 1005b19–20)

If "in the same respect" was omitted, he would arrive at the qualms of his predecessors about *one* turning out to be *many*. But a thing can be divided into parts in different ways and things can be unified in different ways with respect to some criterion of indivisibility:

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"For whenever things are without division, they are universally called one in that respect in which they are without it, as for instance if they are without division *qua* man they are one man, if *qua* animal one animal, if *qua* magnitude one magnitude." (*Met A* 6 1016b3–6; cf. *I* 1 1053b7–8)

Aristotle adopts a "*relativized* conception of unity or indivisibility", as Koslicki (2006, p. 729) has aptly pointed it out: "...to be *one* is always to be one *something-or-other*; the "something-or-other" in question supplies the *measure*, by means of which the thing in question is judged to be one or indivisible."⁶⁶

The measure does not have to be always numerically one ($\tau\tilde{\omega} \acute{\alpha}\rho\iota\theta\mu\tilde{\omega} \hat{\epsilon}\nu$) but sometimes "more than one", e.g. the articulate sounds by which speech is measured are more than one (*Met I* 1 1053a14–17; cf. 1053a21–2).

"The measure is always co-generic [*syn-genes*] [with what is measured]; for [measure] of spatial magnitudes is a spatial magnitude, and in particular [measure] of length is a length, of breadth a breadth, of voiced sound a voiced sound, of weight a weight, of monads a monad." (*Met I* 1 1053a24–7)

If there is something which is *simply* one, it is a mereological atom, "indivisible relative to *all* conceivable measures in relation to which other objects turn out to be mereologically complex" (Koslicki 2006, p. 729).

⁶⁶ Similar considerations are in Haslanger (1994, p. 135): "So, roughly, a set of parts may be called 'one' with respect to a principle of unity just in case applying the principle to the parts yields a kind of unified whole." Cf. Kirwan 1971, p. 135.

2.2. Ways of Division: Parts

A rough list of the various senses of 'part' is given at *Met Δ 25*. Relevant remarks are likewise to be found in *Met Δ 24*, which is an entry on the meanings of the preposition 'out of'. *Physics Δ 3 210a15–24*, where the senses of 'in' are distinguished, and *Met Δ 23*, which is an entry on 'possessing' or 'having', also contain elaborations on 'part'. I will mark out senses that have mereologically interesting contents and further analyze only those aspects of the above-mentioned chapters that talk about 'part'. Despite the fact that parthood presupposes wholeness, the more subtle elaborations on 'whole' and 'one' will be left for the next chapters. The classification of parts will outline the general scheme of part–whole relations.

I take *Met Δ 25* to be the core account of the types of part:

- an arbitrary quantity is a part of a quantity;
- a non-arbitrary quantity is a part of a quantity;
- a form is a part of a genus;
- form and matter are parts of a whole;
- genus and differentia are parts of form.

The previous list gives parts into which a thing can be *divided*, whereas *Met Δ 24* touches upon parts that *compose* a whole:

- a thing is out of matter (in the sense of the first genus or of the last form);
- a compound is out of matter and shape (or form);
- a form is out of a part of a form (out of the differentia; out of an element or the matter of the form).
- a compound is out of a part of the compound (a child is out of a part of father (sperm, i.e. form) and a part of mother (*catamenia*, i.e. matter), a plant is out of a part of earth).

I will not analyze all of the senses where 'out of' means 'to come from' in a non-mereological sense of the word: as a fight is out of swearing, i.e. out of the first origin that effects change (1023a29ff); as night is out of day and a storm out of good weather (alteration), as the voyage is out of the equinox and the Thargelia out of the Dionysia (succession in time) (1023b5ff).

Met Δ 24 parallels *Δ 25* in such a way that 'a thing is out of matter' is correlated with 'a form is a part of a genus' and 'form and matter are parts of a whole' (see **2.2.5**); 'a compound is out of matter and shape' with

'form and matter are parts of a whole'; 'a form is out of a part of a form' with 'genus and differentia are parts of form'; 'a compound is out of a part of the compound' with 'form and matter are parts of a whole'.

The many senses of 'in' appear in Aristotle's *Physics* Δ 3 210a15–24:

- a part is in a whole (as a finger is in the hand);
- a whole is in its parts;
- a form is in the genus;
- genus and differentia are in the definition of the form;
- form is in matter;
- thing is in a vessel, i.e. in a place.

Again, I have listed only the mereological senses leaving out the following: the fate of Greece is in the hands of the king (210a22) – 'a thing is in a ruler' (Simpl. *In Cat* 46.14; Porph. *In Cat* 77.32–3); action is for the sake of good (210a22–3) – 'a thing is in a goal' (Simpl. *In Phys* 552.13–15; *In Cat* 46.12; Porph. *In Cat* 77.30–2). The commentators add more senses of 'in'. Simplicius and Porphyry distinguish 'in a vessel' from 'in a place' (Simpl. *In Cat* 46.6–7; Porph. *In Cat* 77.22–4). Simplicius distinguishes 'in the moving cause' from 'in the ruler' (*In Cat* 46.13–14), adds 'in time' (*In Cat* 46.7–8; *In Phys* 553.6–7), and also 'accident is in a subject' (*In Phys* 552.20–2), 'subject is in the accident' (*In Phys* 553.8–10). Porphyry equates 'accident is in a subject' with 'form is in matter' on the grounds that only forms are inseparable from their matter (*In Cat* 78.6–9). The relation between subject and accident are, in fact, interesting from a mereological point of view: an accident is not a part of what it is in and cannot exist separately from what it is in (*Cat* 1a24–5; Simpl. *In Phys* 552.20–2). I have not included this in the present analysis because Aristotle in the *Metaphysics* does not qualify accidents as parts strictly speaking. Attention to accidents will be paid when the senses of 'one' (*Met* Δ 6) are outlined and when the inherence of forms and of accidents is distinguished (v.i. 4.2.4).

A parallel entry to the senses of 'in' is the account of 'possessing' in *Met* Δ 23:

- matter possesses form;
- a whole possesses its parts as a container possesses its contents;
- what holds together ($\tau\acute{o}$ συνέχων) possesses the things it holds together.

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I have skipped the following non-mereological sense: x is said to possess y if x is directing y according to the nature of x , as a fever possesses a man, tyrants – cities, wearers their clothes (1023a8ff).

Again, the senses of 'in' in the *Physics* Δ 3 and in the *Metaphysics* Δ 23 are related as follows: 'matter possesses form' goes with 'form is in matter'; 'a whole possesses its parts as a container possesses its contents' with 'a part is in a whole' and 'thing is in a vessel'; 'what holds together possesses the things it holds together' with 'a whole is in its parts'. In fact, I have correlated 'a part is in a whole' and 'thing is in a vessel' on the basis of 'a whole possesses its parts as a container possesses its contents'. Additional justification of this correlation ensues from Simplicius' distinction of 'in a vessel' from 'in a place' (*In Cat* 46.6–7). Place is immovable, while vessel is a 'movable place' (*In Phys* 552.15–16). Moreover, the example 'wine is in the amphora' given by Simplicius to characterize 'in a vessel' corresponds to the sense in which a container possesses its contents: a bucket possesses liquid and a city men and a ship seamen (*Met* Δ 23 1023a15–16).

The fact that I have included 'form is in matter' and 'matter possesses form' among mereological senses suggests that 'form is in matter' or 'matter possesses form' means 'form is a part of matter'. The latter statement contradicts Aristotle's attempts to substantiate the separateness of form in *Met Z* 10. Strictly speaking, form cannot be a part of matter. I have left 'form is in matter' and 'matter possesses form' on the lists because the disjointness of form and matter has not yet been discussed, and their exclusion is not evident.

The above-mentioned items can be collected together under four main rubrics:

- 'an arbitrary quantity is a part of a quantity'; 'a non-arbitrary quantity is a part of a quantity'; 'a part is in a whole';
- 'a form is a part of a genus'; 'a thing is out of matter'; 'a form is in the genus';
- 'form and matter are parts of a whole'; 'a thing is out of matter'; 'a compound is out of matter and shape'; 'a compound is out of a part of the compound';
- 'genus and differentia are parts of form'.

I will go through each of these rubrics in turn.

2.2.1. Division of a Quantity into Quantities

Whatever is taken away from a quantity *qua* quantity is a part of that quantity, whereas, as Alexander of Aphrodisias (*In Met* 423.33–9) notices, a quality (e.g. heat, whiteness or sweetness) is not a part of the quantity, because when it is taken away from the quantity, its removal does not lessen the quantified thing. This suggests that a quantitative part can be described by the relation 'less than': if two is a part of three, two is less than three.

Quantity can be divided into arbitrary sub-quantities, which do not measure the thing, or into non-arbitrary sub-quantities, which measure the thing.

"We call a part, in one sense, the result of any kind of division of a quantity; for what is subtracted from a quantity *qua* quantity is always called a part of it; as two is called a part of three in a way /../" (*Met A* 25 1023b12–15)

Division into arbitrary sub-quantities presupposes any kind of division of a quantity – in this sense a part is anything that is subtracted from a quantity. However, a non-arbitrary division requires a measure according to which the division takes place.

"/In/ another sense, /we call parts/ only those among such parts which give the measure of a thing; that is why two is called a part of three in a way, but in a way not." (*Met A* 26 1023b15–17)

In this sense two is not a part of three but rather a part of four, and also, as Alexander points it out (*In Met* 424.2–3), a part of six and of all even numbers. Aquinas (*In Met* 5.21.9) emphasizes that non-arbitrary parts result, only if a smaller quantity measures a larger one. Two is not a part of three, but rather a part of four – two measures the number 'four', since two times two equals four. The answer to the question "How many parts does the number 'four' have?" would be "two", if two is taken to be the measure.

Bostock (1994, p. 146) thinks that a non-arbitrary quantity of a thing is the number of parts that the thing contains; the parts have to be equal to one another and to some given unit or measure of that quantity. Bostock's reading is too narrow, since he supposes that the quantity of a thing is the number of *discrete* parts that the thing contains. But the parts do not have to be discrete or countable; in case of magnitudes, the parts only have to be measurable:

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"A certain quantity is a plurality if it is countable, a magnitude if it is measurable; that which is potentially divisible into non-continuous parts is called a plurality, into continuous a magnitude. Of magnitudes those which are continuous in one dimension are lengths, in two breaths, in three depths." (*Met A* 13 1020a7–14)

Simons (1991, p. 664) sees the distinction between arbitrary and non-arbitrary quantities as a consequence of the nature of the subtracted quantity. If the subtracted quantity is complex, it is an arbitrary part. If it is simple, it is non-arbitrary. Two is a part of three, if it is a complex part; two is not a part of three, if it is a simple part.

It seems that Aristotle should also have mentioned the opposite process to division of a quantity, namely, composition of a quantity out of quantities, i.e. summation under the heading of the senses of 'out of'. The idea of summation is hinted at, but left unelaborated, in *Met M* 2 1077a20–4, where Aristotle puzzles about what it is in virtue of which mathematical magnitudes are one, and notices right away that their unity cannot be reached in the same way as the unity of organisms which are unified in virtue of their soul or a part of the soul. If they lack form, they are dissolved into their constituents. But magnitudes are *already* divided up, so the unifier has to be of a different nature, since their unity is different. We will turn to summation in more detail in relation to the senses of 'whole'.

There is another part–whole relation which is subsumable under the heading of quantitative division. It is the division of a material compound into material parts. Alexander notes (*In Met* 424.17–19) that the bodily parts of an animal, e.g. head, chest, is a result of a quantitative division. It is not told whether or not the division is arbitrary. Most obviously it is non-arbitrary, since head or chest is an organ with certain functions. However it does not seem to be appropriate to say that such parts measure the animal.

In *HA A* 1 Aristotle describes bodily parts as either uniform or non-uniform. Uniform (also homogeneous or homoeomerous) parts are stuffs out of which non-uniform (heterogeneous or non-homoeomerous) parts are made. Uniform parts are synonymous with the whole (*PA B* 9 655b21; *PA B* 2 647b18). Aristotle calls them 'simple', since they can be divided into like parts, as flesh into pieces of flesh, in contrast to 'compounds', e.g., limbs that cannot be divided into like parts, as the hand cannot be divided into hands, nor the face into faces (*HA A* 1 486a5–7; cf. *PA B* 1 647a1f). Non-uniform (non-homoeomerous) parts, e.g. animal limbs are made up of other parts (*HA A* 1 486a10–13).

Uniform parts are, e.g. bone, tissue, blood etc., and their constituents, the elements: fire, earth, water, air (*Met A* 3 1014a26–35; cf. *GA A* 1 715a9–11). Uniform parts are also the nutriment and the residue of the

nutriment, i.e. the dregs (*PA B 2 647b27*) or semen (*GA A 18 725a11*). Bodily organs are 'proximate' (functional) matter in contrast to mere stuffs, which constitute these parts and are therefore more 'remote' (remnant). The natural elements (fire, air, water, earth) are the 'prime matter' out of which the remote parts are constituted.⁶⁷

The term 'element' does not only designate natural chemical stuffs but also constituents into which a material compound can be divided:

"For/ although as a particular thing /*πρᾶγμα τι*/ and a nature /*φύσις*/ fire is an element, still the name ["element"] means that the following is a property of it: that *something is 'out of' this as primary constituent.*" (*Met I 1 1052b12–14*)

However, stuffs and constituents also share a feature (that is why both are called 'elements'): the elements are further indivisible in form into another form. The elements, e.g. the letters, of a spoken sound, e.g. a syllable, make up the sound and the sound is divisible into its elements but the elements are not themselves further divisible into spoken sounds that differ in form. If they were divisible, they would remain the same in form, e.g. a portion of water is water (*Met Δ 3 1014a26–35*). Also, a portion of flesh is flesh, but flesh is not an element, since it is further divisible into elements other in form, i.e. fire and earth.

2.2.2. Division of Form or Genus into Forms

Division *without quantity* is said to apply to form (*eidōs*). The terms '*eidōs*' and 'genus' are relatives whose meaning is determined by the context. Within a classification, the highest *eidōs* is always genus, i.e. *ultimum genus*, the intermediate genera are *eidē* of the highest genus and genera of *eidē* below them, and the last *eidōs* is always *eidōs*, i.e. *infima species*, which is also the object of definition (cf. Porphy. *In Cat* 83.18–23).

"Again, the results of any non-quantitative division of a form /*εἶδος*/ are also called its portions; that is why people assert that forms are portions of their genus." (*Met Δ 25 1023b17–19*; cf. *H 1 152a16*; *GC A 3 317b7*; *Top Δ 1 121a12*)

Aquinas (*In Met* 5.21.10) understands the division without quantity as a division of a genus into *species*. He translates *eidōs* as 'species' in contexts where the term 'genus' is used. Aquinas contrasts the division of

⁶⁷ On the nature of elements see Gill 1989; Sokolowski 1970. For discussions of prime matter see Charlton 1983, Graham 1987, Robinson 1974. On the question whether the elements constitute prime matter see Cohen 1984.

a genus into species with the division of a quantity into sub-quantities in the following way: "For a whole quantity is not in each one of its parts, but a genus is in each one of its species."

Alexander understands *eidōs* differently (the translator renders *eidōs* as 'species'), as becomes apparent from the subsequent text in his commentary, according to which *eidōs* means the essence ($\tau\acute{o} \tau\acute{\iota} \tilde{\eta}\nu \tilde{\epsilon}\tilde{\iota}\nu\alpha\iota$) as expressed in the formula or in the definition, and its parts would then be the parts of the formula and of form, i.e. genus and differentia. Alexander refers to 1023b2, where the parts of the *eidōs* are the matter of the *eidōs* (*In Met* 424.8–10). He also points out that *eidōs* admits of a quantitative division, which would yield individuals as parts. The non-quantitative division of *eidōs* yields differentia and genus as parts thereby precluding *eidōs* from being a part of a genus.

Alexander (424.17–21) seems after all to maintain a position similar to Aquinas. Instead of saying '*eidē* are portions of their genus' he paraphrases the statement as 'several forms are parts of a higher order form taken *as* a genus'. 'Animal', for instance, can be divided *as* a genus (i.e. higher order form) by differentia into subordinated forms. The division of something *as* a genus is a division of that thing taken without matter (*In Met* 424.17–19; Dooley 1993, p. 176 n. 506). If the thing were taken with matter, its division would yield material parts, not forms. When 'animal' is divided *as* a genus, it has parts 'man' and 'horse'. If 'animal' is taken with matter, its division yields bodily parts.

Aquinas (*In Met* 5.21.13) in the explanation of the way in which *eidōs* (rendered as 'species') is a part of a genus introduces important terminology: the distinction between *subjective* and *integral* parts. *Eidōs* is a part of a genus as a subjective part of a *universal* whole, whereas genus is a part of *eidōs* as an integral part of an integral whole. The definitions of subjective and integral parts are not given in this fragment but can be deduced from Aquinas commentary (5.21.15–16) to *Met* Δ 26 1023b28–32.

Aristotle distinguishes two ways in which a thing is a whole:

"/And/ this [the containment of the constituents in such a manner that they are one thing] /occurs/ in two ways, either as *each* being one thing or as *making up* one thing." (*Met* Δ 26 1023b28–9)

The first way Aquinas dubs 'universal whole' and the second – 'integral whole'. The definition of 'universal whole' is stated immediately after the distinction of the two senses in Aristotle's text:

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For what is universal and what is said to be as a whole, implying that it is a certain whole, is universal as containing several things, by being predicated of each of them and by their all – each one – being one thing; as for instance man, horse, god, because they are all animals ($\zeta\tilde{\varphi}\alpha$ – living things). (*Met* Δ 26 1023b29–32)

Aquinas (*In Met* 5.21.16) explains the passage by pointing out that the universal is a common predicate predicated of each individual as of its parts. Similarly, Aristotle in the *Physics* *A* 1 184a25–6 points out that a universal is that which is predicated of many things or that which embraces many things as parts.

The main idea is that universal wholes can be predicated of their parts:

x is a universal whole iff y is a part of x and x is predicated of y .

In a correlative way we can define a subjective part:

x is a subjective part iff x is a part of y and y is predicated of x .

Parts of universal wholes are called 'subjective' because in the statement 'Man is animal' the part 'man' is a subject and the whole 'animal' is predicable of the part.

An integral whole is "one thing composed of parts in such a way that none of the parts are that one thing", namely it "is not predicated of any of its own integral parts":

x is an integral whole iff y is a part of x and x is not predicated of y .

Universal wholes are predicated of subjective parts but integral wholes are not predicated of integral parts.

There is a correlative notion of an integral part:

x is an integral part iff x is a part of y and y is not predicated of x .

In his commentary to Aristotle's *Physics* Δ 3 210a14–24, where Aristotle talks about the senses of 'in', Aquinas points out that "the part of the integral whole is included actually in the whole, but the part of the universal whole is included potentially in the whole" (*In Phys* 4.4.3). The reason for this, as Aquinas explains further, is that genus extends to more things than species does in potentiality, i.e. potentially there are more things which belong to a genus than to a species (of that genus), but species may extend to more

things actually, i.e. in actuality there may be more things belonging to a species than to a genus (which is super-ordinate to that species).

2.2.3. Division of a Compound into Form and Matter

Another kind of division without quantity is that which applies either to form or to that which has the form yielding form and matter as parts (cf. *Z* 10 1034b32–35a9; *Z* 8 1033b14–16; *Z* 7 1032b32; *M* 8 1084b11–12).

"/Again/, anything into which a whole, whether a form /εἶδος/ or something that possesses a form, is divided, or out of which it is composed, as for instance both the bronze (that is, the matter in which the form is) and the angles are parts of a bronze cube, or a bronze ball." (*Met* *A* 25 1023b19–21, my underline – L. M.)

The whole is not only *divided* into such parts but also *composed* out of them (cf. *A* 24 1023a31–4), which suggests that form and matter are prior to the whole and the whole is posterior to them, incapable to exist without them. These are *essential* constituents of a whole as a form–matter compound. That which consists of form and matter, i.e. that which is 'a this' (τόδε τι) and an unqualifiedly separate being, has both form and matter as its *substance* (cf. *H* 1 1042a26–31): in virtue of form a thing is called 'a this' (*DA B* 1 412a8–9) but in virtue of matter there is something that *can* be called 'a this'. While the form is responsible for determining the matter so that it becomes the matter of the composite substance, it is very hard to say what matter is. The definition that Aristotle gives in a parenthetical remark is as follows:

"I mean by matter that which, though it is not some this actually, is potentially some this." (*H* 1 1042a27–8)

Aquinas (*In Met* 5.21.11) translates again *eidōs* as 'species' here and says that the whole is a species or the thing having the species, i.e. the individual, which has species and matter as parts. Bronze is a part of a bronze sphere or of a bronze cube and not a part of the species 'sphere', in contrast to an angle, which is a part of a triangle as a part of its species. Namely, 'bronze' is not essential to 'sphere'; the account of a sphere does not have to include reference to bronze. But 'angle' is essential to 'triangle'; the account of a triangle has to include reference to an angle. Trivially, matter is not included in those things which do not consist of form and matter, i.e. (pure) forms.

Division into form and matter is a distinction between different aspects of one thing and not of two things in one aspect. Bronze sphere has two parts – matter, the bronze, of what the sphere is made, and the

sphericity, an 'angle' or curvature characteristic to spheres that makes it spherical. Quantitatively a sphere cannot be divided into such parts. For a material substance to remain what it is, a quantitative division is not possible, because it would lead the substance to collapsing into material constituents. If a sphere is cut in half, we get two semi-spheres, not matter and *eidos*. These two semi-spheres are themselves material compounds. A quantitative division of a material compound yields further material compounds.

This is perhaps more easily understood if we divide a wooden table in two different ways: (i) into wood and table, which is a division into matter and form, and (ii) into countable material parts, as four legs and a surface, which is a quantitative division. The countable material parts are material compounds because they are made out of wood, just as the table is made out of wood.

Aristotle admits that the sum of all the material parts of a compound – the compounds which make up a compound – is also the matter of the compound. Thus, 'matter' can be taken as (i) the sum of all the material parts of the compound, which are yielded by quantitative division (e.g. a sphere has semi-spheres as parts and a table has legs and a top as parts); (ii) the material aspect, which is obtained by the division into form and matter.

In order to clarify what is meant by 'material aspect', it is necessary to look at Aristotle's statement at *Met* Δ 24 1023a31–4, where the talk is about the composition of a compound out of form and matter:

"In/ another sense /something is said to be 'out of', as out of what is composed (*συνθέτοϛ*) out of matter and shape, as parts are out of a whole, a line out of the *Iliad*, and stones out of a house. For the shape is a fulfillment, and what has attained fulfillment is complete."

The explanation of 'being out of form and matter' contains the word 'compound' (*συνθέτοϛ*, 1023a31) and explicitly links form and matter with parts of a whole. Aquinas (*In Met* 5.21.3) argues that the preposition 'out of' (or 'from' in Rowan's translation) – if the talk is about form and matter – applies both to composition, because 'out of' determines a material principle, e.g. stones, when we say 'the house is out of the stones', and to dissolution, because 'out of' signifies a formal principle, e.g. the house, when we say 'the stones are out of (i.e. come from) the house'.

Aquinas suggests (ibid.) that form and matter are *simple* in relation to the *composite* of form and matter. Namely, a part is to the whole as something simple is to the composite. Division into 'simples' pertains to dissolution into parts, and in this sense parts are 'out of' the whole, as a verse is out of the *Iliad*, if *Iliad* is

divided into verses, and a stone out of a house, if it is divided into these. Presumably, Aquinas would also agree that the opposite process pertains to the composition of the whole, and in this sense the whole is out of the parts.

The analogy between the division of a compound into form and matter and between the division of a compound into material parts is already highlighted by Alexander of Aphrodisias (*In Met* 422.6ff). However this analogy between form and matter as parts and verses of the Iliad or stones as parts of a house is incomplete, because form and matter do not behave similarly to material parts.

Aquinas goes further than Alexander in this respect by emphasizing the close linkage between form and composition, on the one hand, and matter and division or dissolution, on the other hand. Form is the goal in the process of generation (while matter would be the means). A whole is *complete* only when it has attained its goal or end or fulfillment: "that is perfect which has a form". Aquinas statement suggests that form is a part of the form–matter compound only when the whole truly is a form–matter compound, i.e. when the whole is complete. But when the whole is incomplete, it exists as matter for the complete whole: "when a perfect whole is broken down into its parts, there is motion in a sense from form to matter; and in a similar way when parts are combined, there is an opposite motion from matter to form" (*In Met* 5.21.3).

The division into form and matter applies not only to sensible but also to insensible objects (cf. *Met* Z 11 1036b32ff): the matter of sensible objects Aristotle calls 'perceptible' and the matter of insensible objects – 'intelligible':

"Matter can be perceptible or intelligible, perceptible, e.g. bronze and wood and such 'matter' as is changeable; intelligible occurring *in* perceptibles not *qua* perceptible, e.g. the objects of mathematics" (Z 10 1036a9–12).

Another example of perceptible matter is the matter of the syllable $\beta\alpha$ – written marks (drawn in wax) or articulated sounds (vibrations in the air) (Z 10 1035a14–17). Intelligible matter is, e.g. the matter of the circle – its segments (cf. Z 10 1035a12; 1035a34).⁶⁸

⁶⁸ Kit Fine (1992, p. 37) thinks that this 'matter' is constitutive of the circle "in exactly the same general way as physical matter is constitutive of something physical". I, however, object that this matter is constitutive, if "constitutive" means "what constitutes the whole". Aristotle argues in *Top* Z 13 150a21–5 that a whole cannot be generated out of lines and numbers, *ergo* out of segments (v. i. 2.3.3.4).

Aquinas (*In Met* 5.21.13) in his commentary to *Met* Δ 25 lists form and matter among integral parts. All senses, except the sense in which species (form) is a part of a genus as a subjective part of a universal whole, describe integral parts of integral wholes.

The parthood of form and matter is highlighted also in Simplicius' commentaries. When commenting on Aristotle's *Physics* Δ 3 210a21, where it is stated that form is 'in' matter, Simplicius explains (*In Phys* 552.23–4; cf. 556.10–11) that, if form is 'in' matter, then "form is a part of what consists of matter and form".

An insight of the way form is a part can be gained from the contrast Simplicius' draws between form's being in matter and an accident's or attribute's being in a subject. The definition of being in a subject is given in the *Categories* 1a24–5 (cf. Simpl. *In Phys* 552.20–2): x is in a subject if and only if x is not a part of what it is in and cannot exist separately from what it is in.

Likewise form is not a part of what it is in and cannot exist separately from what it is in. But there are significant differences between attribute's being in a subject and form's being in matter (Simpl. *In Cat* 46. 23–30):

- (1) that which is in a subject is in the composite substance, the form–matter compound, and is not a part of it, whereas the form which is in matter is in what is formless and is a part of the form–matter compound;
- (2) that which is in a subject "takes its being" from the subject, whereas form "gives matter its being";
- (3) that which is in a subject does not complete the substance, whereas form which is in matter completes it;
- (4) that which is in a subject is an accident, whereas form is substance and subject.

Point (3) is especially relevant: an accident does not complete the composite substance (i.e. the subject in which it is) but form completes the composite substance. That which is in a subject cannot complete the substance in which it is because the accident is not a part of the substance (but at best a part of the accidental compound). M. Chase (2003, p. 129, n. 484), the commentator of Simplicius' commentary, thinks that there is a tacit assumption: that which completes a substance is a part of that substance. The assumption, according to Chase, is based on the principle " x is a part /of a substance/ $\equiv x$ completes a

substance". I think that this formulation is too narrow, since not everything which is called 'part' completes a substance. Simplicius rather meant that form is an essential part of form–matter compounds (cf. Aquinas *In Met* 5.21.11).

This reading also accords with Aristotle's statements that "nothing is complete (*teleios*) unless it has /attained/ an end (*telos*)" (*Phys I* 6 207a14), and form is the 'end' or the final cause (*Phys B* 3). Thus form completes the whole. In addition, it accords with Aristotle's insistence that the whole has to consist of its proper constituents and not accidents (*Top Z* 13 150a21–5), which makes it manifest that form is a part along with matter.

2.2.4. Division of Form into Genus and Differentia

A part is the result of the division of *eidos* and the formula (viz. definition):

"Again, whatever is in the formula indicating each thing is also a portion of the whole; that is why a genus is also called a part of its form, although in a different way the form is a part of its genus." (*Met A* 25 1023b22–5; cf. *Z* 10 1034b20–2)

Upon this division genus is a part of *eidos*, not *eidos* a part of genus as in *A* 25 1023b17–19. The contrast is also delineated in *Phys A* 3. On the one hand, form is in the genus: 'man' is in 'animal' (210a17–18; *Simpl. In Phys* 551.26; *In Cat* 46.9–10); 'man' participates (*μετέχει*) in 'animal' (*Simpl. In Cat* 46.11). On the other hand, genus is in the form: 'animal' is in 'man'; genus is contained within the form as a part of the account of the form (Arist. *Phys A* 3 210a19–20; *Simpl. In Phys* 551.27–8).

Alexander takes parts of the formula (definition) to be parts of the composite (*In Met* 424.38f), where 'genus' mentioned in the definition signifies matter of the thing (425.3). Accordingly 'differentia' should refer to the form of the thing.

Similarly Simplicius (*In Cat* 47.15–18) points out that the coordinated genus completes the form, insofar as the form is composed of genus and differentia. The genus is a part of the form (along with the differentia), just as the form, taken together with matter, is a part of the material substance. In this sense genus is as matter: "for that to which a differentia or quality belongs, that is the subject, which we call matter" (Arist. *Met A* 28 1024b8–9).

2. Foundations of Aristotle's Mereology. 2.2. Ways of Division: Parts

Met A 24 1023a35–b2 presents a parallel sense of 'part' by focusing on the composition of *eidos* out of the parts of the *eidos*:

"/One thing is out of another in the sense that/ the form is out of the part /of the form/, as for instance a man is out of the two-footed and a syllable out of an element (for this is different from the way in which the statue is out of bronze; for a composite substance is out of perceptible matter, but a form is also out of the matter of the form)."

Alexander (*In Met* 422.21f) points out that Aristotle is referring here to the 'complete' *eidos* or essence. Dooley (1993, p. 174 n. 493) explains that *eidos* as essence is complete, in contrast to *eidos* as form, which is incomplete until united with matter in the material composite. The complete *eidos* or essence, being the object of definition, consists of genus and differentia, and because it consists of such parts it is complete (cf. *Simpl. In Cat* 47.15–18).

Alexander maintains the position that the parts of the 'complete' *eidos* are its matter (contrary to the association of differentia with form and genus with matter which Alexander himself suggests at 425.3): "for the matter of the form, i.e. the essence, is its parts, those that make its formula complete, and these parts themselves are included in the formula, just as the form itself is" (*In Met* 423.6–8).

The complete *eidos* is similar to the sensible substance: both are out of matter, although not in the same way. The matter of each of them is their own parts (422.36). The difference is that the parts of the substance are 'perceptible', while the parts of essence are 'imperceptible'.

A subtler explanation in what sense *eidos* has parts is provided by Aquinas. He introduces additional terminological apparatus, which he unfortunately does not use in the analysis of the other senses of mereological terms: the distinction between *real* and *conceptual* parts.

According to Aquinas' interpretation (*In Met* 5.21.4), a part of a species (*eidos*) can be taken either in reference to the conceptual order or to the real order. According to the conceptual order, 'two-footed' is a conceptual part of 'man', because it is predicated of the whole – 'two-footed' is predicated of 'man' as its subject:

x is a conceptual part of y iff x is a part of y and x is predicated of y .

According to the real order, a letter is a real part of a syllable, e.g. α is a real part of $\beta\alpha$, because a letter is not predicated of the whole, i.e. we cannot say " $\beta\alpha$ is α " in the same way we can say "Man is two-footed":

x is a real part of y iff x is a part of y and x is not predicated of y .

The meaning of the distinction seems to be closely linked with another terminological device, the distinction between integral and subjective parts. However, we must be cautious here, because 'real' is not on a par with 'integral' and 'conceptual' is not on a par with 'subjective'. The contrast between 'subjective' and 'integral' lies in the satisfaction of, or the failure to satisfy, the *predication of a whole to a part*, i.e. a subjective part is such that the whole is predicated of it, whereas an integral part is such that the whole is not predicated of it. But the contrast between 'conceptual' and 'real' lies in the satisfaction of, or the failure to satisfy, the converse *predication of a part to a whole*, i.e. a conceptual part is predicated of the whole, whereas a real part is not.

The justification for the maintenance of the distinction between integral and real parts, and subjective and conceptual parts, can also be derived from Aquinas' recapitulation (*In Met* 5.21.13) of the senses of 'part' in *Met A* 25 where he states it quite clearly that Aristotle speaks about integral parts, except when he mentions the case where the whole is predicated of its part, as it is with form being a part of a genus. There we can also find evidence for the distinction between real and conceptual parts as special cases of integral parthood. Division into form and matter is a division into parts of a *thing* (*pars rei*, whence 'real part'), where the 'thing' is *eidos* or that which has the *eidos*, whereas a conceptual division gives us parts of the definition (*pars rationis*).⁶⁹

2.2.5. Issues pertaining to the Distinction between the Part–Whole Relations

As a result we have the following part–whole relations:

- Division of a quantity into quantities. The outcome is quantitative integral parts of integral whole.
- Division of form or genus into forms. The result is subjective parts of universal whole.
- Division of a compound into form and matter. This yields real substantial integral parts of real substantial integral whole.

⁶⁹ D. P. Henry (1991, p. 232) thinks that Aquinas' notion of integral part–whole relation embraces "all those cases in which there is no predication possible either way between the part and the whole". His interpretation is unacceptable because it neglects the fact that Aquinas includes parts which are predicated of the whole (genus and differentia) in the class of integral parts.

- Division of form into genus and differentia. The outcome is conceptual substantial integral parts of conceptual substantial integral whole.

The distinctions among part–whole relations deserve more comment.

2.2.5.1. Elaboration on the Distinction between Subjective and Integral parts

The distinction between subjective and integral parts used by Aquinas is not a common phenomenon in the contemporary literature that touches upon the Aristotelian notion of parthood. The reason is perhaps that scholars interested in mereology focus only on integral part–whole relations, leaving out of the picture subjective parts of universal wholes as a bizarre case. But there are exceptions.

Mario Mignucci (2000), who has noticed the parallels between parthood and predication in Aristotle, makes a very similar distinction to Aquinas' by arguing that there are two non-equivalent senses of parthood: (i) 'predicative parts' (cf. subjective parts) and (ii) 'constituent parts' (cf. integral parts). The predicative parts are unified into a universal whole due to the fact that the whole can be predicated of each of them – as in 'Man is an animal' and 'Horse is an animal'. In contrast, constituent parts do not admit of being subjects of predication in the same way – a natural whole, e.g. a particular horse cannot be predicated of each of its parts severally.

Predicative parts, according to Mignucci (p. 14), operate in the domain of sets, where parthood is inclusion and therefore also a transitive relation. Man is a part of animal as a sub-set is a part of a set. For concrete objects such as Socrates or {Socrates} these sets are singletons, which are at the bottom of (i.e. are the last terms for) the predicative parthood relation. Mignucci points out that the conception of individuals as 'predicative' parts significantly differs from modern Fregean theories, according to which individuals' falling under a concept is understood as set-membership, which, in contrast to inclusion, is not a transitive relation. Because of this discrepancy Mignucci (ibid.) concludes that Aristotle has a different notion of 'particular': "/Particulars/ are those items that do not have predicative proper parts, and in this way they are distinct from universals which do have predicative proper parts."

Mignucci's theory presupposes that the sentence 'Socrates is a man' has the following deep structure: Socrates is a predicative part of man, because {Man} contains the singleton set {Socrates}. According to his theory, then, the singleton set {Socrates} should also have a predicative part – Socrates. Socrates is an

improper part of {Socrates}. If particulars had proper predicative parts, universals and particulars would collapse into a single category.

The reason for Mignucci's unwillingness to claim that Socrates is a proper part of {Socrates} is that he thinks that Socrates is not a member of {Socrates} or of any other set, e.g. {Man}. But his willingness to treat predicative parthood as inclusion and thus as a transitive relation lets him conjecture that the particular Socrates simply *is* the singleton set {Socrates} and not a member of it. Since Socrates is identical with {Socrates}, Socrates is nothing but an improper part of {Socrates}.

Mignucci's theory seems awkward, unless some additional constraints are placed upon it. Aristotle claims that particulars are material wholes such that they can be divided up into material parts (or they are integral wholes having integral parts in Aquinas' terminology). But surely {Socrates} cannot have material parts in the same sense as Socrates does. Sets do not have tangible physical parts. Clearly, Socrates has to be distinguished from {Socrates}.

For Mignucci's theory to be consistent with Aristotle, it should be reconstructed as follows:

- (1) There are universal wholes: {Man}
- (2) These universal wholes have predicative (subjective) proper parts – particulars, e.g. {Socrates} or {Coriscus}. These parts are singleton sets, which are included in the universal whole {Man}, thus allowing for transitivity. Singleton sets themselves do not have predicative proper parts, thus they are distinguished from universal wholes, i.e. sets.
- (3) The singleton set {Socrates} has a single member Socrates, which is a natural (integral) whole.
- (4) The natural whole, Socrates, has constituent (integral) parts, e.g., Hand or Head.

What is done here is that the concept of particular is distinguished from that of 'natural whole'. It would be impossible that a particular (a singleton set {Socrates}) had the same constituent (integral) parts as a natural whole (Socrates).

The simplest solution is to claim, as Aquinas would, that an integral whole (as such) cannot be a subjective part of a universal whole, because these are two entirely different divisions. In Mignucci's

terminology it would be expressed as follows: a natural whole cannot be a predicative part of a universal whole. Socrates is a subjective part of a universal whole only if Socrates is taken *qua* universal, e.g. if Socrates is {Socrates}.

What happens when a particular is predicated of itself (as in the expression 'Socrates is Socrates')? Such predication can be explained in three ways, of which the latter is the most preferable:

(a) The natural whole, Socrates, is a member of the singleton set {Socrates}. Socrates is a predicative proper part of {Socrates}. This goes against Mignucci's idea that particulars do not have predicative proper parts. It attributes to Aristotle the concept of set-membership, for which there is no perspicuous evidence.

(b) If the distinction between a particular and a natural whole is not made, the expression 'Socrates is Socrates' indicates that there is a predicative part of the particular. And since it was stated that only universal wholes have predicative proper parts, it follows that if a particular has a predicative part, this part should be an improper part. Aside from the confusion that arises, if Socrates is identified with {Socrates}, the acceptance of (b) requires textual grounding that Aristotle had the concept of improper parthood. (We will turn to this question when inspecting mereological principles pertaining to part–whole.)

(c) 'Socrates is Socrates' is a trivial statement, a repetition of the same thing, and there is no further relation (i.e. predication) in virtue of which Socrates is Socrates.

The difficulty of pinning down the relationship between integral and universal wholes is not a superficial matter. There are two relations that need some comment: the relation (i) between forms and particulars (such as Socrates), and (ii) between forms and genera. Alexander (*In Met* 424.10–12) tells us that the division of the last form into particulars (*ἄτομα*, 424.11) is effected with respect to quantity but the division of a genus into forms is without quantity. This remark is disturbing, since 'quantity' should properly apply to integral wholes, not to universal wholes. If universal wholes are quantitatively divisible, then there are quantitative subjective parts. We get a chimerical sense of part–whole, whose characteristics are far from clear. What would a quantitative universal whole be? It clearly cannot be a sum of all particulars, for then it would be an aggregate, a kind of integral whole. The only solution at hand (or rather

a suspension of the problem) is to treat particulars as forms, when they stand in the subjective part–universal whole relation.

2.2.5.2. Elaboration on the Distinction between Real and Conceptual Parts

The distinction between a real and a conceptual part is simply the distinction between a part of the thing (*pars rei*) and a part of the definition (*pars rationis*). Real parts must not be predicated of their wholes, e.g. it is wrong to say "Hand is a finger", whereas conceptual parts are predicable of the *definiendum*: 'animal' is predicated of 'man' in "Man is a two-footed animal". Unfortunately, there are real parts which do not seem to be real. Unless some qualifications are added, the treatment of form and matter as real parts is problematic. Consider the following predication:

"Socrates is a man"

If 'man' is taken to be the form, we see that the form is predicable and thus does not fulfill the criterion that real parts are not predicable. In fact, the above sentence is a predication of a universal whole 'man' to a subjective part 'Socrates'. If we want the predication to fail, we need substitute 'man' with 'soul'.

"Socrates is a soul"

The above statement is clearly false, since Socrates is not just a soul but has a body also. Neither is 'body' predicable of Socrates in the same way:

"Socrates is a body"

If 'body' is a real part of Socrates, it should not be predicable of him. The predication sounds perfectly fine due to the fact that 'body' can be taken similarly to 'man' as designating the form as a universal whole to which Socrates belongs. If we want the predication to fail necessarily, we should say "Socrates is his body". In that manner it is evident that soul and body are real parts of Socrates that cannot be predicated of him.

2.2.5.3. The Interconnectedness between 'Subjective Part–Universal Whole' and 'Conceptual Part–Conceptual Whole' Relations

Let us consider the conceptual whole 'man' which consists of two conceptual parts, 'two-footed' and 'animal'. Since a conceptual part can be predicated of the whole, in this case there are two predications, viz. genus 'animal' and differentia 'two-footed' are predicated of the form 'man':

"Man is animal"

"Man is two-footed"

The predications that take place in the case of conceptual parts, where a part is such that it is predicated of the whole, represent a figure of predication, where a universal whole is predicated of a subjective part. The conceptual part which is predicated behaves as a universal whole, while that of which the conceptual part is predicated behaves as a subjective part. On this account the differentia 'two-footed' behaves like a universal whole and 'man' as a subjective part.

But not in all cases the differentia can behave as a universal whole. It is allowed only in those cases when the differentia is form-producing (*εἰδοποιός*), i.e. when it composes the form together with the genus (*Top* 143b8–9), e.g. two-footed composes man together with animal. Those differentiae that are generative (*γεννητικαί*) and productive (*ἀποτελεστικαί*) of the form lie above it and can be predicated of it (*Porph. In Cat* 85.18–20), e.g. two-footed is predicated of man. But when the differentiae serve to divide the genus into subordinate forms, then these divisive (*διαιρετική*) differentiae fall under the genus and cannot be predicated of it. For instance, two-footed and four-footed divide the genus 'animal' into man and horse, and two-footed and four-footed cannot be predicated of animal, for animal is not composed as a form by the differentiae that divide it (85.21–8). Instead, animal is composed as a form by the differentiae 'animate' and 'sensitive' (85.15–17).

The genus does not participate in its divisive differentiae, for otherwise "the same thing would simultaneously 'share in' contraries – since the differentiae by which the genus is differentiated /./ are contrary" (*Met Z* 12 1037b18–21), viz. the genus 'animal' can be differentiated both by 'two-footed' and 'four-footed' (v.i. 4.3.2).

2.2.5.4. Genus as Matter

Before the description of the sense in which a material compound is 'out of' matter and form (*A* 24 1023a31–4), Aristotle lists another sense of 'out of', viz. 'a material compound is 'out of' matter', which shows resistance to this division of the senses of part–whole.

"We call being OUT OF something, in one sense, that out of which as matter (*ὡς ἕλη*) a thing is, and this in two ways, either in respect of the first genus or in respect of the last form /*eidōs*/; as for instance in one way everything meltable is out of water but in another way a statue is out of bronze." (*Met A* 24 1023a26–9)

Here Aristotle divides 'out of something as of matter' into two sub-cases: (a) 'in respect of the first genus' as everything 'meltable' or all 'liquids' and 'liquables' (e.g. bronze) are out of water, or (b) 'in respect of the last *eidōs*' as a statue is out of bronze.

On the one hand, it seems that this sense should be subsumed under 'quantitative integral parts' (v.s. **2.2.1**). But the problem is that, in contrast to a quantitative part whose removal lessens the thing, the removal of the whole of matter does not lessen the thing but simply destroys it. The removal can be only effected in thought, so that in result we obtain understanding that, e.g. the statue is out of bronze, and bronze as a further form–matter compound is out of water. In this sense matter is the entire material of which something consists. In the case of quantitative parts, 'matter' has plural reference, but when the talk is about the whole matter – 'matter' has singular reference (cf. Fine, K. 1992, p. 37). These considerations suggest that 'out of something as of matter' means 'the form–matter compound is composed out of the matter of the compound'. Since here 'matter' refers to the whole of matter taken as one thing, this sense of the part–whole relation belongs to the sense according to which both form and matter are parts of the form–matter compound, i.e. to the real substantial integral part–whole relation (v.s. **2.2.3**).

On the other hand, the mention of first genus and last *eidōs* invites one to think that Aristotle is talking about the subjective part–universal whole relation. This thought is fortified by Alexander's remark that 'last *eidōs*' means 'proximate matter' and the 'first genus' means 'primary' or 'ultimate' matter which is "in

some way a genus of the things under it" (*In Met* 421.32): water is the matter of bronze and of all meltables.⁷⁰

The disturbance is caused by the statement 'statue is out of bronze' which cannot be a subjective part–universal whole relation, since bronze is not a genus of statue. The disturbance is quelled by the last sentence of the quote: "as for instance *in one way* everything meltable is out of water but *in another way* a statue is out of bronze" (my italics – L. M.). Thus again in the little fragment at *A* 24 1023a26–9 Aristotle has conflated two different senses as is revealed by 'in one way' versus 'in another way'. The contrast is as follows: 'in one way' water is the genus of meltables and also meltables are constituted out of water, e.g. bronze is out of water and water is the genus of bronze; 'in another way' statue is constituted out of bronze but bronze is not its genus. Thus, in some cases 'genus' and 'matter' overlap (in case of stuffs such as water and bronze), in other cases genus is merely *hōs hylē*. For further elaboration on genus as matter see **2.3.1.2.**

⁷⁰ Alexander raises the possibility that the 'primary' matter could be an even more remote matter, "which would be in turn a genus both of the matter of water and of that of bronze" (421.35).

2.3. Ways of Being One

This chapter contains elaboration on the first insight that was already presented in the discussion on the ambiguity of 'one' (2.1). I will describe in more detail ways of being 'one', viz. several senses in which an item is a *whole* and corresponding senses in which more items are the *same* as each other being parts of that whole. Sections 2.3.1–3 pertain to 'one' as 'whole'. Sections 2.1.4–5 pertain to 'one' as 'the same'.

2.3.1. Whole as One (Integral vs. Universal Whole)

This section will discuss two basic kinds of whole, integral and universal, in sketching an answer to the question what makes a whole such that it is one and not many (*Met Δ 26*).

Met Δ 26 starts with a presentation of the most general definition of 'whole' involving two aspects:

"We call a WHOLE both /1/ that of which no part is absent out of those of which we call it a whole naturally; and /2/ what contains its contents in such a manner that they are one thing." (1023b26–8)

The first aspect of 'whole' – "that of which no part is absent out of those of which we call it a whole naturally"⁷¹ – refers to the idea that a whole is complete if it does not lack any of the parts it should naturally have.⁷²

The second aspect of 'whole', namely, as "what contains its contents in such a manner that they are one thing" has to be understood in two broad senses: as a *universal* whole – "as *each* being one thing", and as an *integral* whole – "as *making up* one thing" (1023b28–9). We have already noticed this duality of 'whole' following Aquinas (*In Met 5.21.15–16*).

It is pointed out already in the *Physics A 1* 184a25–6 that "the universal is a sort of whole: it embraces many things as parts". In the *Metaphysics Δ 26* 1023b31–2 it is explained that the things contained in a universal whole – its parts – are one because the whole is predicated of each of its parts, for instance, 'animal' or 'living thing' contains man, horse, god, and all of them are one (i.e. unified under a genus), because 'living thing' is predicated of each.

⁷¹ Cf. *Met Δ 16* 1021b12–22a3; *I 4* 1055a12; 1055a15–16; *Phys Γ 6* 207a9–15.

⁷² The thought which is sketched in *Met Δ 26* 1023b26 is further elaborated in *Phys Γ 6* 207a9–15, where Aristotle deals with the infinite as something incomplete and finitude as completeness.

2. Foundations of Aristotle's Mereology. 2.3. Ways of Being One

But the things contained in an integral whole are one in a different way, since, as pointed out earlier, the integral whole is not predicated of each of its parts. In *Δ* 23 1023a22–3 Aristotle says that "that which holds things together", i.e. the compound *has* the things it holds together, or else they would be "separate, each according to its own impulse" (tr. Ross, in Barnes 1984, p. 1615).

In order to understand each kind of whole, it is necessary to examine the descriptions Aristotle and his commentators offer. Mostly attention is devoted to quantitative integral wholes. Universal wholes are not investigated separately but rather in connection with 'genus' whose mereological status has caused considerable confusion.

2.3.1.1. Quantitative Integral Whole

Some integral wholes are "continuous and limited" (*Δ* 26 1023b32). Aquinas (*In Met* 5.21.17) explains that these characteristics are related to perfectness and completeness, "for what is unlimited does not have the character of a whole but of a part". Aquinas probably means that a part has the character of the infinite because, according to Aristotle, the continuum is infinitely divisible.

Continuous integral wholes are more unified than non-continuous because continuous wholes contain their constituents potentially (1023b33–4). Aquinas (n. 18) remarks that wholes which contain their constituents actually, as a heap contains stones, are non-continuous. Aquinas (n. 19) notices a correlation between wholeness and potentiality, on the one hand, and parthood and actuality, on the other:

"Now although a thing is a whole to a greater degree when its parts are present potentially than when they are present actually, nonetheless if we look to the parts, they are parts to a greater degree when they exist actually than when they exist potentially."

Thus, if the parts can be actually separated out, the whole is less of a unity than if the parts have only a potential existence and cannot be easily severed or even readily distinguished. That is why integral wholes which are continuous by nature are more unified than those which are such by art (1023b34–5), since art presumably cannot unify the constituents as tightly as nature can.

In *Met Δ* 6 1015b36ff Aristotle classifies continuous items as 'one in their own right' or *simpliciter* (cf. *I* 1 1052a19ff) – in contrast to items that are one only accidentally, i.e. coincident things which are distinct in definition, such as the artistic Coriscus. Here among continuous things Aristotle also includes items in which the parts can actually be separated out and which are continuous in virtue of some fairly loose

connection, a bundle in virtue of its tie and planks of wood in virtue of their glue (*Met* Δ 6 1016a1). Thus continuity is a spectrum, where at the one end we have attenuate unities of effortlessly separable pieces aggregated together so that they are in close spatial proximity to one another, and at the other end we have naturally continuous objects, such as the parts of the body, which are "more one" than those which are one by art (1016a3–4).

Aristotle explains in *Met* I 1 1052a23–8 that things which are one by nature contain in themselves their cause of continuity – the form which holds them together is not imposed on them by constraint (by gluing, nailing or tying), it is not external to them. Such things also move as one spatial magnitude – their motion is indivisible in respect of place and time.

Continuous integral wholes (due to being spatial magnitudes) are *quantitatively divisible*. Aristotle sorts them into three groups. The criterion of classification is the ability or inability of a whole to survive the transposition of its constituents (1024a1–8):

(1) If the constituents can be transposed without affecting the identity of the whole, it is a totality;⁷³ it is called 'all' (*πᾶν*), e.g. water and other liquids, and number (quantity). As Aquinas puts it (5.21.23), "when their parts are interchanged no change occurs in anything that is proper to them".

(2) If the transposition of the constituents does make a difference, the object is called 'whole' (*ὅλον*). Aristotle here significantly narrows the meaning of 'whole'. Aquinas (5.21.22) suggests that the examples are man, animal and a house. For a house cannot have its parts arranged anyhow, otherwise it would be but a pile of stones.⁷⁴

(3) Anything which admits of both possibilities is both a whole and a totality, e.g. wax and a cloak (or garment): "these are the things whose nature, though not their shape, survives transposition" (1024a3–5). Aquinas (5.21.23) suggests that the nature which survives transposition of the parts is matter. It remains the same whereas the form changes obviously due to change in the material parts. This is the reason why these things can be called both 'alls' and 'wholes': because of the ability to take on different forms we call

⁷³ f. Koslicki 2006, p. 718 n. 12; 2007, p. 136 n. 13; 2008, p. 149.

⁷⁴ Arlig (2005, n. 104, pp. 117–18) has noticed the peculiar way Asclepius (*In Met* 346) understands the distinction between totalities and wholes: a whole is something which cannot lose a part, whereas a totality can lose parts and still persist. Thus, wholes, in contrast to totalities, according to Asclepius, have all their parts essentially. This requirement, however, seems too strong, for otherwise wholes could not be mutilated.

them 'wholes' and because of the ability to preserve the same matter we call them 'alls'. It should be noted that the form which is changed is accidental, not substantial – otherwise these things would not continue to be what they were. This is also another version of what Aristotle means by nature here.

Aquinas (5.21.24) explains the requirements that have to be fulfilled in order to apply the word 'all' to anything: (i) the object is either an actual plurality (as in a number there is an actual plurality of units) or potentially divisible (a multitude that is "in proximate potency", as in the case of water); or (ii) it has uniform (homogeneous or homoiomereous) parts – components which are divided into components similar to the whole. The division into uniform parts creates "multiplication of the whole," for instance, "in each part of water there are many waters".

Finally, Aristotle discerns a special characteristic that applies to totals – a totality can be taken as one thing and as distinct things – and he designates this difference by the use of distinct terms:

"We call EVERY those things to which 'all' /τὸ πᾶν/ is applied as to one thing, 'every' /τὸ πάντα/ being applied to them as to distinct things: all this number, every one of these units." (*Met A* 26 1024a8–10)

When someone refers to a totality, he should say 'all' (τὸ πᾶν), but when the reference is made to each of the members of the totality, it is appropriate to say 'every' (τὸ πάντα). Alexander explains that we say 'all this number' "when the aggregate /ἄθροισμα/⁷⁵ of units is taken as one", and 'every one of these units' "when the units from which all the number was [constituted] are again taken as separate, but in such a way that they make up all the number" (*In Met* 426.21–4). In effect, 'every' is "predicated of the parts as separate" and 'all' "of the parts as united" (426.24–5). Alexander (426.25–6) remarks that 'all' and 'every' by the same token can be applied to, e.g. 'man': we can either say 'all men' (πάντες ἄνθρωποι) or 'all man' (πᾶς ἄνθρωπος); presumably then 'all men' would designate an aggregate, whereas 'all man' a unity. It is not straightforward whether the latter is a unity in the sense of an integral or a universal whole. If 'all men', similarly to 'every one of these units', are taken in such a way that they make up 'all man', then 'all man' must be an integral whole, since only integral wholes can be composed from their parts.

According to Aquinas (*In Met* 5.21.24), 'all' is *distributive* from the whole to the parts (whence the connection of 'all' and 'every'), while 'whole' signifies a *collection* of parts in a single whole (thus 'whole'

⁷⁵ The word ἄθροισμα here translated as 'aggregate' is not used by Aristotle, but appears in ancient commentaries (e.g. *Simpl. In Phys* 1242.1; *In Cael* 7.603.20).

is non-distributive). The distributivity of 'all' has a theoretical affinity with the notion of 'universal whole' in the sense that as 'animal' or 'man' is distributed to each of its subjective parts (cf. Alex. *In Met* 426.25–6), so 'water' is distributed to each of its parts. In effect, the predication "All water is water" is correct, since every part of water is water. However, this affinity is not absolute, since not every part of *this* portion of water is this very portion of water.

2.3.1.2. Universal Whole: Genus

Aristotle relates 'universal' to 'genus' (*Met A* 26 1023b29–32). Genus is 'said in many ways'. In *Met A* 28 Aristotle gives the following senses of genus:

- (i) the continuous generation of the same form, (*eidōs*), e.g. the genus of men (1024a29–31; 1024b6–7; cf. Porph. *Isag* 1.18–21; Asclepius *In Met.* 352.2–4);
- (ii) the first mover (begetter) of the same kind, e.g. Helen is the begetter of Hellenes (1024a31–6; 1024b7–8; cf. *Isag* 1.23–2.10)
- (iii) 'as matter' (*ὡς ὕλη*, 1024b8–9; 1024b4–6).

It is the latter sense, '**genus as matter**' (cf. 2.2.5.4), that we are interested in, since this sense, in contrast to the others, is "of account to philosophers" (*Isag* 2.14–15). Genus as matter includes two aspects:

- (a) **predicate**: genus is what is predicated in answer to 'What is it?' (cf. Porph. *Isag* 2.16–17);
- (b) **subject**: genus as a constituent of the formula is a subject of its differentia (cf. *Met. A* 28 1024b3–4).

Aristotle says that genus is the "first constituent in formulae which is stated in [answer to the question] what a thing is" (1024b4–5), e.g. genus 'animal' is stated in answer to what is, e.g. man or horse. Thus, as aptly explained by Porphyry, "a genus is what is predicated, in answer to 'What is it?', of several items which differ in species/*eidōs*/; for example, animal" (*Isag* 2.16–17, tr. Barnes). That is why "we call a genus that under which a species/*eidōs*/ is ordered" (*Isag* 2.10–13, tr. Barnes; cf. Asclepius *In Met.* 352.1–2). But genus as a constituent of the formula is also a subject of its differentia (cf. *Met. A* 28 1024b3–4), for a formula consists of a genus and a differentia, e.g. man is a rational animal. We see both aspects of genus here, and, following Aquinas, have to agree that "genus as a predicable and genus as a subject are

included in a way under one meaning, and that each has the character of matter" (*In Met* 5.22.5). Genus is not exactly *hylē* but only *hōs hylē*, for *hylē* or matter strictly speaking belongs to form–matter composites.

The subject-aspect and the predicate-aspect of genus in the sense of 'genus as matter' gives us some information about the mereological status of genus, especially if we remember what Aristotle states in *Δ* 25 1023b22–5: a genus is a part of its form in a different way (*ἄλλω*) than the form is a part of its genus. Namely, when *genos hōs hulē* is a part of *eidos*, genus functions as the subject of the differentia and thereby the genus and the differentia make up the formula of the *eidos*; and when *eidos* is a part of *genos hōs hulē*, genus functions as the predicate of its *eidos* (cf. 1038a5–6; 1058a23–4) and *eidē* are differentiated or 'cut' out of the genus. In other words, **genus as a predicate is a universal whole** predicated of its form as of a subjective part, whereas **genus as a subject is an integral part** of the form along with the differentia. (Genus as a subject can also be a subjective part of a higher order genus, in case that genus is predicated of it.)

The question that is pertinent is this: what is the nature of genus as a universal whole? Aristotle does not give us a clear answer, but Boethius in the *De Divisione* (879b–880a) offers four differences between genera and wholes. It seems that by 'whole' Boethius means something akin to what Aquinas later would call 'integral whole' (cf. *integrum*, *De Div* 879c4). The first difference of genus and whole is also formulated by Alexander (*In Met* 424.10–12). The last three are explicitly embraced by Simplicius (*In Phys* 551.32ff).

Firstly, genus is divided with respect to quality whereas the whole is divided quantitatively (v.s. 2.2.2). To subsume man under animal is to divide the genus in respect of quality: "man is animal *qualified* in the sense that it is informed by a determinate quality" (*De Div* 879b21, tr. Magee 1998, p. 13).

Secondly: "Every genus is by nature prior to its proper species whereas a whole is posterior to its proper parts" (879b24–5). *Species* (Boethius' rendition of *eidos*) is posterior but a part is prior to the whole. Namely, the parts can exist before they come together to compose the whole but the *species* do not exist without the genus. This is why genus cannot be composed out of *species* but only divided into them. The destruction of the genus obliterates the *species* but the destruction of a *species* leaves the genus intact. In contrast, the destruction of the whole does not obliterate the parts; the parts remain in separation. But the removal of a part makes the whole less whole (879b24–c5). The same point that the removal of a part affects the whole but not the genus is made also by Simplicius (*In Phys* 551.29–32). Boethius' second

difference of *whole* corresponds to the description of those continuous integral wholes whose identity is affected by the transposition of their constituents in *Met A* 26 1024a1–8 (v.s. **2.3.1.1**).

The third difference is that genus is the matter of the *species*, whereas in the case of a whole the parts are the matter and the composition of these parts is the form. Boethius draws a contrast between *forma* and *species* by saying that "a whole differs from each and every part by virtue of its peculiar *composition* from those same parts whereas a species differs from its genus by virtue of the addition of a *differentia*" (879d10–12, tr. Magee 1998, p. 15).

Similarly, Simplicius takes the whole to be consisting merely of material parts, which makes him say that, while genus is a part of the account of the form, the whole is not a part of the account of the part.⁷⁶ The contrast Simplicius has in mind is expressed more innocuously when he says that "the genus is something common to things already differentiated, belonging equally to all, but the whole is a collection (*συννοχή*) of what remain different elements" (Simpl. *In Phys* 552.4–5). Genus is common in the sense that each form belonging to the same genus *entails* the genus. But there is no entailment between a part and a whole (if 'whole' is understood as a material substance). This is also affirmed by Simplicius' (551.34–552.1) statement that the whole is in *all* its parts (the collection of parts) but the genus is present already in a single form.

This brings to the forth difference between a genus and a whole, which both Boethius and Simplicius embrace. Boethius states that the *species* is always the same (*idem*, 879d12) as its genus ('man' is the same as 'animal'), whereas parts are not always the same as the whole (a hand is not the same as a man). Even if parts appear to be the same as the whole, i.e. homoiomereous parts (as bronze in a bronze rod), they are not the same, since each portion of bronze differs quantitatively from any other. It is reasonable to assume that 'same' does not mean 'identical', for it is still the case that *species* is differentiated from genus by a *differentia*. Simplicius (*In Phys* 551.32–3) expresses this difference of genus and whole more warily by saying that "genus is predicated /synonymously/ of all the /forms/" ('animal' is predicated of 'man' and of 'horse'), but "the whole only of things with similar (*ὁμοιομερῶν*) parts, and then not whole", viz. 'bronze' is predicated of a portion of bronze but a portion of bronze is not the whole of bronze.

⁷⁶ Cf. *Met Z* 10: there are parts such that their account depends on the account of the whole.

2.3.2. Whole as a Perfection that Can Be Mutilated (Continued Elaborations on Integral Wholes)

In this section attention will be paid to ways how a whole can be mutilated – damaged while retaining the properties of a whole (*Met A 27*).

'Perfect' and 'complete' are attributes that are ascribed to some wholes suggesting that the talk is about integral wholes. In order to understand perfection, truncation has to be investigated, for that shows what parts a perfect whole must have. Before we turn to wholes that are lacking in some ways, let us look at the parallels between 'whole' and 'complete':

"/That/ is how we define 'whole', as meaning that of which no part is absent – e.g. a whole man or a whole box. /../ ('Whole' and 'complete' are either exactly the same or very close in their nature. Nothing is complete unless it has an end, and an end is a limit.) (*Phys Γ 6 207a9–15*)

If a thing is lacking in some ways, it is not the 'whole thing', i.e. some parts are missing. The adjectival use of 'whole' suggests a form of mereological essentialism: wholes have their parts essentially; if a whole loses a part it is not the same whole anymore.⁷⁷ However, not all parts are such that the removal of them 'lessens' the whole, i.e. makes something less 'whole'.

Oneness in a way already implies completeness, which is not restricted to any particular type of whole: both form and the substance can be said to be complete (*Phys Δ 4 228b11–15; Γ 6 207a9–15*). 'Complete' also applies to such entities as syllogism (*An. Pr A 1 24b22–3*), reproductive soul (*DA B 4 416b24–5*), city (*Pol 1252b28*), and poetry (*Poet 6 1449b24–5*). Completeness means the fulfillment of one's capacities (*Met Δ 17 1022a6–8*). Each substance is in a complete state, i.e. in actuality (*Met H 3 1044a9*) and cannot consist of other substances that are in actuality (*Z 13 1039a3–4*), or else it is a heap, i.e. 'all' and not 'whole'.

In *Met A 27* Aristotle speaks about a mutilated (*κολοβόν*) quantity. It is shown what the whole and what the parts should be like so that the whole could be called 'mutilated'. Firstly, following Aquinas (*In Met 5.21.26–32*), seven properties are enumerated.

⁷⁷ The dependence of the whole on the complete set of parts is manifest in the definition of 'part' offered by Ammonius *In An. Pr 8.28–9*: A part is that which completes *x*'s being and whose destruction destroys the whole. Hence, the loss of even a single part corrupts the whole. If a hand is cut off, the man perishes as a whole, viz. it is not a whole anymore; it is mutilated and imperfect (8.32–3).

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(1) The mutilated thing should be a certain quantity, i.e. it must have "parts into which it may be divided quantitatively" (5.21.26).

(2) The quantified entity should be divisible into and composed of different parts. Flesh and sinew although quantities cannot be mutilated (5.21.27).

(3) The mutilated quantity cannot consist of two equal parts. In mutilation the smaller part is taken away from the whole but a compound of two equal parts cannot be mutilated (5.21.28).

(4) In the act of mutilation "the substance of mutilated thing remains after the part is taken away" (5.21.29; cf. 1024a15). A goblet can be mutilated, but a number cannot. When a unit is subtracted from a number, a different form (species) of number is created and the initial substance of number is lost.

(5) Even a whole consisting of unlike parts cannot always be mutilated. In one sense numbers consist of different parts, but as shown above, they cannot be mutilated (5.21.30).

(6) For a whole to be mutilated, it must have a "notion of a determinate arrangement of parts" (5.21.31) included in its substance. Wholes, where the parts do not have specific position (fire, water), cannot be mutilated but only structured wholes (a man or a house) can.

(7) The whole also must be continuous. For example, a harmony (a discrete whole) consists of unlike parts and each part has a certain position but it cannot be mutilated because after taking away one note from a harmony, the harmony still remains unmutilated (5.21.32).

Secondly, the properties of the parts which are taken away in mutilation are indicated (1024a22–8). Not every part can be taken away. After taking away some parts the whole is not mutilated at all, but if some other parts are taken away, the whole is annihilated, not mutilated. According to Aquinas (*In Met* 5.21.33–5), three such properties are enumerated.

(1) A principal part of the substance cannot be removed. The substance of the thing must remain after mutilation. Hence a man whose head has been cut off cannot be called 'mutilated' (5.21.33).

(2) Consequently, the removed part should be in extremity of the whole, it should be a less important part. So cutting off a head is not a mutilation while cutting off a hand is a mutilation of a man (5.21.34).

(3) The removed part should be such that it does not regenerate. Thus shaving hair is not mutilating, as the hair would grow back (5.21.35).

To summarize, only a divisible, continuous whole having unlike parts and a substantial order of its parts can be mutilated. Yet these are only necessary but not sufficient conditions for mutilation (as harmony cannot be mutilated). The mutilation itself means taking away the smaller, less important part (but not a part of no importance – a part that can regenerate) of the whole so that the substance of the whole is not lost. Annihilation is not mutilation.

On the one hand, the introduction of the concept 'mutilated whole' again gives the conditions for being a whole. On the other hand, this allows us to see a certain hierarchy of parts – some parts are such that the removal of them destroys the whole, some parts are such that the removal of them mutilates the whole, which is not the same as the initial whole, but still it can be recognized as that whole. Some parts are such that the removal of them does not make any difference at all (the removal of these parts does not mutilate the whole).

2.3.3. In Search of a Correct Definition of a 'Genuine Whole' (Continued Elaborations on Integral Wholes)

Determining the conditions under which something fails to be a whole (*Top Z* 13–14) will point out various restrictions which have to obtain in order to call something a 'genuine whole'.

In the *Topics Z* 13–14 Aristotle is concerned with methodological problems regarding the proper way of giving a definition. His considerations introduce significant conditions on what it means to be a whole. The talk is about integral wholes.

Aristotle assumes here that one should mention in the definition those constituents of the object which are typical of the given object. He considers whether it is enough just to list the constituents or there is something else which should be included in the definition. He presents three options (150a1–2):

- (1) z is x and y (τάδε);
- (2) z consists of, or is made up of, x and y (τὸ ἐκ τούτων);
- (3) z is x together with y (τόδε μετὰ τοῦδε).

Alexander of Aphrodisias in his commentary (*In Top* 485.19–23)⁷⁸ illustrates them with examples:

- (1) The house is stones and logs;
- (2) Justice is made up of courage and temperance or a house is made up of stones and logs;
- (3) Justice is temperance together with courage or a house is a shelter together with stones and logs.

What are the implications of the three options? Aristotle will test them by presenting several conditions. All the options will turn out to be equivalently invalid by the end of the discussion and the difference between them will be merely verbal: Someone who says that honey-wine is wine together with honey says something similar to someone who asserts that honey-wine is honey and wine or out of honey and wine (*Top Z* 13 150b27–32; *In Top* 490.21–491.2). Therefore I will treat the conditions simply as being directed against the idea that z is x and y (whatever that means in each of these examples).

2.3.3.1. A Whole Is Not an Arbitrary Sum

In 150a2–14 Aristotle invites us to suppose that 'justice' is defined as 'temperance and courage'. This definition is wrong in so far as it suggests that justice is the sum of things that have temperance and courage. Aristotle refuses to conclude that the sum of two men each of whom has one of these virtues makes up justice. For each of these men could have contrary features and thereby also constitute a case of injustice (v.i. **3.3.1**).

2.3.3.2. The Existence of Parts Does Not Guarantee the Existence of the Whole

There is another argument against the view that whole is the sum of parts, i.e. against the narrow interpretation of this claim, according to which 'part' refers solely to material constituents or ingredients.

The arguments that show that parts (material constituents) and whole are not the same are especially appropriate, in Aristotle's opinion, when the compounding of parts is manifest. If there are stones and logs, it is not necessary that there is a house; the existence of parts does not guarantee the existence of the

⁷⁸ Aristotle's text in the *Topics Z* 13 is elliptical. A very helpful source which I have used here is a neglected commentary by Alexander of Aphrodisias. Only the first book of Alexander's commentary on the *Topics* has been translated in English by Van Ophuijsen (2000). I have used the Greek text in *CAG* 2.2. Alexander presents a close reading of Aristotle's text supplementing it with clarifying remarks and illuminating examples that Aristotle himself does not care to present. I will tightly follow Alexander in the quest that hopefully will lead closer to the conditions of unity of a structured whole.

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whole (*Top Z 13 150a14–21*; *In Top 486.14–23*). Hence z is not x and y . Thus, if there are z 's constituents, x and y , it is not necessary that there is a z such that z is identical with x and y .

Alexander adds that this holds only for non-uniform parts (*In Top 486.24*), i.e. parts that are unlike in form, in contrast to liquids or masses, which have the same form as the whole or are synonymous with the whole (cf. *PA B 9 655b21*; *PA B 2 647b18*). It should be also noted that 'whole' here is used in a restricted sense; it is a structured whole or a composite substance. If 'whole' were applied to heaps or arbitrary sums, it would not be true that whole and parts are not the same. Aristotle admits the existence of additive or summative wholes (v.s. **2.3.1**).

2.3.3.3. A Composite Cannot Have Incompatible Components

Someone might say that the whole is not identical with (the sum of) the parts but is generated out of the parts, e.g. the house is not stones and bricks but out of stones and bricks. In that case one needs to consider whether the parts can at all be combined into something one. For some things are such that nothing *one* can come to be from them, for instance, it is inappropriate to define 'whiteness' as made up of, e.g. fire and color: if z is made up of x and y , then x and y are compatible (*Top Z 13 150a21–25*; *In Top. 486.26–487.2*). Similarly Aristotle says: "Nor is it possible for anything you please to come into contact with anything you please" (*Phys Γ 8 208a14*) and "nature does not allow any chance thing to be mixed with any chance thing" (*Met A 8 989b1*, tr. Ross, p. 1564).

2.3.3.4. Accidents Do Not Make Up a Whole

Entities out of which a whole cannot be generated are also lines and numbers (*Top 150a21–5*). Alexander adds "the accidental in general" (*In Top 486.33*) suggesting that what cannot exist by itself cannot make up a whole. Again, the hint here is to a composite substance, in which the accidents inhere. Lines and numbers, in contrast to the Platonic tradition, cannot exist on their own; they exist due to a body, whose attributes they are: if z is made up of x and y , then x and y are not accidents.

2.3.3.5. The Whole Cannot Be in One Thing and the Parts in Another

In 150a26–33 Aristotle argues that "the whole must necessarily exist in those things in which the parts exist": it is forbidden to pick parts from different things and declare that they make up a whole, "for where

parts appear, there the whole must appear" (Alex. *In Top* 487.12–13). This condition is more fully explored in 3.3.2.

2.3.3.6. Parts Cannot Perish Together With the Whole

It is wrong to define z as consisting out of x and y , if the parts, x and y , perish together with the whole z : "...the whole perishes when the parts do so, and it does not necessarily follow that the parts also have perished when the whole has perished" (*Top Z* 13 150a34–36). When the parts perish, the whole necessarily perishes, but when the whole perishes, the parts do not necessarily do so. If there are no parts, then there is no whole. If the definition mentions parts that perish together with the whole, it is false. Alexander (*In Top* 488.2–11) provides an illustration: It is a mistake to define 'body' as consisting out of planes, 'plane' out of lines and 'line' out of points, because a plane perishes with the body, a line with the plane, and a point with the line. Similarly, it is wrong to say that genus *consists* out of forms (albeit *divisible* into them), if forms perish with the genus, and that number consists out of odd and even.

2.3.3.7. Some Wholes Must Have the Same Properties As the Parts and Some Must Not

There are cases when it is wrong to define z as consisting of x and y unless z has the same properties as x and y and vice versa. Take a property, goodness or badness. If the formula ' x consists of y and z ' is accepted, then it is impossible that the compound (*συνκείμενον*) out of the parts should be either "good" or "bad", if the parts are neither good nor bad, and vice versa. But there are cases when the whole is good or bad, and the parts are neither, or the parts are good or bad and the whole is neither. (*Top Z* 13 150a36–150b1; *In Top* 488.12–18.)

Aristotle is hinting at the thought that the properties of some integral wholes are not simply the sums of the properties of the parts, i.e. there are wholes such that their properties are not reducible to the properties of the parts. As Simons (1991, p. 665–6) puts it, "some properties of a whole are not – to use Nelson Goodman's terminology – *dissective* to the parts, and some properties of the parts are not *expansive* from the parts to the whole, they do not carry over from the parts to the whole".⁷⁹

⁷⁹ However, sometimes Aristotle defends the claim that the properties of parts determine the nature of the whole: "If then no portion of earth can move away from the centre, obviously still less can the earth as a whole so move. For it is the nature of the

Even if the "goodness" of some parts outweighs the "badness" of others or the other way round, it would be wrong to say that the compound "follows that which is more". As it is not necessary that the compound out of good things is always good or out of bad always bad, so it is not necessary that what is better arises out of that which is better or out of worse what is worse. It would be true, Aristotle points out, in the case of beings that are what they are by themselves (*καθ' αὐτά*), but not always in the case of those beings that produce good (or bad) things. A lot of things produce what is good but they are not good when they are mixed with one another. Virtue is good by itself and remains good in the composition with others, for the parts of what is good by itself necessarily are good, likewise in the case of bad things. But for those things, whether good or bad or neither, which produce something, it is not necessary that what is generated out of them has to be the same as the constituents. Aristotle proves that this holds regarding health producing drugs and poisons. Constituents that are not by themselves healthy (but on the contrary poisonous) when mixed with other ingredients may generate something that produces health. On the other hand, that what is not by itself poisonous but wholesome when mixed with other ingredients may produce poison (*Top Z 13 150b1–13; In Top 488.20–489.15*).

Consider that the compound *x* consists of a "better" part *y* and a "worse" part *z*. If *x* fails to be "worse than the better and better than the worse", Aristotle remarks (150b14f), it would not be right to say that *x* consists of these parts, *y* and *z*. Alexander explains (489.17–21) that *x* which is made up of *y* and *z* "becomes the middle" between *y* and *z*, only if *y* and *z* are taken by themselves in an unmixed state. However, when the ingredients are mixed, *y* and *z* do not survive in the mixture; "through mixture with the contrary each of them becomes secondary", namely, *y* and *z* unmixed are not identical with *y* and *z* in a mixture. Thus it is wrong to say that *x* consists of *y* and *z*, if *y* and *z* are lost in *x*.⁸⁰ But if *x* consists of *y* and *z*, then *y* and *z* are preserved in *x*.

The compound does not fail to be "worse than the better and better than the worse", i.e. manages to be "in the middle", if *x* is composed out of that which is simply good or simply bad, and if each of the parts are preserved in *x*. For instance (489.21f), assume that temperance is made up of right judgment and bad desire. The constituents, *y* and *z*, are such that they are preserved in the compound, *x*. Thus temperance is better than bad desire and worse than right judgment. But, Alexander notes (489.24f), regarding those

whole to move to the point to which the part naturally moves" (*Cael B 14 296b32–5*, tr. Stocks 1922, p. 100; cf. *B 14 297b10; A 3 270a4*).

⁸⁰ On Aristotle's concept of mixture see Cooper 2004; Fine, K. 1996; Frede, D. 2004.

things which produce good or bad (versus being simply good or bad), it is not necessary that they survive in the mixture. On the contrary, such parts will change in the 'mutual composition'. Nothing prevents the compound of a better part and a worse part to be both better than each of the parts or worse than each of the parts.

2.3.3.8. The Whole Cannot Consist of Synonymous Parts

The whole cannot consist out of parts which are synonymous with the whole (150b19f). Alexander (490.5–10) gives an example: Suppose virtue x is courage y , justice z and prudence u , and each of these virtues, y , z , u , is synonymous with the whole x . What is meant is that somebody might say that $x = y$, $x = z$, $x = u$. The falsity of the supposition is shown by a counterexample: a syllable is not synonymous with its elements. Clearly, a syllable $\beta\alpha$ is not synonymous either with β or α , $\beta \neq \beta\alpha$, $\alpha \neq \beta\alpha$.⁸¹ If x consists of y and z , then $x \neq y$, $x \neq z$.

It has to be noted that 'synonymy' of parts has to be understood in a different sense than homoiomereousness: homoiomereous parts are the same as each other and as the whole but 'sameness' is not identity, since a homoiomereous part, albeit indistinguishable from the whole, differs with respect to quantity, i.e. the result of a quantitative division is a part that is 'less' than the whole.

2.3.3.9. The Whole Cannot Consist of Arbitrarily Connected Parts

It is not enough to state that x is made up of y and z without "adding the method of their composition". Aristotle (*Top Z* 13 150b23–6) makes an important point:

"For the /substance/ of each compound is not merely that it is made up of this and that, but that it is made up of this and that compounded in a particular way, as in the case of a house; for this and that material put together anyhow does not constitute a house."

⁸¹ That the whole is not identical with any of its parts is admitted also with respect to processes and motions: "Moreover, each process is incomplete during the processes that are its parts, i.e. during the time it goes on; and it consists of processes that are different in form from the whole process and from one another" (*EN K* 4 1174a20–3, tr. Irwin 1999, p. 157). Similarly: "For laying stones together and fluting a column are different processes; and both are different from the [whole] production of the temple. For the production of the temple is a complete production, since it needs nothing further [when it is finished] to achieve the proposed goal; but the production of the foundation or the triglyph is an incomplete production, since [when it is finished] it is [the production] of a part. Hence [processes that are parts of larger processes] differ in form; and we cannot find a process complete in form at any time [while it is going on], but [only], if at all, in the whole time [that it takes]" (*EN K* 4 1174a23–9, tr. Irwin 1999, p. 158).

Alexander's paraphrase of the passage introduces the notion of substance: "The explanation of a substance which consists of parts is not sufficient, if the method of composition of parts is not present." Here 'substance' designates a compounded thing, e.g. a house or a syllable. But then he immediately switches to another use of the term that is also evident in the quoted fragment by referring to the structure *of* that compound: "For the substance of each compound is the way in which the parts are compounded." The structure is that which makes the compound what it is: "Neither a house is simply stones and bricks and logs but a certain order of parts, nor a syllable is simply letters, but a certain composition of letters" (Alex. *In Top* 490.12–19).

Alexander (491.4f) refines the notion 'being together'. The expression 'y is together with z' means either that y and z are contained (i) in the same object, or (ii) in the same place or (iii) in the same time. For instance, (i) virtue is justice together with courage, both, justice and courage, are in the same receptacle, in the soul; (ii) body is a three-dimensional object with a surface; where body is, there is also surface; (iii) courage is daring together with right opinion; when there is daring, then there is right opinion. Alexander admits that these criteria are too weak, since, as Aristotle tells us (151a1f), if y or z could exist in the same time, either y or z might not be in the same thing (or the same place), and if y and z are in the same thing, either y or z might not be said with respect to the *end* of x. It also does not count if y and z are said "with respect to the same incidental subject", i.e. it is insufficient that y and z merely coincide in the same thing.

Alexander (491.4–30) elaborates this further: y and z should not be said with respect to different ends or goals, e.g. suppose that temperance is bad desire together with right opinion; each of the parts of temperance, bad desire and right opinion, are related to different goals. Even if y and z are said with respect to the same end or goal, y and z might be said with respect to some chance goal. Suppose courage is daring together with right opinion. When a doctor makes an incision in the wound, he has both daring and right opinion, and both daring and right opinion are directed to one and the same goal, namely, to cure the patient; however, it would not be correct to say that the doctor is courageous, since to cure the patient is a chance goal with respect to courage. Both parts of courage here fulfill the same goal, i.e. to cure, but the parts should be related with that very goal with respect to which courage is said. Since courage is said with respect to right action in war, so too the parts of courage, i.e. daring and right opinion, should be related to the same goal.

Finally the conclusion is reached (*Top Z* 13 151a14–19; *In Top* 492.3–11) that some definitions whose lexical form is 'x is y together with z' denote something entirely different and none of the actual meanings of 'y together with z', or anything from the previous versions, i.e. 'x is y and z' and 'x consists of, or is made up of, y and z'. Sometimes 'x is y together with z' means x is y *because of* z. For one who says that anger is pain together with an idea that one is slighted does not mean any of the previous cases; the intended meaning of this statement is that anger is pain which is caused by the idea that one is slighted. To call the fact that y is because of z 'y is together with z' is misleading. Hence we get another version: 'x is y because of z'. The 'because' designates the form or the substance of the object in question.

2.3.3.10. A Whole Is Not a Composition (*synthesis*) of Parts

Since Aristotle attempts to contract the notion 'whole' as much as possible, he says that a whole is not a composition (*σύνθεσις*), although in principle there are wholes that fit this description. He begins by imposing restrictions on composition:

"For it is not enough to speak of composition, but the kind of composition must be further defined; for flesh is not formed of these components /fire, earth and air/ put together anyhow, but there is one form of composition for flesh and another for bone." (*Top Z* 14 151a23–26; cf. *In Top* 492.13–18)

A similar point is stressed at *Met H* 2 1043a7–12:

"/If/ we had to define threshold, we'd say wood or stone lying like THIS, or house: bricks and boards lying like THIS – or again, the purpose ... would go in too in some cases; and ice: water frozen or solidified like THIS; or harmony: THIS sort of mixture of high and low; and similarly in the other cases."

Finally, a claim is made that even stating the way of composition is not sufficient. The argument is as follows: A whole is not a composition, because every 'composition' has as its contrary, viz. a decomposition, and nothing is contrary to a whole (*Top Z* 14 151a26–29; *In Top* 492.19–22).⁸² Take a genuine whole, Socrates; if Socrates was a composition, then his decomposition would not destroy

⁸² In *De Anima A* 4 Aristotle criticizes 'composition' in a different way by addressing the so-called harmony theory, according to which it is not the whole compound that is called a 'composition', but rather the form of it. "Its supporters say that the soul is a kind of harmony, for harmony is a blend or composition of contraries, and the body is compounded out of contraries" (407b30–2). Aristotle thinks that the theory is easily refutable: "That soul is a harmony in the sense of the mode of composition of the parts of the body is a view easily refutable; for there are many composite parts and those variously compounded; of what bodily part is mind or the sensitive or the appetitive faculty the mode of composition? And what is the mode of composition which constitutes each of them?" (408a10–13)

Socrates, but it does. When 'decomposed', Socrates cannot be reassembled again. Aristotle adds (151a29f) that a living being which is a compound (*σύνθετον*) is not a composition, i.e. some compounds are not compositions.⁸³ Alexander explains (493.2f) that a living being is not a composition of soul and body because a living being is an "ensouled" sensible substance. Although the soul is a certain part of a man (*Met Δ* 18 1022a32), it is not a separable part.

It is understandable that Aristotle does not want to describe some integral wholes in terms of 'composition'. However, this does not mean that nothing pertaining to 'composition' pertains to 'whole'. The notions of 'whole' and 'composition' overlap without implying that the former should be reduced to the latter. In a composition, the constituents are put together in accordance with some arrangement, whereas in a stronger whole the ingredients are merged so that they cannot be detached from one another.

2.3.4. One and the Same

This and the next section focus on oneness as sameness, viz. on such expressions as 'x is the same as y', while bearing in mind that, if x and y are somehow the same, x and y also are parts of some whole (v.s. 2.1.1). The many senses of 'the same' are given in *Met Δ* 9 1017b27–1018a9; *I* 3 1054a32–b3; 'the same' overlaps with 'one' (*Δ* 9 1018a4–5). The fact that Aristotle has as many senses of 'the same' as there is of 'one' should make us wary of reading 'same' as 'identical'. We should be cautious to attribute the concept of numerical identity to Aristotle along with Leibniz's Law, as will be suggested below (2.3.5).

The broadest sense of 'one' is 'one in analogy'. Items are one in analogy if and only if two items are related as two further items. Analogy is a relation with four terms (*N* 6 1093b18–20).

Things whose schema of predication is the same make up one genus or are one in genus (*Met Δ* 6 1016b34–5). For instance, man and horse have the same schema of predication, since 'animal' is predicable of both of them. Consequently, man and horse are subjective parts of the universal whole 'animal'.

⁸³ On the grounds of a dialectical premiss that if some compounds are not compositions, then no compounds are compositions Aristotle draws the conclusion that no compounds are compositions. Alexander (*In Top* 492.24–493.7) attempts to fix this reasoning by interpreting Aristotle as repudiating composition altogether. But this turn cannot be feasible, since compositions are wholes in a broader sense.

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A still looser connection between items is oneness in respect of analogy. Items x and y are one in respect of analogy, if x and y are related as are two further items, say, u and v (*Met Δ 6 1016b34–5*). If x and y are one in genus G , they are also one in analogy in that x is to G as y is to G (cf. Kirwan 1971, p. 140). What is one in genus is one in analogy, but what is one in analogy is not always one in genus (*Met Δ 6 1017a1–3*).

One in form are things whose formula or definition is one (*Met Δ 6 1016b33*). Sameness in definition amounts to sameness in being, i.e. in all essential properties. What is one in form is one in genus but what is one in genus is not one in form (*Met Δ 6 1017a1–2*).

Things whose matter is one are one in number (1016b32–3). What is one in number is also one in form but what is one in form is not always one in number (1016b36). The particular (*τὸ καθ' ἑκάστων*) is one (indivisible, *ἀδιαίρετον*) in number (*I 1 1052a32*). There is also a semantic characterization of 'one in number': things are one in number when the names are many but the thing is one (*Top A 7 103a9–10*).

What is one in number is either one *per se* (one *qua* continuous, *Met Δ 6 1015b36f*) or one accidentally (1015b17f). 'One *per se*' is a quantitative integral whole which was inspected in the previous chapters. Accidental oneness has been left out so far, since Aristotle is unwilling to treat accidents as parts of a substance. But accidents can be regarded as 'parts' of a different kind of whole, the accidental compound, where the 'part' is one with the whole (b24–6) or two 'parts' are one in virtue of belonging to the same thing (b26–7). Parts such as these do not "lessen" the whole when removed nor enlarge it when augmented. For this reason Alexander calls such parts 'qualitative' (*In Met 423.33–9*), in contrast to quantitative parts, which are the only items whose addition or removal makes the whole bigger or smaller. Coriscus and Coriscus minus one hair are numerically distinct items but Coriscus and artistic Coriscus are not.

Aristotle gives several cases of numerical oneness involving accidents:

(i) Artistic Coriscus: a thing and that same thing described in terms of an accident are numerically one: "it is the same thing to say 'Coriscus and the artistic' and 'artistic Coriscus'" (*Met Δ 6 1015b16–19*; cf. *Top A 7 103a29*). Similarly, there is a unity of 'man' and 'artistic' (*Met Δ 6 1015b28–34*).

(ii) Artistic Coriscus and Coriscus: "the artistic Coriscus is in a certain sense one with Coriscus because one of the portions ($\mu\omicron\rho\iota\omega\nu$) in the formula coincides in the other, I mean the artistic in Coriscus" (*Met A* 6 1015b23–6).

(iii) The artistic and the just: two accidents of one and the same subject are one because both coincide in one substance (*A* 6 1015b19–23).

(iv) Two compounds, the artistic Coriscus and the just Coriscus, are one, if a part of each – being just or being artistic – coincides in the same one thing – Coriscus (*A* 6 1015b26–27). If two things are the same, then any accident of the one is an accident of the other and vice versa (*Top H* 1 152a33–37).

Besides accidental oneness, Aristotle mentions also oneness in terms of *propria*, i.e. unique properties. Namely, something and that same thing under a description of it in terms of some property unique to it are numerically one (*Top A* 7 103a23). In contrast to accidents, *propria* are mutually necessary qualifications. The *proprium* of being capable of possessing knowledge of grammar and the *proprium* of being capable of laughing are mutually necessary in the sense that someone who is not capable of laughing is not capable of possessing knowledge of grammar and vice versa. Accidents lack that kind of mutual necessity, since someone can be just without being musical and vice versa. *Propria* should not be confused with essential properties either. A unique property, although it belongs to that thing alone, does not belong to that thing's being (*Top A* 5 102a17–19), so it is different in being from the being of that thing. To be a man and to be capable of possessing knowledge of grammar are mutually necessary properties (someone who is not a man is not capable of possessing knowledge of grammar and whoever is not capable of possessing knowledge of grammar is not a man), but we need not refer to knowledge of grammar in order to define what a man is (cf. Deslauriers 2002, p. 121).

Oneness in number includes also 'one in actuality'. Action and passion, e.g. teaching and learning are one in actuality, and in general the movement of the mover and the movement of the moved are one in actuality; their actualities coincide in the movement of the thing moved. The interval between 1 and 2 is one in actuality with that between 2 and 1, the direction 'upwards' is one in actuality with the direction 'downwards' of the same line, the road from Thebes to Athens is one in actuality with the road from Athens to Thebes, etc. But it does not follow that the things that are one in actuality are also one in being (essentially one) or have the same descriptions, like 'garments' and 'clothes' (*Phys I* 3 202a15–20; b11–

19). Oneness in actuality takes place when there are items which are numerically one but distinct in being and they coincide because they coexist necessarily.

2.3.5. Oneness in Number, Leibniz's Law, and Identity

As it is obvious from the previous section, 'one in number' is a predicate whose application depends on the relation obtaining between parts, which are not quantitatively or numerically distinct. The relation obtains because either one item inheres in the other or more items inhere in one subject.

It is crucial to detach the notion of 'one in number' from the notion of numerical identity.⁸⁴ Aristotle's talk about oneness in number is a talk about unity rather than numerical identity (cf. Charlton 1994, p. 43). If two things are numerically *one*, it does not mean that they are numerically *identical*.

The now widely accepted notion of numerical identity is the relation⁸⁵ between *identicals*, i.e. the relation everything bears to itself and to nothing else (cf. Koslicki 2008, p. 130 n. 16) and which satisfies Leibniz's Law (LL) or the principle of the indiscernibility of identicals:

If x is identical to y , then, for every property F , x has F if and only if y has F .

We already saw that two things can be the same in number without being numerically identical.⁸⁶ The artistic Coriscus and the just Coriscus have the same "matter" (i.e. subject) – Coriscus (cf. *Met A 6 1015b26–7*) and therefore both are one and the same in number (1016b32–3).

But Aristotle might have a concept of identity that hints at the contemporary notion, even though what he calls 'one in number' is something different. The idea, I think, can gain support from the following passage:

"/The/ artistic Coriscus /is one/ with just Coriscus because a part of each coincides in the same one thing /ἐκατέρου μέρος τῷ αὐτῷ ἐνὶ συμβέβηκεν/." (*A 6 1015b26–7*, my underline – L.M.)

⁸⁴ The difficulty of pinning down Aristotle's concept of identity and numerical 'oneness' is treated in Barnes, K. 1977; Burger 1987; Charlton 1994; Code 1978; Cohen 2008; Dahl 1997; Gill 1994; Hartman 1976; Jones 1972; Lewis, F. 1982; Mariani 2000; Matthews 1982; Miller 1973; Pelletier 1979; Regis 1976; Runggaldier 1989; White, N. 1971; 1986.

⁸⁵ An equivalence relation – a reflexive, symmetric and transitive relation.

⁸⁶ Similar considerations appear in Haslanger 1994, p. 139 n. 16.

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The underlined phrase "the same one thing" suggests that Coriscus is that part of both compounds which the compounds have in common and which is therefore identical in both – Coriscus is the *very* same Coriscus both in 'artistic Coriscus' and in 'just Coriscus'.

Can Aristotle's concept of identity veiled in the phrase 'the same one thing' be equated with LL? There is a passage in *Top H* 1 152b25–29 which very much resembles LL: Aristotle suggests that the statement "two things are the same" means "whatever is a predicate of the one must be a predicate of the other".

The argument in *Met Z* 17 1041b12–16 that a whole is not its elements also seems to assume LL.⁸⁷

"/But/ the syllable is not its elements, $\beta\alpha$ is not the same as β and α , nor is *flesh* fire and earth (for when they have been sundered, the wholes, e.g. the flesh and the syllable, no longer exist, but the elements [of the syllable] exist, and so do the fire and the earth."

This passage evokes the contrapositive of LL:

If there is some F which x has and y does not, or vice versa, then x is not identical to y .

Thus, two things are distinct, if they do not share the same properties, in this case – the same persistence conditions. The whole is not numerically identical to its elements, if the elements (as a sum) can survive dissolution, while the whole cannot (v.i. 4.1.1.1).

Z 17 1041a14–19 presents further reflections on identity which eludes LL. Aristotle explains that it is in vain to study the oneness of something with oneself. To ask why a thing is itself (*διὰ τί αὐτό ἐστὶν αὐτό*, Z 17 1041a14), or literally – why man is man or why musical is musical (or why any x is x) – is to ask nothing at all, because the fact that x is x and that x exists is evident. But by explaining the vacuousness of the identity question, Aristotle states a significant principle:

"/.../ each thing is indivisible from itself and that is [its] *being one*." (*ἀδιαίρετον πρὸς αὐτὸ ἕκαστον, τοῦτο δ' ἦν τὸ ἐνὶ εἶναι*, 1041a18–19)

⁸⁷ This passage (Z 17 1041b12–16) is the source from which Koslicki draws her attribution of the 'classical' concept of numerical identity to Aristotle, reading it as a Leibniz's Law-style argument (2006, p. 718 n. 13). Koslicki (2008, p. 48; cf. 2006, p. 719 n. 13) formulates Leibniz's Law as follows: "If $x = y$, then for any property, if x has it, then y has it, and for any relation and any given things, if x stands in that relation to those things, then y stands in that relation to those things."

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The only cause of a thing's being itself is that each thing is indivisible with respect to itself. The expression ' x is x ' (cf. *Z* 14 1039a34) is somewhat tricky, since we are taught to think about identity by assuming that the things between which the relation of identity holds are first somehow distinct and then, after placing the identity sign, they immediately turn out to be not distinct. Although we understand that in ' $x = y$ ' identity is a relation between identicals, the linguistic form invites us to see them as distinct. Aristotle admits that "when someone says that a thing is the same as itself /he treats/ it as two things" (*Met* Δ 9 1018a8–9). Aristotle presumably chooses expressions like 'man is man' (' x is x ') to avoid this bizarre circle of distinguishing and re-identifying identicals. Identity seems to be a trivial fact which cannot be further explained (cf. Haslanger 1994, p. 144).

Another peculiar feature of ' x is x ' is that it does not allow us to see whether Aristotle anyhow distinguishes the 'is' of identity from the 'is' of predication. When commenting on the passage Aquinas (*In Met* 7.17.5) says that "each is one with itself. Hence each is predicated of itself". What he could have meant is this:

If x is x , then x is predicated of x .

On this account the 'is' of identity merges with the 'is' of predication: identity is a borderline case of predication. Aquinas' interpretation is justifiable, since Aristotle talks about predication as a kind of equation of the subject term with the predicate term, i.e. the subject in a predication is *in a way* the same as the predicate. We can observe this, for instance, in *Phys A* 2 185b25–186a3, where Aristotle tells us about his predecessors, who were afraid to use the copula (the word 'is') in a predication because they thought that the insertion of 'is' would render one many. Some of them were afraid to say 'Man is pale', for that would suggest that *one* thing is both man and pale (many things). Aristotle does not object to the idea that 'is' renders one many but to the illusion that the rendering causes a contradiction. The predecessors fallaciously thought that "things were said to be or be one in only one way". Presumably, in some cases 'is' means identity (as in 'Man is man'), whereas in some it does not (as in 'Man is pale').

If one thinks that all predication is a part–whole relation (as in Mignucci 2000), one could infer the following:

If x is predicated of x , then x is a part of x .

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This is correct, if x is an improper part of x (for only improper parthood admits reflexivity), and since improper parthood coincides with identity, ' x is x ' means $x = x$. But it would be senseless to understand the statement as saying that if x is x , then x is a proper part of itself, for reflexivity would destroy the whole idea of proper parthood.

Aquinas emphasizes the fact that Aristotle relates ' x is x ' to indivisibility: "it is the same thing to say that each thing is one with itself and that it is indivisible in relation to itself" (*In Met* 7.17.6). Thus, x is not divisible with respect to x , i.e. x does not have x as a part:

x is x if and only if x is not a part of x .

Rewritten in a quasi-Leibnizian manner as if expressing a relation between identicals, e.g. in the form " x is identical to y if and only if x is not a part of y ", the statement would be false, since one thing's failure to be a part of another clearly is not a sufficient condition for identity of the two items.

2.4. Summary of Chapter 2

The most important results from Chapter 2 are the distinctions between different senses of the part–whole relation:

- quantitative integral part–whole;
- subjective part–universal whole;
- real substantial integral part–whole;
- conceptual substantial integral part–whole.

The quantitative integral part–whole relation applies to material parts of the composite substance and to such parts of any material aggregate, i.e. a heap. We saw that both wholes in a strict sense, such as a man or a house, and wholes in a loose sense, i.e. 'alls', such as wax or garment, or liquid, are quantitatively divisible.

The subjective part–universal whole relation applies to genera, forms, and individuals as belonging to their respective forms and genera. Thus form is a subjective part of the genus, and also an individual is a subjective part of the form. This relation is distinct from the quantitative integral part–whole relation, since the division of genera and forms is qualitative, not quantitative.

The real substantial integral part–whole relation applies to form and matter as parts of the composite substance, and, in general, to any form–matter compound. This relation is distinct from the quantitative integral part–whole relation, since we cannot obtain form and matter by quantitative division, which yields only material parts. Form and matter result from substantial division. The idea that form and matter are substantial parts can be deduced from Aristotle's statement that matter, form and the compound are substance (*H 1 1042a26–31*; Porph. *In Cat 88.15–21*).

The conceptual substantial integral part–whole relation applies to genus and differentia as parts of the form. This sense of the part–whole relation, similarly to the previous two senses, presupposes non-quantitative division. In contrast to the real substantial integral part–whole relation which talks about parts of the thing, i.e. the composite substance, the conceptual substantial integral part–whole relation talks about the form – not as a part of the thing but as an object of the formula.

The senses of part–whole that were discussed in this chapter can be ordered with the help of this table:

	integral part: an integral part is such that the whole is not predicated of it	integral whole: an integral whole is not predicated of its part
real order: a real part is not predicated of the whole	arbitrary quantity (number 3)	quantity (number 4)
	non-arbitrary quantity (number 2)	quantity (number 4)
	perceptible matter (bronze)	material compound (bronze sphere)
	<i>eidōs</i> (sphere)	material compound (bronze sphere)
	intelligible matter (lines)	<i>eidōs</i> (circle)
	a part of <i>eidōs</i> (a letter, α or β)	<i>eidōs</i> (a syllable, $\beta\alpha$)
conceptual order: a conceptual part is predicated of the whole	genus (animal)	<i>eidōs</i> (man)
	differentia (two-footed)	<i>eidōs</i> (man)
	subjective part: a subjective part is such that the whole is predicated of it	universal whole: a universal whole is predicated of its part
	<i>eidōs</i> (man)	genus (animal)
	particular (Socrates)	<i>eidōs</i> (man)

3. Mereological Principles of Parts and Wholes

The aim of this Chapter is twofold. Firstly, the aim is to investigate the possibility of characterizing the Aristotelian senses of the part–whole relation by formal properties and principles which (in different combinations depending on the nature of the theory) are accepted in most of the contemporary mereologies as characteristic to the relation which a part bears to its whole or a whole bears to its parts. I will focus on the notion of 'proper part', i.e. a part which is not identical to the whole. It is necessary to clarify and establish the notion of proper part for the sake of the main question of my dissertation, viz. the problem of unity, which would lose its footing, if the items to be unified were not proper parts. I believe that the investigation of formal mereological principles would help to better understand what Aristotle means when he says things like 'A house is *out of* stones and bricks' or 'The bronze and the angles are *parts* of a bronze cube or a bronze sphere', or 'Animal and two-footed are *parts* of man', or 'Animal is a *whole* which includes man and horse as *parts*' etc. It is important that Aristotle has the notion of proper part in mind, when he makes such statements, or else it is not clear why he should ask questions about the unity or divisibility of the items referred to in these statements.

Secondly, a conjoined aim is via the investigation of formal mereological principles to provide additional support for the claim that Aristotle has distinct senses of the part–whole relation. By distinct senses I do not mean 'proper parthood' and 'improper parthood' as contemporary mereologists might suppose. Instead, my hypothesis is that all of the Aristotelian distinct senses of the part–whole relation are senses involving proper parthood. I will strive to demonstrate that some of the contemporary principles which pertain to proper parts or to wholes consisting of proper parts also pertain to Aristotle. But one should not expect that this would lead to a consolidation of the Aristotelian senses into a single conglomerate governed by a single set of principles.

In fact, such a move would be illegitimate. If we can locate a mereological principle with respect to a particular kind of items, we should not infer that this principle is true *simpliciter*. In regard to the distinct senses of the part–whole relation, it would be a violation of the regulations of correct inference, if the mereological principles that hold in one sense would be unconditionally transferred to the other senses. This thought is in line with what Aristotle says in the *Sophistical Refutations*: if an object has a property in a certain respect, it does not mean that it has that property in all respects (167a11–4; a19–20; cf. Bäck 2011). In general, it is wrong to infer a nonqualified statement from a qualified statement.

It will be evident that the Aristotelian senses of the part–whole relation succumb to distinct principles. If a sense s_1 of the part–whole relation is governed by the principle p_1 and not by p_2 , then s_1 is distinct from those senses which are governed by p_2 .

The variance in mereological principles is a necessary and not a sufficient condition for establishing distinctions between the Aristotelian senses of the part–whole relation: even if some senses did succumb to the same principles, the consolidation of these senses under a single sense of the part–whole relation would not automatically ensue.

3.1. Basic Formal Principles of Parthood

Most of the contemporary mereologists, regardless of whether they espouse extensionalistic or non-extensionalistic theories, accept as a primitive either the relation 'part of' or the stronger relation 'proper part of'.

'Part of' is a reflexive, transitive, antisymmetric relation.

Reflexivity of Parthood (RP): x is a part of itself.

Transitivity of Parthood (TP): if x is a part of y and y is a part of z , then x is a part of z .⁸⁸

Antisymmetry of Parthood (AP): if x is a part of y and y is a part of x , then x and y are identical.

'Proper part of' is also transitive, but irreflexive and asymmetric.

Transitivity of Proper Parthood (TPP): if x is a proper part of y and y is a proper part of z , then x is a proper part of z .

Asymmetry of Proper Parthood (APP): if x is a proper part of y , then y is not a proper part of x .⁸⁹

⁸⁸ In Goodman's (1977) system transitivity of parthood is deduced as a theorem from definitions.

⁸⁹ There are extraordinary exceptions to the general acceptance of asymmetry. Thomson (1998) thinks that there are legitimate cases of symmetric parthood: clay is not identical with the statue, the clay merely constitutes it, but the statue and the clay are part of each other. Thomson (p. 155) assumes that (1) " x is part of y at t if and only if the space occupied by x at t is part of the space occupied by y at t ," and (2) " x constitutes y at t only if x and y occupy the same space at t – thus only if x is part of y at t

Irreflexivity of Proper Parthood (IPP): x is not a proper part of itself. (IPP follows from TPP and APP.)

Which of these sets of principles are chosen is a matter of taste: the stronger relation 'proper part of' can be defined in terms of the weaker one 'part of' and vice versa.

Proper Part_{df}: x is a proper part of $y \equiv x$ is a part of y and x is not identical to y .⁹⁰

Part_{df}: x is a part of $y \equiv x$ is a proper part of y or x is identical to y .

Improper Part_{df}: x is an improper part of $y \equiv x$ is identical to y .

I will examine the attribution of the above-mentioned principles to Aristotle, and indicate problems that arise, if some of these principles are assumed as unqualifiedly true in every sense of part–whole.

Before embarking on this endeavor, there is another significant aspect that cannot be left out. The properties of 'proper part' – IPP, APP, and TPP – are insufficient to express a full-blown mereology. Characterized solely by these, proper parthood is a strict partial ordering. But not all strict partial orderings are instances of proper parthood. Consider two examples (taken from Donnelly 2010, p. 5).

(i) The relation of *less than* ($<$) is a strict partial ordering that operates, for instance, in a sequence of natural numbers: $1 < 2 < 3 < 4$ etc. We do not expect that the constituents of an object have this kind of linear structure, where each of them is either a part of the next one in the sequence or has the previous one as a part.

(ii) The relation of 'proper divisor of' is a strict partial ordering that holds between a positive integer and its factors other than itself, e.g. the factors of 9 are 3 and 1, and the factors of 6 are 3, 2, 1. A common proper divisor of 9 and 6 is 3 and 1. All positive integers except the number 1 have a common proper divisor, viz. the number 1. It would follow then that all parts of an object (or even all objects) share a common proper part.

and y is part of x at t ." Since the statue and the clay occupy the same space, they are part of each other. Thomson's assumptions that lead to symmetric parthood are followed by Donnelly (2010, p. 12).

⁹⁰ Donnelly (2010, pp. 9–10) argues that this formulation allows parthood to be symmetrical. In order to exclude this possibility one should choose a stronger definition: x is a proper part of y if and only if x is a part of y and y is not a part of x . This formulation is adopted by Varzi (2010).

To avoid this, mereologists add a principle of supplementation, which provides a decomposition of a whole into its proper parts. A mereology can be build also by other means, i.e. by accepting some kind of composition principle, for instance, Goodman in his *Calculus of Individuals* endorses arbitrary (or unrestricted) summation, i.e. Existence of a Sum. The supplementation and composition principles will be sketched and attributions of them to Aristotle will be evaluated after the basic formal principles are examined.

3.1.1. Reflexivity vs. Irreflexivity

The argument in *Phys A 3 210a 25ff* that nothing is 'in' itself can be read as evidence for attributing irreflexivity of proper parthood to Aristotle.

"One might raise the problem whether a thing can be in itself, or whether nothing can, but everything is either nowhere or in something else. This is a double question, depending whether we mean the thing itself /καθ' αὐτό/ or relatively /καθ' ἕτερον/. For when there are parts of a whole, one in which something is, the other that is in it, the whole will be said to be in itself; for it is said to be so relatively to its part. Thus one is said to be white because one's surface is white, and learned because one's intellect is. So a jar will not be in itself, nor the wine; but the jar of wine will be. For what it is and what it is in are both parts of a whole." (*Phys A 3 210a 25–33*)

A thing cannot be in itself with respect to itself. It can be in itself with respect to something else, viz. to a part. The combination of the parts, i.e. the whole, is in itself, because a part of it is in another part of it: the jar-of-wine is in itself because the wine-content is in the jar-continent; by extension (although Aristotle does not say this directly) the white man is in itself because whiteness is in the surface; the learned man is in itself because learnedness is in the intellect. The whole can be called after its part, e.g. man is called white due to the whiteness of the surface of his body.⁹¹ By analogy it seems plausible to suppose that the jar-of-wine can be called 'wine' or 'jar'.

"So in that way it is possible for a thing to be in itself, but it is impossible in the primary sense. For example, white is in the body, since the surface is in the body, and learning is in the soul. It is in relation to these parts, taken as being in the man, that the man, for example, is called white. The jar and the wine separately are not parts, but together they are; so when they are parts the thing is in itself." (*Phys A 3 210a 33–b4*)

⁹¹ This suggests that Aristotle takes whiteness to be a part, although strictly speaking an attribute is not a part, if we follow the terminology in the *Categories*. Simplicius (*In Phys 554.15–16*) makes a good point that Aristotle "seems to call anything contributing to the whole a part".

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Simplicius (*In Phys* 554.30) notes that Aristotle here explains the distinction between 'primarily' and 'in respect of something else'. Color primarily is in the surface but it is in a body in respect of something else, i.e. the surface. Learning primarily is in the intellect, but it is in the soul and in the man in respect of something else, i.e. the intellect, the rational part of the soul. A body is not white primarily, but in respect of its part, the surface. If the color is in the surface primarily, it does not follow that the white surface cannot be in itself (since the white surface consists of white and surface); what follows is that the color 'white' cannot be in itself. Something can be in another thing primarily but nothing can be in itself primarily.

Simplicius makes a crucial point: "if the surface is white primarily /i.e. if whiteness is in the surface primarily/ it does not follow that the surface and the white are the same thing" (*In Phys* 555.15–16). This is what Aristotle says (210b8): the surface and the color are different in form or in nature.

"From an inductive point of view we see nothing that is in itself in any of the senses distinguished, and rationally it is clearly impossible. For each thing will have to be both, e.g. the jar both vessel and wine and the wine both wine and jar, if it is possible for a thing to be in itself. So if they were completely in each other, the jar would receive the wine, not as being wine itself but as the wine is wine, and the wine will be in the jar, not as being the jar itself, but as the jar is a jar. Thus it is clear that they are different in essence, for the accounts of container and contained are different." (*Phys.* Δ 3 210b8–17)

Aristotle exhorts us to understand that by studying separate cases (i.e. 'from an inductive point of view') it becomes evident that there is no sense in which something can be 'in' itself primarily.

Simplicius (*In Phys* 556. 2–16) elaborates on each of these senses. (For the many senses of 'in' see the preamble to 2.2) The elaboration is very important in terms of negatively answering the question whether Aristotle accepts reflexivity. Simplicius (556.2–11) provides reasons why there is no sense of 'in' according to which something can be 'in' itself in its own right.⁹² (I have skipped what Simplicius has to say on the non-mereological senses of 'in'.)

"/556.2–3/ For the part in the whole is not in itself, since the part is other than the whole, /556.3–5/ nor is the whole that is in its parts *qua* parts in itself, since the parts are many and different, but the whole is one. /556.5–6/ For if the whole is not additional to the parts, still being a whole is one thing, being parts another. /556.6–8/ Nor can a thing be in itself in the sense of being in a

⁹² I have represented Simplicius somewhat tendentiously. The reasons that Simplicius lists are disputed later on (560.10ff), so that in the end it turns out that a thing can be in itself. Simplicius wants Aristotle's theory to be compatible with Plato's views in the *Parmenides* (145b; 138a), so he modifies Aristotle's account. Simplicius' modification of Aristotle's theory deserves a separate study.

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genus; for nothing is its own genus, if genus is different from /form/. /556.8–9/ Even when something is in its /form/ as a genus, it is not in itself; for the genus is a part of the account of the /form/, /556.9–10/ and it is impossible for a thing to be both part and whole. /556.10–11/ Nor is the form that is in the matter in itself; for in matter it stands apart from itself." (Simpl. *In Phys* 556.2–11)

If no part is such that it is a part of itself, and everything which is a part is a part of a whole, then every part is other than the whole (556.2–3). The moral of the argument is that the notions 'part' and 'whole' are essentially different. Nothing which is regarded as a whole is simultaneously a part and vice versa (556.9–10).

The whole is not in itself because the whole is in its parts, which make up the whole. The fact that the whole is different from the parts does not mean that the whole is additional to the parts. The difference between the whole and the parts is that the parts are many but the whole is one (556.3–6; cf. 559.32–33).

If form is in a genus, form is not in itself, but in a genus. Nothing is its own genus: the notions of 'genus' and 'form' do not coincide (even if their extensions may do so). When a form is distinguished within a genus, genus and form differ (556.6–8).

Genus and form differ even if a genus is distinguished within a form, because at this time form is taken as a whole and genus – as a part. Hence also if genus is in its form, genus is not in itself, but in the form (556.8–9). In one sense form is the whole, in another sense genus is the whole, but in no sense anything is both a part and a whole (556.9–10).

Form is not in itself, for it is in matter. However, form is not a part of matter, because "in matter it stands apart from itself" (556.10–11). Form is in matter in the sense that form turns matter into one substance.

That nothing can be in itself primarily or in its own right can be recognized also by deductive reasoning. Simplicius suggests that it is proved by the second form of hypothetical argument (or *modus tollens*):

"If/ there is something that is in itself, then different definitions will belong to the same thing, but this is impossible, therefore there is nothing that is in itself." (*In Phys* 556.24–6)

Neither the jar nor the wine can be in itself, since, if each of them were, each of them would have to be both the wine and the jar: the wine (because it is in the jar) would be 'wine *qua* contained' plus 'jar *qua* container' and the jar (because the wine is in it) would be 'jar *qua* container' plus 'wine *qua* contained'. The

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same thing will have different accounts *qua* container and *qua* contained. Thus the same thing due to having different accounts will be different from itself, which is absurd because nothing can be different from itself (Simpl. *In Phys* 557.3).

The wine and the jar can be said to be completely in each other only in the sense that one of them is in the other (557.8–10). The jar receives wine without becoming wine and wine is in the jar without becoming jar. No absurdity results from two definitions fitting the same thing (the jar of wine), if that thing is that which can be in itself with respect to something else: the jar of wine can be defined as that which receives or as that which is received (557.20–22).

So also 'deductively' it is shown that nothing can be in itself in its own right. The metaphors of 'container' and 'contained' is a way of speaking generally about 'whole' and 'part'. Nothing can be a whole and a part at the same time, or else that thing (supposing that it were possible for it to be both a whole and a part at the same time) will be different from itself.

Thus, it is evident that in no sense of 'in' reflexivity holds. Since the senses of 'in' that were investigated here overlap with the senses of 'part' (except for the sense in which the whole is 'in' its parts), it is plausible to conclude that in Aristotle's view every part–whole relation is governed by irreflexivity.

3.1.2. Asymmetry, Anti-symmetry, Symmetry

Does Aristotle accept asymmetry (APP)? APP operates definitely with respect to quantitative parts, which are 'less' than the whole (Alex. *In Met* 423.33–9). For surely 'to be less' is an asymmetric relation. APP holds also with respect to terms of the syllogism. In Aristotle's theory of demonstration it is required that the middle term is 'smaller than', i.e. a part of, the first extreme (*An. Pr A* 31 46b1–2). We do not find this explicitly in Aristotle, but by saying that the larger can only be predicated of the smaller (as animal of man) and not vice versa, Porphyry links 'smaller' and 'larger' with *eidōs* and genus (*Isag* 7.4–8).

One might argue that Aristotle cannot accept APP on the grounds that he simultaneously holds the following propositions to be true: 'man is a part of animal' and 'animal is a part of man'. This *prima facie* looks like a denial of APP. However, this can be easily remedied by means of Aquinas' distinction between integral and subjective parts. Here the expression 'is a part of' contains two different meanings of

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parthood: 'is a subjective part of' or 'is an integral part of'. Thus, even if it seemed that there was symmetry, this was only because relation 'is a part of' includes two different meanings of part.

We can see also that Aristotle fails to accept antisymmetry (AP). If he accepted AP, he would have to admit that there are cases in which two things are part of each other *in the same sense of parthood*. If the statements that genus is a part of form and form is a part of genus did characterize the same sense of parthood, AP in conjunction with these claims would yield that genus and form are identical. But we know from previous exposition that form that are parts of genera and genera that are parts of form are related through different part–whole relations: form is a part of genus as a subjective part of a universal whole, while genus is a part of form as an integral part of an integral whole.

Kit Fine (1992, p. 45) argues that direct evidence for Aristotle's acceptance of asymmetry is the claim at *Met A 2 1013b8–11*: "things may be causes of one another /../ yet not in the same sense". This gives additional support to the previous argument, as it is evident, if 'cause' is substituted with 'part': 'things may be *parts* of one another yet not in the same sense'.

The following table summarizes the status of the principles in two senses of parthood.

Relation	Example 1	Example 2	Symmetry (Y/N)	Asymmetry (Y/N)	Anti-symmetry (Y/N)
'is a part of'	Animal is a part of man (TRUE)	Man is a part of animal (TRUE)	Y	N	Y
'is a subjective part of'	Animal is a subjective part of man (FALSE)	Man is a subjective part of animal (TRUE)	N	Y	N
'is an integral part of'	Animal is an integral part of man (TRUE)	Man is an integral part of animal (FALSE)	N	Y	N

APP holds if an expression does not have the same truth value as its inverse. The only case when APP does not hold is when the relation 'is a part of' is stated without qualification. But when the relation 'is a part of' is unfolded, parthood is asymmetric.

Not all senses of part given by Aristotle need to be analyzed in this manner. For instance, the expression 'Bronze is a part of sphere' is true, while the expression 'Sphere is a part of bronze' is false. No additional interpretation of the relation 'is a part of' is necessary. In both cases the inverse of the original expression is false and the principle of APP holds.

3.1.3. Transitivity

Examples of TPP that can be found in Aristotle's text are stated with respect to quantitative parts and accidents. This is bizarre, since accidents are not 'parts' strictly speaking. Moreover, he connects these different parts in one transitive chain: "white is in the body, for the surface is in the body" (*Phys* Δ 3 210a34–b1); "white is in the man because it is in the body, and in that because it is in the surface" (210b4–5).

Another occurrence of TPP is attributed to Aristotle by Simplicius, where we can observe TPP in the context of quantitative parts. Aristotle in *Phys* 210a15–16 explains that a part is in a whole as a finger is in the hand. Simplicius provides a further example that a hand is in the whole body (*In Cat* 46.8–9) and concludes: "/A finger is/ in the hand as a part and in the whole body as a part of a part" (*In Phys* 551.19–20).

TPP is uncontroversial in the case of homoiomerous parts, i.e. parts which are the same in form as the whole. For instance, any part of water is water. A more curious example is flesh: divide flesh ad infinitum and all you get is yet a smaller piece of flesh. Aristotle can hold that flesh also is infinitely divisible, because he does not think that there are material atoms.

TPP holds with respect to subjective parts of a universal whole: genus can be divided into forms which can be divided into further forms until the last form is reached.⁹³ A part of a form is also a part of genus, as is manifest in the predication of the genus to the part of the form (cf. *Porph. Isag* 7.8ff).

In general, TPP works whenever there is a part of a part.⁹⁴ It should be always taken into account what senses of 'part' are under investigation, viz. whether the talk is about formal or material parts. Thus, there are the following special cases of TPP which cannot intersect:

If x is a material part of y and y is a material part of z , then x is a material part of z .⁹⁵

⁹³ Ammonius *In Isag* 9.27–10.8 distinguishes three ways of cutting forms into forms: division (*διαίρεσις*), incision (*ἐπιδιαίρεσις*), and subdivision (*ὑποδιαίρεσις*). Division and incision are two different cuts of the same genus: division is when animal is divided into rational and non-rational; incision is when animal is divided into mortal and non-mortal. However, subdivision is a cut of a part or a form of the already divided genus, e.g. the genus 'animal' is subdivided into 'wanderer' and 'non-wanderer', since 'heavenly being', which is the form or the part of 'animal', is divided into 'wanderer' and 'non-wanderer'. Subdivision is a direct example of TPP usage.

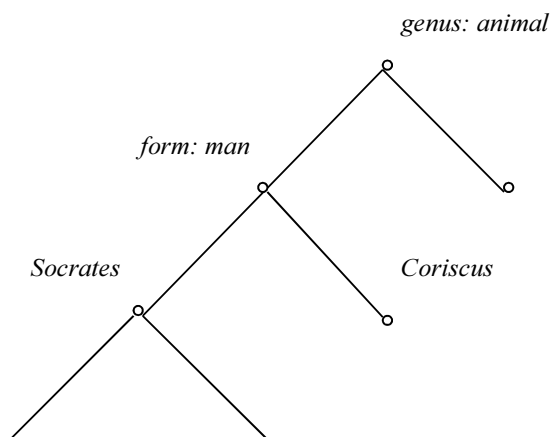
⁹⁴ Interestingly, Ammonius *In An. Pr* 8.34–36 notes that a part of a part is called 'portion' or 'particle' (*μόριον*), e.g. a part of philosophy is theoretical science, but a portion of philosophy is theology.

If x is a formal part of y and y is a formal part of z , then x is a formal part of z .

TPP becomes problematic, (i) if one supposes that all Aristotelian senses of part–whole are reducible to a single asymmetric and transitive relation and (ii) in cases where the division has yielded only two parts. I will briefly discuss these issues below.

3.1.3.1. A Single Asymmetric and Transitive Relation?

Let us assume for the sake of argument that all of the senses of 'part' in Aristotle are governed by a single asymmetric and transitive relation. It requires that we suppose that a part of form (or a part of matter) is a part of a form–matter compound, say, Socrates or Coriscus, which is a part of form 'man', which in turn is a part of genus, animal. To illustrate the idea, let us draw a constituency tree, where the initial node designates the whole and its immediate descendants designate the immediate constituents of the whole, whose constituents designate the mediate constituents of the whole, and so we go until we reach the bottom (cf. Kit Fine 1992, p. 50). (This graph, or any other, is merely an illustration and not a formal tool.)



⁹⁵ Kit Fine (1992, p. 41) formulates transitivity for the relation 'matter of': If x is the matter of y and y the matter of z then x is the matter of z . This, however, differs from transitivity for material parts, since 'matter of' extends through different levels of constitution (e.g. if fire and earth is the matter of flesh and flesh is the matter of a hand, then fire and earth is the matter of a hand), whereas 'material part' operates on the same level (e.g. if a finger is a part of a hand and a hand is a part of Socrates, then a finger is part of Socrates).

There is a difficulty (formulated by Koslicki 2008, pp. 157–158), which challenges attempts to squeeze these items in such a constituency tree. Consider two form–matter compounds, Socrates and Coriscus. Both Socrates' and Coriscus' form is composed of a genus and a differentia, viz. rational and animal. By TPP Socrates and Coriscus have among their parts the genus 'animal' and the differentia 'rational'. But Socrates and Coriscus are also themselves parts of the form 'man' which in turn is a part of the genus 'animal'. It turns out that the genus 'animal' is a part of Socrates and Coriscus, and, *contra* APP, Socrates and Coriscus are parts of the genus 'animal'. By TPP it also turns out that Socrates is a part of Coriscus and Coriscus is a part of Socrates.

Koslicki (2008, p. 158; cf. 2007, p. 138–9) suggests three variants how Aristotle could avoid the difficulty: he has to either (i) reject TPP or APP, or (ii) propose that "form, in the sense in which it is a part of any form–matter compound, is *not* to be identified with definition", where definition is genus and differentia, or (iii) suggest that "the sense of 'part' in which, say, form is part of an individual man is not the same sense as that in which, say, Socrates is part of the form, man". Koslicki wants Aristotle to have a single asymmetric and transitive relation of proper parthood, therefore she cannot accept either (i) or (iii), so she opts for (ii). The third option seems very unattractive to her because she thinks that it "ultimately leads to a proliferation of primitive, *sui generis* relations of parthood and composition, whose formal characteristics must be explicitly imposed on them by means of distinct bodies of postulates".⁹⁶

Contrary to Koslicki, I think that the most plausible option is (iii). There is no textual justification in deflating Aristotle's theory. Quite the reverse, Aristotle has explicitly stated *several senses of 'part'*. I hold that form has parts (this does not necessarily amount to identifying form with definition) and that all the mereologically analyzable entities mentioned above cannot be chained together by a single relation of parthood.

Although the thread of transitivity is ruptured as many times as there are senses of 'part', there is nothing special that changes about the application of transitivity within a given sense of 'part'. Thus in one sense,

⁹⁶ Haslanger (1994, p. 135 n. 12), similarly to Koslicki, thinks that different senses of 'part' can be linked together via transitivity. (In effect, these senses do not seem to be really different.) She does not address any difficulties that result from this view. It is merely pointed out that transitivity stipulates hybrid part-whole relations: "If Socrates' flesh is a (material) part of Socrates, and if Socrates is an (individual) part of the species Human Being, then Socrates' flesh will be a hybrid (material cum individual) part of the species Human Being." Haslanger does not give any reasons why Aristotle would have accepted that transitivity cuts across various kinds of 'part'. This also contradicts Haslanger's (p. 132) statement that "...Aristotle's views on part and whole are complex, and he is working with more than one part-whole relation".

where form is a part of genus, it runs from genus through the form to the individuals, and in another sense, where genus is a part of the form, it runs from the highest genus to the lowest differentia.

One might argue that the difference in sense is not due to the fact that there are different relations of parthood but due to the fact that the term 'genus' itself is ambiguous. The chain is snapped because the links of the chain are incompatible. Thus, one might insist that the statement 'Genus is a part of form and form is a part of genus' is true, if the referent of the first occurrence of 'genus' (and of 'form' respectively) is not identical with the second. Then there would be the following proliferation of entities: 'genus having form as a part' = $genus_1$; 'form being a part of genus' = $form_1$; 'form having genus as part' = $form_2$; 'genus being a part of form' = $genus_2$. Let us assume that $genus_1$ is a set of specimens, and $genus_2$ is a set of properties that belong to a single individual. It follows then that $genus_2$ is not a part of $genus_1$, since the former cannot make any contribution to the latter. Namely, a set of properties belonging to Socrates fails to belong to the class, to which Socrates belongs as a specimen.

This objection is rebuttable as follows: although genus is 'said in many ways' (*Met A* 28 1026b6–9), there is no distinction between genus as a set of specimens and genus as a set of properties. The sense of genus which fits the case under consideration is 'genus as matter'. None of the rest of the meanings, i.e. 'genus as continuous generation' and 'genus as begetter' is appropriate. Genus as matter functions both as a subject (of differentia) and as a predicate (viz. a universal said of its form as subjects). This is the confusing elegance of Aristotle's thought: genus has the *same* meaning but it operates under *different* headings of 'part': universal and integral (v.s. 2.3.1). This is the reason why Aristotle says that "a genus is also called a part of its form, although *in a different way* the form *is a part* of its genus" (*Met A* 25 1023b24–5, my italics and boldface – L. M.). The talk is about the same genus which is entangled in different part–whole relations.

There is another difficulty that would arise, if the string of transitivity were not severed by means of the distinction between integral and subjective parts. The difficulty is formulated by Mignucci (2000, p. 6). Take the proposition 'Camels are animals' and interpret it as 'camel is part of animal'. If one assumes that transitivity of the part–whole relation extends from subjective to integral parts,⁹⁷ then one is compelled to admit that the tail of Hali's camel is an animal.

⁹⁷ Mignucci uses the terms 'predicative' and 'constituent' parts.

3.1.3.2. Transitivity in a Model with Two Parts

TPP is problematic in cases when the division is such that it cannot yield more than two parts – when a compound is divided into form and matter or when form is divided into genus and the last differentia – the two parts cannot be parts of anything else but of the whole of which they are the parts. They are purely atomic and unconnected to anything below or above them except the whole whose division has yielded them. But if the whole happens to be a part of another whole, these two will not necessarily be parts of the other whole, because parts of that whole might result from a different division. We already saw that if Socrates, who can be divided into matter and form, is a part of form 'man', form and matter as parts of Socrates are not parts of the form to which Socrates belongs, because the division of form into individuals is a different division than the division of an individual into form and matter.

The division into two parts, which (within that division) are atomic and mereologically unrelated to anything except their whole, represents a system consisting of just one whole with two parts. If these two items are proper parts, TPP becomes indeed problematic. TPP is a property of a proper part, thus the atomic elements belonging to the whole should also have the property of TPP. However, TPP describes the relation between the whole, a part of the whole, and a part of this part. But in the above-mentioned system there are just the whole and its two atomic parts.

The problem can be narrowed down by the following consideration. If the whole consists of at least three atomic parts, any two of these parts can be united in a 'secondary' whole, which would be a proper part of the initial whole. Thus, then there would be three objects: the initial whole x , its atomic parts, y , z , u , and the sum of any two of these atomic parts, $y+z$, $z+u$, $y+u$. If it is assumed that the universe (the initial whole) consists of indivisible atoms, then a certain number of atoms can be united in a whole, which on the one hand would be a part of the universe, and on the other hand would consist of atoms. Such a constellation would allow transitivity.

But if the whole consists of just two indivisible parts, the creation of such 'secondary' wholes is suspicious, because then we would have to assume that the whole has a part which is the sum of all the parts of the whole. Namely: the only parts of x are y and z , which are united into $y+z$, and the sum, $y+z$, is labeled as a further part of x . For instance, if the whole consists of form and matter, on this assumption it would follow that the sum of form and matter is another part of the whole. But it was posited from the start that the whole was divided only in two parts, i.e. form and matter.

If someone corrected us and said that the sum is not a further part but the only immediate part of the whole, which has the atoms as its mediate parts, since they are parts of that immediate part, the suspicion would remain for the same reason that the whole was divided into two parts. And these – being the only products of the division – have to be labeled as immediate.

Also, if the sum of the atoms were the only immediate part of the whole, the question would arise whether it is a proper part of the whole at all. Some contemporary mereologists (Donnelly 2010; Gilmore 2009, p. 119 n. 45) seem to allow wholes to have single immediate parts. But Aristotle thinks that a whole cannot have a single immediate part, for a division ($\delta\iota\alpha\acute{\iota}\rho\epsilon\sigma\iota\varsigma$) is always a cut into more than one part (cf. *Met A* 6 1016b4; *An. Post B* 13 97a35f).

One might argue for yet another strategy in trying to implement TPP in a universe consisting of just two atoms. The strategy would be to let a part of the whole to have a single part. The chain of objects then would be as follows: the whole x which consists of an indivisible part y and a part z' which consists of the atom z . It is clear that also in this case there would be an object that consists of a single proper part: z' that consists of z , which is inadmissible. As a whole is banned from having a single immediate part, likewise no part of the whole is allowed to have a single immediate part, because a part which has parts is itself a whole – the part z' turns into a secondary whole consisting of one atomic element z .

Taking into account the results of the two issues, we have to conclude that (i) transitivity cannot chain together two (or more) distinct senses of part–whole, and (ii) there are divisions which yield only two parts, and since these divisions represent distinct senses of part–whole, the parts of these divisions cannot be linked to other parts outside these divisions. Thus (in contrast to irreflexivity and asymmetry which hold in every sense of part–whole) transitivity fails to hold in every sense of part–whole.

3.2. Decomposition (Supplementation) Principles

In this chapter I will review the possibility to attribute several decomposition or supplementation principles to Aristotle. ('Decomposition' and 'supplementation' are alternative designations for the same operation of fixing formal conditions when there are parts of a whole.) I will show that the distinct senses of the Aristotelian part–whole relation manifest a variability in the decomposition principles to which these senses succumb. This provides additional support for the claim that some of the senses are irreducible to others.

3.2.1. Overly Weak Supplementation Principles

In the contemporary literature there are several decomposition principles of varying degrees of strength. Let us first consider two supplementation principles that are clearly too weak (taken from Simons 1987, p. 27–8):

Weak Company:⁹⁸ if x is a proper part of y , then there is a z such that z is a proper part of y and z is not identical to x .

Strong Company: if x is a proper part of y , then there is a z such that z is a proper part of y and z is not a part of x .

Weak Company is too weak, because it allows a model with an infinitely descending chain of parts. We can illustrate the idea by means of a constituency tree. The nodes represent objects and the lines going downwards stand for the relation of a whole to a proper part.



Weak Company

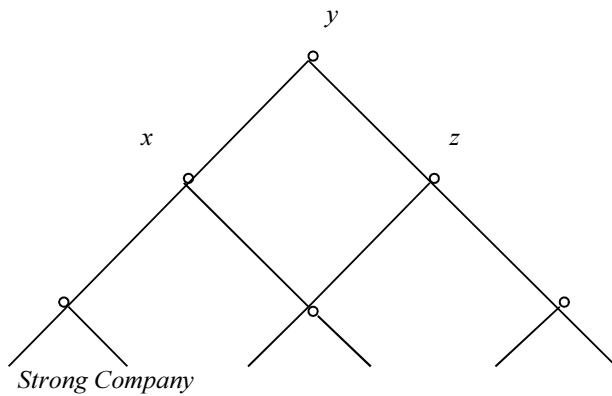
Strong Company rules out the model above but satisfies an equally unacceptable model below, where all the proper parts overlap one another. For even if z is not a part of x , there could be a part of z which is also a part of x .

The contemporary concept of overlap is defined as follows:

Overlap df. x and y overlap $\equiv x$ and y have a common part.

⁹⁸ Weak Company and Strong Company are names coined by Varzi 2010.

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Aristotle does not discuss these overly weak supplementation principles, but he turns down the models that can be drawn in accordance with these principles. If he rejects the models, he should also repudiate the principles which make such models possible. First, Aristotle would spurn Weak Company, which permits an infinitely descending chain of parts. In *Met a* 2 994a3–5 it is stated that the causes of things do not form an infinite series. The most demonstrative example of the impossibility of an infinite chain is material causation.

"/One/ thing cannot proceed from another, as from matter, *ad infinitum*, e.g. flesh from earth, earth from air, air from fire, and so on without stopping." (Tr. Ross in Barnes 1984, p. 1570.)

A clear formulation of this principle can be found in Kit Fine's (1992) reflections on the Aristotelian conception of matter:

"There is no infinite sequence of objects x_1, x_2, x_3, \dots such that x_2 is the matter of x_1 , x_3 is the matter of x_2 , and so on *ad infinitum*." (P. 40.)

Kit Fine (p. 36) suggests treating the relation 'matter of' in terms of constitution, focusing on the matter of a thing in so far as it is what makes up the thing. He thereby merges the notions of 'matter' and 'part' and leaves such concepts as 'form' and 'compound' out of the confines of the theory.

But the principle stated with respect to the case of matter can be extrapolated to other cases of causation – efficient, final, and formal (994a5ff). Interestingly, Aristotle calls members of infinite chains 'parts' (*μῶριον*, 994a19), which suggests that the prohibition of infinite chains can be treated as a general mereological concern. Thus, we can generalize Kit Fine's formulation and posit a similar truth in Aristotle with respect to any kind of parthood:

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There is no infinite sequence of objects x_1, x_2, x_3, \dots such that x_2 is a part of x_1 , x_3 is a part of x_2 , and so on ad infinitum.

Concerning the other overly weak principle, Strong Company, Aristotle would turn it down at least with respect to continuous wholes, because he does not allow the existence of a whole, all of whose parts share a part with (i.e. overlap) one another.

Aristotle has an analogue to the contemporary concept of 'overlap'. In *Phys E* 3 227a11–12 he gives the definition of two things' being continuous (*συνεχέες*):

"For/ I mean by one thing being continuous with another that those limiting extremes of the two things in virtue of which they touch each other become one and the same thing /../" (Wicksteed & Cornford 1996, p. 39.)

Although, according to Aristotle, sharing a limit is not exactly the same as sharing a part, since a limit (*πέρας*) is not a part strictly speaking (*Δ* 8 215b18–19) because objects are not divided into or composed out of limits, the idea of overlap still remains, for in the above-mentioned definition there is the notion of two objects' sharing one and the same thing, i.e. they have something (a limit) in common.

The idea that there cannot be an object all of whose parts overlap one another can be attributed to Aristotle on the grounds that he admits the impossibility of a continuous whole all of whose parts share a limit or a boundary with one another. He never gives an explicit proof of this, but we can deduce the idea from his emphasis that the continuous is potentially divisible *ad infinitum* (*Γ* 7 207b16–17). Thus, if it were possible for a continuous whole to be such that all of its parts share a boundary with one another, the whole in question would be indivisible in all respects. But it is divisible, even *ad infinitum*, hence all of the parts cannot share a boundary with one another.

Thereby we can see that Aristotle rejects both overly weak supplementation principles. But what kind of supplementation principle does he accept? The intuition behind the idea that all of the parts of a whole cannot overlap each other is that complex objects must have parts that are *disjoint*. Most of the contemporary mereologists agree on the following definition of disjointness:

Disjointness_{df.} x and y are disjoint $\equiv x$ and y do not overlap.

Aristotle never explicitly uses the concept of 'disjointness' but he often talks about 'separateness'.

'Separate' ($\chi\omega\rho\iota\varsigma$) sometimes means 'capable of independent existence' (cf. *Cat* 2 1a25) but it can also mean 'not sharing a common definition'. The latter indicates a lack of common content of the items that are told to be 'separate' (*Met* Δ 6 1016b2; Δ 23 1023a20; *Z* 11 1036a34; *Z* 10 1035a4-6, *H* 1 1042a29–31; *Phys* *A* 2 185b32; *B* 1 193b6; 194b12). An example of such separation is that between 'surface' and 'color':

"And these things, the surface and the white, are different in form and each has a different nature and power." (*Phys* Δ 3 210b6–8)

Things that are not separate (unless 'separate' means independent) cannot have different natures, they should have at least some community of content. But if such a community is lacking, surely they are separate and they do not share a common part: although the surface is colored, nothing that is a part of color is also a part of the surface and vice versa. This inability to share a common part is also at the heart of the contemporary notion of disjointness.

3.2.2. The Weak Supplementation Principle

Peter Simons (1987, p. 27) points out that complex objects must have *at least two disjoint parts* such that the removal of one part leaves a remainder. A supplementation principle which expresses this idea is the Weak Supplementation Principle (WSP).

WSP: if x is a proper part of y , then there is a z such that z is a proper part of y and z is disjoint from x .

Simons thinks that WSP plus APP and TPP are minimal principles that constitute "the formal skeleton of the meaning of 'part'" (Simons, 1987, p. 362).⁹⁹ WSP prohibits composition out of a single proper part.¹⁰⁰

⁹⁹ In Simons' system the variables are free, therefore he needs an additional principle, i.e. Falsehood Principle: if x is a proper part of y then there is exactly one of x and there is exactly one of y (1987, p. 362).

Alternatively: "...if an object is part of another, both objects exist" (1987, p. 383).

Koslicki (2008, p. 167) also accepts APP, TPP and WSP as a basis of her mereology.

¹⁰⁰ Composition out of a single proper part presumably takes place in the case of singleton sets. While the set /Socrates/ contains nothing but Socrates, it is still distinct from its sole proper part, Socrates. There are no proper parts disjoint from Socrates, yet /Socrates/ and Socrates are not identical. Koslicki (2008, p. 180 n. 20; cf. 2007, p. 156 n. 29) argues that the singleton set containing Socrates does not violate WSP: /Socrates/ has a disjoint proper part besides Socrates, but this part is not another member (or else the set would not be a singleton) – it is 'something else': the additional parts are *formal components* which can be expressed via the axioms of set theory.

The attribution of WSP to Aristotle depends mostly on the interpretation of *Met Z* 17 1041b11–33. This passage is pivotal in regard to Aristotle's mereology and it will be analyzed in detail with respect to the problem of unity. (The passage is fully quoted at the beginning of 4.1.)

Aristotle argues that when a compound is not a heap but a whole, it has something else beyond its elements, and this 'something else' is not an element but a principle, i.e. form. Aristotle inspects two cases – when the 'something else' is an element and when it is a compound of elements – and concludes that both cases lead to undesirable results.

- (i) If the 'something else' is an element beyond the original elements of which the whole is said to be composed, then a regress follows, since it would be necessary to posit yet another element that binds the original elements with the additional element and so *ad infinitum* (1041b20–22).
- (ii) If the 'something else' is 'out of' an element, a similar undesirable consequence takes place (1041b22–5). The consequence is not spelled out, but a fair guess is to assume that in this case the regress occurs within the 'something else' which was posited to bind the original elements.

In the second argument at 1041 b22–3 Aristotle makes a seemingly trivial remark – if the 'something else' is 'out of' an element, it is out of more than one, otherwise, i.e. if the compound consists of only one element, "that one will be the thing itself" and we return to the results of the first regress:

"And if it's made 'out of' an element, clearly it won't be 'out of' one but more than one, or else [if of only one] that one will be the thing itself /../"

The interpretation of this remark has far-reaching implications with respect to the question whether we can attribute WSP to Aristotle.¹⁰¹

The remark at 1041b22–23 contains two statements:

- (1) If *y* is made out of an element, *y* is not made out of one element, but more than one;
- (2) If *y* is made out of only one element, that element is *y* itself.

¹⁰¹ Koslicki (2006, p. 719 n. 14) thinks that here Aristotle explicitly states WSP. I will examine her view below along with other commentaries on 1041b22–3.

The first statement is an outright endorsement of WSP, if it is surmised that the two elements are disjoint. The second statement is compatible with WSP, if it is read as saying that when a composition out of a single element takes place, the compound is identical with its element: if x consists of y and nothing else, then $y = x$. If (2) violated WSP, (2) would have to imply that the compound was not identical with its sole element. Moreover, (1) entails (2) and vice versa, since (2) is a contraposition of (1).¹⁰²

Aristotle has to make the assumption that the whole is nothing but the element (or elements) in order to argue towards the conclusion that the whole has to contain 'something else'. Thus, if it is assumed that all wholes are nothing beyond their elements and there is a whole consisting of a single element, this whole will be identical to its sole element.

Nothing changes, even if the term 'element' is ambiguous. Two senses of 'element' appear as examples in 1041b11–33. There are elements, α and β , of the syllable, $\beta\alpha$, and there are elements of flesh – fire and earth (b12–18). The latter are stuffs, which are infinitely divisible in parts that are the same in kind as the whole. Flesh, in fact, is itself a stuff; it is a *mixis* of fire and earth, and flesh is also divisible into homoiomerous parts. In contrast, the former, α and β , are *atoms* or are taken as atomic in grammatical contexts; they cannot be further divided into parts that are the same in kind as the whole. The term 'element' interpreted either as an atom or as stuff warrant the idea that if x consists of y and nothing else, then $y = x$. If ' α ' consists of α and nothing else, then $\alpha = \alpha$. Similarly, if 'earth' consists of earth and nothing else, then earth = 'earth'. Aquinas' comment on 1041b22–3 (*In Met* 7.17.30) affirms the same thing of 'water': "for what is composed of water only is truly water".

There is a consideration which makes one cautious to unqualifiedly attribute WSP to Aristotle. The context of 1041b11–33 suggests that, if WSP occurs at b23, it is assumed for the sake of argument to avert the possible collapse of the first case (b20–2), where the 'something else' *is* an element besides the original elements (there is an element + the original elements), with the second case (b22–5), where the 'something else' is *out of* an element (there is an element 'out of' an element + the original elements). At this stage of argument (i.e. when the second absurdity is under consideration) we have to assume that the 'something else' is composed of many elements. For someone might think that y which consists solely of an element x

¹⁰² WSP says that if x is not identical to y and x is a part of y , then y has another part, which is disjoint from x . But if, by contraposition, y does not have parts disjoint from x , then either x is identical to y or x is not a part of y .

is identical with x , i.e. that y is the very same x . If it is added that the 'something else' is not out of one but out of many, the seeming collapse of both cases is prevented, and the argument can move on.

The interpretation, according to which WSP is undoubtedly present in 1041b22–3, is defended by Koslicki (2006, p. 719 n. 14):¹⁰³

"/A/ compound, Aristotle says, cannot be composed of just one element, since the object in question would then be identical to its sole element (reading 'being that one' again as denoting in this context the relation contemporary metaphysicians call "numerical identity")."

Koslicki reads $\eta\ \acute{\epsilon}\kappa\epsilon\iota\lambda\upsilon\ \acute{\alpha}\nu\tau\acute{o}\ \acute{\epsilon}\sigma\tau\alpha\iota$ as saying that the 'compound' will be the very same element, namely, the whole will be strictly identical with its sole part in the contemporary metaphysicians' sense of numerical identity (v.i. **2.3.5**).

There are yet other sources of support for the attribution of WSP to Aristotle. Burnyeat et al. (1979, p. 155) have concluded that 1041b23 strongly suggests that to be 'out of' is to be 'out of many':

"That a thing's being $\acute{\epsilon}\kappa\ \sigma\tau\omicron\iota\chi\epsilon\acute{\iota}\omicron\upsilon$ as opposed to its being a $\sigma\tau\omicron\iota\chi\epsilon\acute{\iota}\omicron\upsilon$ implies its being composed of a plurality of elements is explicitly assumed here /./" (original emphasis)

No grounds are given for this except that 'out of' ($\acute{\epsilon}\kappa$) goes with plural ($\sigma\tau\omicron\iota\chi\epsilon\acute{\iota}\omicron\upsilon$) in 1041b20. Burnyeat's et al. comment suggests that Aristotle has to downgrade the case of an element being composed of a single element, because being 'out of' one part requires another part. The additional proper part then would have to be another element, since it was assumed that the remainder – the 'something else' – in this regress argument at all events is an element.

Ross (in Barnes 1984, p. 1644) translates $\eta\ \acute{\epsilon}\kappa\epsilon\iota\lambda\upsilon\ \acute{\alpha}\nu\tau\acute{o}\ \acute{\epsilon}\sigma\tau\alpha\iota$ as "it will itself be that one" and in his commentary (1958, p. 225) assumes without qualms that nothing can consist of a single element. But he refers to *Met H* 3 1043b10–12 where the object of 'out of' is again in singular:

"Nor indeed is the man animal *and* two-footed, rather there has to be something besides these, if these are [=were] matter, [something else] which is [= would be] neither an element, nor composed 'out of' /an element ($\acute{\epsilon}\kappa\ \sigma\tau\omicron\iota\chi\epsilon\acute{\iota}\omicron\upsilon$)/, but substance." (My underline – L. M.)

¹⁰³ See also: Koslicki 2006, p. 727; 2007, p. 135 n. 11; 2008, p. 108 n. 18; p. 110 n. 23; p. 138 n. 36; p. 153 n. 67.

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The passage says that man is not a heap of 'animal' and 'two-footed', but if it were, 'something else', which is neither an element, nor composed 'out of' an element, would be required. For if man were a plurality of 'animal' and 'two-footed', both 'animal' and 'two-footed' would be as matter (i.e. elements), and the need for 'something else' (i.e. the substance) would arise (v.i. 4.1.1). Unfortunately there are no commentaries on the use of singular *ἐκ στοιχείου*.

Bostock (1994, p. 245) entertains the possibility that in 1041b23 Aristotle might have assumed as a principle that if the compound consists of only one element, the compound will be the same as its element. Then he argues that this principle is mistaken on the grounds that Aristotle himself admits the possibility of an object's consisting of just one element – a bronze statue consists just of bronze and a threshold consists of just one element, a stone slab. These objects consist of just one element *in* a certain arrangement – bronze is arranged statue-wise and the slab is arranged threshold-wise, i.e. put in the right position.

Bostock's mistake is to tear the sentence at 1041b23 out of its context, where it is explicitly assumed that the whole is nothing but its elements in order to further argue that on this assumption absurdity results. It is a further question whether the arrangement (or rather the cause of the arrangement) is a part which supplements the single element.

In order to validate the claim that a whole which is composed of a single element is not numerically identical to its element, Bostock refers to *Met H 3* 1043b8–10. However, it is not at all plain that the view is stated there:

"../ if the threshold is such by position, the position isn't composed 'out of' the threshold' but more like vice versa, threshold 'out of' position."

Rather, Aristotle says that the arrangement (position) does not contain threshold as a part but the threshold contains the arrangement (position) as a part, presumably a part besides the stone slab.

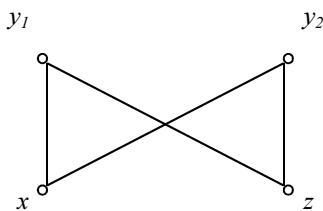
In general, apart from the context of 1041b23, a whole can be the same as its element (a bronze statue has undoubtedly something in common with bronze) without being that very element (a bronze statue is not identical with bronze). While it is true that an object can consist of a single element, nothing compels one to think that therefore it can consist of a single element and *nothing else*, i.e. of a single part.

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The Aristotelian commentators exclude the possibility for anything to consist of a single part, which becomes clear by looking at the way they use language: *σύνκειμαι* or *συντίθημι* together with the preposition *ἐκ* or *ἐξ*, as well as *διαίρεω* plus *εἰς*, normally requires plural. Explicit avowal of the idea that the whole has more than one part is found in Ammonius: "the whole does not consist of one part but of many" (*In Isag* 91.11–12; cf. *In Cat* 29.11–12); "one cannot be divided into one" (*In Isag* 11.9).

We can test the validity of the attribution of WSP from the other end – by evaluating whether Aristotle would embrace its implications.

WSP is satisfied in a model, where two distinct wholes are made up of the same proper parts. Non-extensional mereologists might consider it a virtue that WSP is strong enough to guarantee a remainder but weak enough not to exclude such models.



WSP

Does this fact make it the principle that Aristotle is likely to accept? In order to decide this, we have to look again briefly at 1041b16–19 where Aristotle says that the whole is also 'something else' besides the elements:

"././ therefore, the syllable is something, not just the elements, the sounded [=a vowel, α] and the unsounded [= a consonant, β] but also something else, and the flesh is not just fire and earth, or hot and cold, but also something else ././"

1041b16–19 is the conclusion of 1041b12–16: the whole is not just the elements because the whole ceases to exist when divided but the (plurality of) elements¹⁰⁴ do not. This is in accordance with the diagram above – x and z constitute both y_1 and y_2 , where y_1 is a whole and y_2 is a heap.¹⁰⁵

¹⁰⁴ This is true even if 'element' means, e.g. water (as in Aquinas example), since water is a heap (2.3.1.).

¹⁰⁵ It is plausible that if Aristotle allows that the same parts can compose distinct objects, then he accepts the dictum 'the whole is greater than the sum of its parts'.

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The compliance to the model above can be taken as a simple proof of Aristotle's acceptance of WSP. But it is very important to note that this acceptance is stated with respect to elements – material parts, i.e. quantitative integral parts. It still should be examined whether WSP may be extrapolated to the other senses of the part–whole relation.

WSP conforms well to the sense of part–whole according to which both form and matter are parts, since the substance is already divided into *two* parts. The same consideration thus applies to every division into two parts, e.g. to division into genus and differentia.¹⁰⁶

The subjective part–universal whole relation is problematic. In accordance with WSP, if form is a part of genus, then genus has to contain a supplement (another form) disjoint from the original form. This sits well with the idea that "the splitting of a genus always yields several species" (*Isag* 7.1–2, tr. Barnes 2003). The problem is that the parts yielded by the division fail to be supplements for one another, since every part contains the entire divided item. For that reason universal wholes do not consist of their subjective parts but are only divided into them by a differentia. The problem boils down to the perplexing mereological status of the genus (v.s. 2.3.1.2).

3.2.3. Stronger Supplementation Principles

A principle which is stronger than WSP (i.e. a principle which entails WSP but WSP does not entail it) is the Strong Supplementation Principle (SSP):

SSP: if y is not a part of x , then there is a z such that z is a part of y and z is disjoint from x .

SSP says that if one object does not include another, then there is a remainder. From the contraposed form of SSP (if all parts of y overlap x , then y is a part of x) it is possible to deduce the following theorem:

Extensionality: If x has a proper part or y has a proper part, then x and y are identical \equiv whatever is a proper part of x is a proper part of y . (Varzi 2010)

¹⁰⁶ Edward C. Halper (1989, p. 113) holds the contrary view: "Despite appearances, the definition or essential formula contains only a single constituent, the ultimate differentia." Since the ultimate differentia implicitly contains the genus, it is not necessary to mention the genus in the definition, and consequently, the definition has a single constituent. I cannot agree with Halper, because a definition cannot be a single word, for one word does not explain anything. Moreover, the expression "to contain a single constituent" does not make any sense to Aristotle.

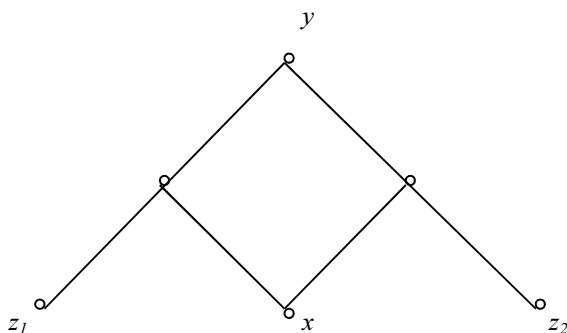
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Extensionality says that all complex objects with the same proper parts are identical. This theorem is at the heart of extensionalistic mereologies.

A still stronger principle, which implies SSP (but not vice versa), is this:

Complementation: if y is not a part of x , then there is a z such that it has as parts exactly those parts of y that do not overlap x . (Varzi 2010)

It says that a part has a complement – something comprising all the parts which are disjoint from that part. It allows the existence of scattered wholes or aggregates composed of (randomly selected) parts of a whole. The model below is satisfied by SSP but not by Complementation: z_1 and z_2 are parts of y that do not overlap x but there is nothing that consists of exactly z_1 and z_2 (Varzi 2010).



SSP

Are any of these stronger principles attributable to Aristotle? If we look at quantitative integral wholes, it is evident that nothing stronger than WSP can hold, since, as we saw, Aristotle allows different objects to be composed of the same material parts (*contra* Extensionality and SSP, and Complementation).

A different situation is with real substantial integral wholes, which have just two parts, form and matter. All of the stronger supplementation principles seem to hold in this case. Consider SSP. SSP says that if the composite is not a part of matter (i.e. if a part fails to include the whole in itself), then there is another part, i.e. form which is a part of the composite and disjoint from matter. Aristotle surely would agree that the composite is not a part of matter, since matter is a part of the composite (*Z* 10 1035a4–6; *Phys* I 6 207a27–28). He also says that form is a part of the composite (1035a1 ff) and is disjoint from matter (*Z* 11 1037a1–2). An additional support for the attribution of SSP is its implications: SSP does not allow that

two wholes are composed of the same proper parts (Extensionality). If two wholes consist of the same matter *and* the same form, they will be identical. (A separate discussion would be necessary to see the full force of SSP, for instance, in case of individuals, such as Socrates and Coriscus.) Next, Complementation also holds: given that within such a whole there is only form and matter, which do not share parts, nothing hinders to conclude that these items are complements of one another: either one of these items comprises every part which is disjoint from the other. (Note that 'comprising every part' does not exclude the possibility that these items have no parts.)

The case of conceptual integral wholes is somewhat similar to the previous one. SSP fits neatly with the division of *eidos* into genus and differentia, since, clearly, two definitions are identical, if they mention the same genus and differentia. Concerning Complementation, it holds only if the definition consists of two words, e.g. 'two-footed animal', otherwise the complement could be a disordered pile of words.

In the case of universal wholes and their subjective parts all of the stronger supplementation principles break down. If my conclusion that WSP does not govern the subjective part–universal whole relation was correct (see the end of 0) and if WSP is entailed by the stronger principles, surely these principles also fail to hold here.

3.2.4. Atomicity and Atomlessness

Before we proceed, a brief comment should be made with respect to the question of allowance of atoms within a theory. Atom is a simple entity, i.e. an object with no proper parts.

Atom_{df}: x is an atom \equiv nothing is a proper part of x .

Mereological atom is a functional and not a rigid term (Simons 1987, p. 16), thus entities are considered atomic within a certain conceptual framework. Whether an entity is in fact atomic is a separate question. Depending on the attitude towards atoms there are three theoretical possibilities:

Atomicity: Every object either is itself an atom or has atoms as parts.

Atomlessness: Every object has some object as a proper part.

Non-Atomicity: Some objects are atomic and some are atomless.

In extensional mereology, if it is atomic, the number of atoms determines the number of objects: if there are n atoms, there are $2n - 1$ objects. Atomless and non-atomic mereologies admit models of infinite cardinality.

Aristotle thinks that matter as a quantity is infinitely divisible (*Phys I 7 207a33f*), viz. "the continuous is divided into infinitely many parts" (207b16–17). Thus, every continuous whole is atomless, since "every magnitude is divisible into magnitudes" (207b26–7). The so-called "simple" elements (fire, air, water, earth) are infinitely divisible into parts that are the same in form as the whole.

Conversely, the division into real substantial integral parts that yields form and matter is atomistic; both parts are atoms. (This was also the reason why TPP did not work; v.s. **3.1.3**.) I cannot directly prove this; the proof is hinted by the arguments within Chapter 4. But some evidence is due. It is certainly easier to argue for the simplicity of form, since it is plainly avowed that form is an atom (*ἄτομον*, *Met Z 8 1034a8*), although not unconditionally, since form has parts in another sense. The simplicity of matter cannot be affirmed unqualifiedly, since matter as a quantity is infinitely divisible. But in relation with a form it is regarded as a simple. Matter is never a separately existing whole; it is always related with some form. In contrast, there are simple independently existing forms, i.e. eternal immovable substances (*A 8 1073a12ff*). Important evidence that both form and matter are simple within the division in question comes from Aquinas. When commenting on the sense of 'out of' "as out of what is composed out of matter and shape" (*Met A 24 1023a31*; v.s. **2.2.3**) Aquinas explicitly states that "one thing is said to come from another as something simple comes from the composite of matter and form" (*In Met 5.21.3*; cf. 7.11.24). What he means is that any part of a form–matter compound is simple with regard to the compound. If we take form as a part or matter as a part – these are simples with regard to the compound they make up.

The conceptual substantial integral part–integral whole relation is also atomistic. When arguing at *Met H 3 1043b34* that definition is a sort of number in the sense that it is divisible Aristotle adds the fact that it is divisible "into indivisibles – for the formulae aren't infinite". If every part of a definition itself had a definition, the definition of a whole would be infinite, which would lead to a vicious regress.

Subjective parts–universal whole relation admit of atomicity, since within the division in question there is the 'first genus' that can be divided, until the 'last form', which is atomic, is reached: 'living being' – 'animal' – 'man', where 'man' is an atom, i.e. not further divisible into forms.

3.3. Composition Principles

Contemporary mereologies offer various composition principles, showing that it is possible to build a mereology starting from the whole, in contrast to the approach outlined in the previous chapter, which starts from principles pertaining to parts. This chapter shows which composition principles could be attributed to Aristotle. Similarly to the attribution of decomposition (supplementation) principles, this project is also hypothetical. I will firstly state the principles and then look at cases in Aristotle where some of these principles seem to be present. I will return to passages in *Top Z* 13 150a2–14 (2.3.3.1) and 150a26–33 (2.3.3.5) and give some other examples.

Before the investigation is carried out, it has to be remarked that it is futile to test whether any composition principles of contemporary mereology are applicable to universal wholes. The reason for this is the fact that *universal wholes are divisible into, but do not consist of, their parts*. Therefore it only makes sense to examine *integral wholes which are both divisible into, and consist of, their parts*. The inability of a universal whole to consist of anything is also the reason why Aristotle does not dwell on questions about their unity. In contrast, the fact that an integral whole consists of its parts makes it interesting to pursue the question of how these parts hold together: Why are stones and bricks a house? How is it possible that bronze and sphere constitute one item? Why is 'animal' and 'two-footed' one and not many?

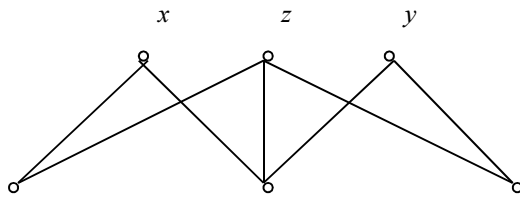
The most commonly accepted composition principle in contemporary mereologies is the following:

Sum: If x and y are suitably related, then there is a z such that z overlaps exactly those things which overlap either x or y .¹⁰⁷

Sum is compatible with the model below, where z is composed of x and y because z is composed of parts of x and y .

¹⁰⁷ The principle of Sum is also expressed in Goodman's definition (D2.047; II 4, p. 36): Binary Sum_{df}: The sum of x and y is that individual z that overlaps all and only those individuals w which overlap at least one of x and y .

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Sum

Sum is sufficiently strong to exclude principles that encompass too much, viz.: (i) principles that hold whenever there is something of which everything is a part¹⁰⁸ or (ii) those that hold even if the alleged sum includes an object that is disjoint from the objects which are being summed up.¹⁰⁹

Sum is a principle that non-extensional mereologists might embrace, since it does not presuppose SSP. If SSP is added to Sum, the result is Strong Sum (Varzi 2010), which bans the previous model.

Strong Sum: If x and y are suitably related, then there is a z such that x is a part of z and y is a part of z and all parts of z overlap either x or y .

The above-mentioned principles are binary showing the summation of two objects. But mereologists want to add up more objects, so they look for more comprehensive principles.

General Sum Principle (GSP): For every F , there is an x such that every y overlaps $x \equiv$ there is a z such that it satisfies F and overlaps y . (Simons 1987, p. 36.)

There is an object consisting of all those things that satisfy F .

General Sum *df.* The general sum of all x 's satisfying F is that individual which overlaps every $y \equiv$ there is a z such that it satisfies F and overlaps y . (Simons 1987, p. 35.)

¹⁰⁸ Such a principle is Upper Bound due to Overlap: If x and y overlap, then there is a z such that x is a part of z and y is a part of z . If two things overlap, then each shares a common part with the other, thus being connected to the other. Simons (1987, p. 33) points out that if being connected is a sufficient condition for being included in a whole, then x and y are both parts of that whole, which is their upper bound. Regardless of how the relation between x and y is construed, Upper Bound is too weak. As Varzi (2010) has shown, the consequent of this principle (i.e. "there is a z such that x is a part of z and y is a part of z ") holds whenever there is something (i.e. the universe) of which everything is part.

¹⁰⁹ Such a principle would look as follows: if x and y are suitably related, then there is something which is a part of exactly those things of which x is a part and y is a part. It is satisfied by a model, where the whole includes an object that is disjoint from x and y (Varzi 2010).

The sum of F s is the object that consists of all objects that satisfy F .

GSP (in contrast to Sum) is an extensionalistic principle. For instance, the full strength of CEM can be reached by adding GSP to APP, TPP, WSP.

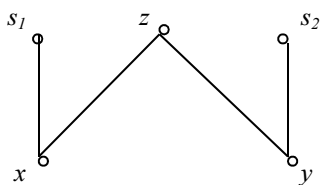
3.3.1. Sum

Aristotle in *Top Z* 13 150a2–14 (condition (i)) purports to argue against the formulation "z is x and y" on the grounds that this would allow that two unrelated things can make up a whole.

Aristotle invites us to assume that justice z is temperance x and courage y and that there are two men, s_1 and s_2 , of whom one has temperance and the other has courage. If so, then justice belongs to both of them together and to neither of them severally (150a2–7; *In Top* 485.23–486.1).

Justice is said to be possessed by s_1 and s_2 taken together. Given that temperance is a part of justice and courage is a part of justice, if there are two men, s_1 and s_2 , such that temperance is a part of s_1 and courage is a part of s_2 , then justice is not a part solely of s_1 and justice is not a part solely of s_2 but justice z – we are told – is shared by s_1 and s_2 , because the parts of s_1 and s_2 compose it. This is in accordance with Sum:

If s_1 and s_2 are suitably related ($s_1 + s_2$), then there is a z such that exactly those things (x and y) that overlap s_1 or s_2 overlap z .



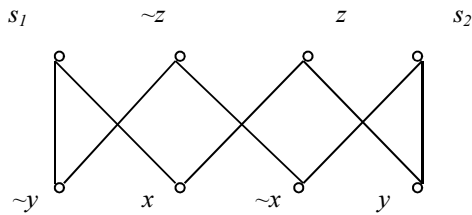
This seems to confirm rather than to rule out that z is x and y . The example is made more complicated by assuming that each of s_1 and s_2 has other parts. The one who is temperate is not courageous, and the other who is courageous is not temperate: x is a part of s_1 and $\sim y$ is a part of s_1 and y is a part of s_2 and $\sim x$ is a part of s_2 .

The fact that each of men singly does not have justice but the two together have justice is compared to a case where there are several men who have one mina at the same time. We are told that both cases are not

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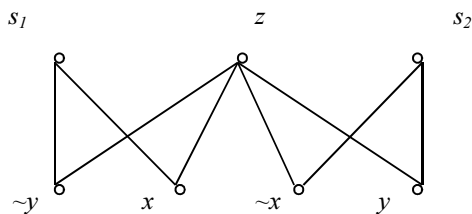
analogous. It is absolutely plausible that one mina might belong to several men at the same time and not to each of them severally. Yet it would seem totally absurd, says Aristotle, that two men taken together should have contrary qualities, justice and injustice (*Top Z* 13 150a7–11; *In Top* 486.1–7).

If justice is courage and temperance and injustice is cowardice and incontinence and if one of men is temperate and cowardly (not courageous), and the other is courageous and incontinent (not temperate), then both of them together have contraries, justice and injustice (150a11–14; *In Top* 486.7–14).



Aristotle thinks that here the entities that are summed up are again s_1 and s_2 and that this leads to the result that the sum ($s_1 + s_2$) has parts (z and $\sim z$) that cancel each other out. Namely, the sum of s_1 and of s_2 simultaneously has justice and injustice.

But actually there is something else going on here: there are two acts of summation of parts of s_1 and of s_2 (the summation of x and y and that of $\sim x$ and $\sim y$) and the result is that the parts of two objects can have sums that are contrary to, or incompatible with, each other. If this is supposed to rule out that z is x and y , it misses the target. If what is attacked here is Sum, then there has to be something which overlaps exactly those things which overlap either s_1 or s_2 . In order to rule out that z is x and y , the case should be construed as follows: s_1 and s_2 have contrary parts; z is the sum of s_1 and s_2 ; if every part of s_1 and every part s_2 enters into the constitution of z , then z has parts that cancel each other out: x and y as well as $\sim x$ and $\sim y$.



We can straightforwardly see that the argument does not indicate that z in principle fails to be x and y . The result is utterly trivial: one should not sum up things that one does not want to sum up. If one wants to

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preserve the fact that z is x and y along with the fact that z consists of the parts of s_1 and of s_2 , then either (1) s_1 and s_2 must not have other parts besides those that properly belong to z , namely, x and y , or (2) those other parts of s_1 and of s_2 must be disjoint from z . In fact, nothing prevents that these other parts (i.e. $\sim x$ and $\sim y$) are disjoint from z , since overlap is not transitive.

Due to these considerations one might get the impression that Aristotle struggles to ban Sum. But this is not at all the case. Rather, he just wants to point out that it is not sufficient to characterize *some wholes* in terms that obey the formulation ' z is x and y ', i.e. that obey Sum.¹¹⁰ A mere formal mereological characterization might be simply too weak, but this does not mean that the principle as such is false.

The attribution of Sum to Aristotle can be fortified on the basis of considerations pertaining to the difference between ' x is in a place' and 'a part is in a whole' mentioned in *Phys* Δ 4 211a29–31:

"/When/ that which surrounds is not divided from, but continuous with, /the thing surrounded/, the latter is said to be in the former not as in a place but as the part is in the whole /../"

If z which contains x is continuous with x , then x is a part of z . Since 'continuous' means 'shares a part' (*Phys* *E* 3 227a11–12; v.s. **3.2.1**), we can derive the idea that a part has a part in common with the whole in which it is in. But this is what Sum implies: if z is composed of x and y because z is composed of parts of x and y , then x and z share a part.

It has to be emphasized that Sum has to be restricted to the *quantitative* integral part–whole relation, which is in accordance with Aristotle's examples in *Met* Δ 26 1024a1–8. Otherwise, if other types of integral part (e.g. form, which is a *substantial* integral part) were squeezed under this dictum, absurdity would result: every part of form would have to have an element in common with a substance *qua* quantitative integral whole. But this is wrong, since form is a substantial, not a quantitative part.

The restriction of the principle to quantitative integral wholes is additionally justified by the context of the above quoted fragment. In *Phys* Δ 3 210a14ff Aristotle lists the senses of 'in' (see the preamble of θ and θ), where the sense of 'in' according to which part is 'in' a whole is rather narrow, since there are other senses

¹¹⁰ Henry (1991, p. 250), when interpreting Aquinas' comments on *Met* Δ 26, remarks that integral wholes share a significant feature: "each of their elements /i.e. parts/ has an element in common with an object of the sort in question, i.e. every element of a part-of- X has an element in common with an X ". Henry calls such wholes 'complete collections'. He (1991, p. 580) uses Lesniewski's definition of 'collective class' (cf. Simons 1987, p. 65), which is akin to Sum. So in a way Henry attributes Sum to Aristotle. I find this attribution plausible, as it is evident below.

of 'part' which are coordinated not with this sense of 'in' but with other senses of 'in'. Moreover, the example Aristotle uses to illustrate this sense is quantitative in character: "the finger is in the hand".

3.3.2. Strong Sum

Let us look at *Top Z* 13 150a26–33 (2.3.3.5), which in fact is compatible with strong composition principles. Aristotle excludes the possibility that the whole is in one thing and the parts are in another. As we know, there are different senses of 'in'. Here 'in' is used to designate the fact that x is located somewhere or x is contained in another thing. Aristotle stresses that it is unacceptable that the whole should be made up of parts, which are not in the whole. Where the compound is, there must be also that out of which it is compounded: "/The/ whole must necessarily exist in those things in which the parts exist /../" (150a29–30).

If *per impossible* the parts that produce the whole do not "come into being primarily in any single thing" but each of the parts are in a different thing, we arrive at absurdity.

Alexander gives a curious illustration of Aristotle's point by inviting us to assume that prudence (previously he said it was justice but obviously it does not make a difference) consists of courage and temperance. Suppose that the soul has three parts, i.e. the rational, the spirited and the passionate. Each of the virtues, i.e. prudence, courage and temperance, are tied to their own special part. Prudence primarily is in the rational part, courage in the spirited part and temperance in the passionate part. If prudence consisted of courage and temperance, prudence would not appear in one part primarily (in the rational part) but rather in several other parts – in the spirited and in the passionate (150a26–30; *In Top* 487.4–15).

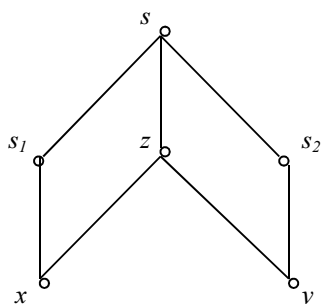
It seems evident that nothing is said that goes against composition as such. The assumption that prudence consists of courage and temperance is wrong because the rational part in which prudence inheres does not comprise passionate and spirited parts in which the other virtues and inhere. The option seems viable that if the rational part consisted of passionate and spirited parts, prudence would be courage and temperance.

Aristotle invites us to consider another case (150a30–33; *In Top* 487.16–26). The soul has three parts, the rational, the spirited and the passionate, and there are three virtues, prudence, courage, and temperance, which make up the whole virtue. Each of the virtues pertains to their special part. But in one thing, i.e. in the soul, there will seem to be the whole virtue, and in another thing (or other things), i.e. the parts of the

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soul, there are the parts of virtue. The whole virtue, which is in the soul, should be where its parts are; however the parts of virtue are not in the whole soul but in the parts of the soul. In other words, there are two wholes z and s such that z is in s ; z consists of parts, x, y, u ; the thing s itself has parts, s_1, s_2, s_3 such that x is in s_1, y is in s_2 , and u is in s_3 . The whole z should be where x, y, u is: z should be in s_1, s_2, s_3 . Yet both all the parts and the whole is not in one and the same thing, but the whole z is in one thing s , and the parts, x, y, u , in other things, s_1, s_2, s_3 .

In order to get a clearer view of the case under investigation let us look at a model with six elements: there are two wholes z and s such that z is in s ; z consists of x and y ; s consists of s_1, s_2 such that x is in s_1 and y is in s_2 .

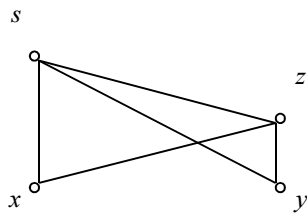


It satisfies not only Sum but also Strong Sum. If s_1 and s_2 are suitably related ($s_1 + s_2$), then there is an s such that s_1 is a part of s and s_2 is a part of s and all parts of s overlap either s_1 or s_2 . (In this case the part of s which overlaps either s_1 or s_2 is z : z has a common part x with s_1 and z has a common part y with s_2 .) This suggests that s consists of s_1 and s_2 , and by the same token z should consist of x and y .

The contention that the whole z is in s but the parts of z are not in s despite the fact that the parts of z are in the parts of s is indeed puzzling. Either the condition rules out the TPP (by denying, for instance, that if x is a part of s_1 and s_1 is a part of s , then x is a part of s) or the hint is to introduce a stronger composition principle:

If z is in s , x is in s_1 , y is in s_2 , and s_1 and s_2 are not identical with s , then z does not consist of x and y . In other words, if x and y are suitably related, then there is a z such that z is a part of s and all the parts of z are parts of s and s does not have any other parts of which x or y is a part.

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The reason for rejecting that the whole virtue is in the whole soul due to the parts of virtue being in the parts of the soul is that s turns out to be the sum of s_1 , s_2 and z the sum of x , y and there is nothing that binds these sums beyond the act of summation. Aristotle (or Alexander) has already assumed that z is not identical with the sum of x and y , and therefore there are two things, z and the sum of its alleged components x , y . Something is missing, namely, that which binds the components into a whole, which is not a part of the sum of the components but rather the components are part of it. Aristotle (or Alexander) needs something stronger than either Sum or Strong Sum:

If x and y are suitably related, then there is an s such that x is a part of s and y is a part of s and there is a z such that all parts of s are parts of it.

However, this thesis is unacceptable, since it goes against the disjointness of matter and form, which has to be prioritized, despite this single counterexample. Otherwise it brings to the conclusion that matter is that which binds all the parts, which is absurd in the face of Aristotle's emphasis on form as the unifier.

3.4. Summary of Chapter 3

Different sets of mereological principles apply to different Aristotelian senses of the part–whole relation. This strengthens the idea that each Aristotelian sense of the part–whole relation is distinct from any other sense. At the same time it has to be admitted that all of these senses should be taken to characterize the relation that a proper part bears to the whole. This can be justified on the following grounds: Aristotle is unwilling to call anything a part which is identical to the whole (2.3.5); for all of the senses of the part–whole relation Aristotle adopts irreflexivity (IPP) (3.1.1) and asymmetry (APP) (3.1.2). IPP and APP are, of course, insufficient for characterizing something as a proper part from the perspective of most of contemporary theories; however, the fact that all Aristotelian senses of the part–whole relation obey to IPP and APP at least guarantees that these are not improper parts. The most problematic is the subjective part–universal whole relation which fails to satisfy a supplementation principle. This also might be the reason why this relation is not regarded as a mereological relation in most of the contemporary theories. Similarly, the real substantial integral part–integral whole relation and the conceptual substantial integral part–integral whole relation might seem puzzling for a contemporary theorist due to their failure to satisfy TPP which is taken to be an essential property of proper parthood.

This table summarizes the applicability of mereological principles to the Aristotelian senses of the part–whole relation:

Relation	Example	IPP (Y/N)	APP (Y/N)	TPP (Y/N)	WSP (Y/N)	SSP (Y/N)	Complem- entation (Y/N)	Sum (Y/N)	Atom- lessness (Y/N)	Atomic ity (Y/N)	Non- atomicity (Y/N)
quantitative integral part– integral whole	A finger is a part of a hand.	Y	Y	Y	Y	N	N	Y	Y	N	Y
real substantial integral part– integral whole	Form / matter is a part of a substance.	Y	Y	N	Y	Y	Y	N	N	Y	N
conceptual substantial integral part– integral whole	Genus / differentia is a part of form.	Y	Y	N	Y	Y	N	N	N	Y	N
subjective part– universal whole	Form is a part of a genus.	Y	Y	Y	N	N	N	N	N	Y	N

4. Complexity and Unity of Substance

The task of Chapter 4 is to unveil the various aspects of the problem of unity of substance and to solve it. This part of the thesis revolves around the passage in the *Metaphysics* Z 17 1041b11–33. The conceptual richness of the passage comprises two inseparable levels: on one level, Aristotle reveals how the unity of parts is achieved via form; on another level, by showing how form unifies the parts, Aristotle insinuates further problems of unity, viz. the unity of form and matter, and the unity of form itself. The first level is discussed in 4.1, where the passage is also fully quoted and analyzed, and the issues presented by the second level are the topics for 4.2–3.

In section 4.1 I focus on how Aristotle demonstrates the necessity of 'something else' to achieve the unity of the composite substance as a compound of elements. The 'something else' is form, which is the unifier of the elements. The elements (*στοιχεῖα*, also rendered in English as 'constituents' or 'ingredients'), are quantitative integral parts, which without being unified are themselves composite substances. In order to avoid any misunderstanding, it is necessary to stress that although all elements are material parts, not all material parts are elements. An element is something which constitutes that of which it is an element and thereby is essential to it, while there are material parts which do not constitute the whole and are accidental to it, e.g. extended bits of wax or bronze (perceptible matter), or segments of a circle (intelligible matter). Elements are such that they need a unifier in order to truly be parts of a whole, not of a heap. Form can serve as a unifier because form is not of the same nature as the items it unifies. Form is not yielded by quantitative splitting and thus form is not a quantitative part, nor does it have quantitative parts. It is explained what undesirable results would ensue, if form were such a part or if it had such parts. It is concluded that *upon the division* of the composite substance *into quantitative parts, form is not a part* of that substance. This does not mean that form is no part of the substance at all.

I argue that *form is a part* of the composite substance, *if the substance is divided into substantial parts – form and matter*. Thus form is not a quantitative, but a substantial part. I examine whether Z 17 1041b11–33 is a proof that form is a part on a par with matter and provide a negative answer.

In section 4.2 I devote various subsections to demonstrate the status of both form and matter as parts. My interpretation of Aristotle's text according to which form is a part on a par with matter is fortified on the basis of the disjointness of form and matter implicitly stated in A 25 1023b19f, and sustained in Z 10–11.

4. Complexity and Unity of Substance

When the distinctness of form and matter is substantiated, the task to establish their unity is undertaken. It is shown that the unity of form and matter is achieved: because both form and matter are not quantitative but substantial parts. The unity of form and matter is such that there is no need for a further unifier.

Nevertheless, the question – why do these two parts hold together? – is still persistent. It is further elucidated that form and matter are united by virtue of the fact that they cannot exist without each other, i.e. form ontologically depends on matter in one way, and matter ontologically depends on form in another way. These ontological dependences are different from the relations that characterize the unity of other types of parts, as it becomes evident in 4.3.

Section 4.3 deals with the parts of form and the relations between them. Since the complexity of form purports to endanger the unity of the composite substance on the supposition that only a simple unifier can unify what is complex, it is argued that the unifier, viz. form remains simple with respect to the sense in which the composite substance is complex. The *form may have parts* but *in a different sense than the item of which it is the unifier*. If form is the unifier of quantitative parts of the composite substance, form is simple in respect of quantity.

While form as a unifier is simple in respect of quantity, it can be complex in other ways. For instance, form as an integral whole can be divided into conceptual integral parts, genus and differentia. But these items are of such a nature that they do not need a unifier, because genus is *entailed* in the form by the differentia (cf. Deslauriers 2007, p. 128–9; p. 135). Form as divided into conceptual parts is a conceptual whole and thus form is not a part of the composite substance as a compound of elements, i.e. form is not a part of the thing. Form as a part of the thing, i.e. as a real part, arises only when the composite substance is divided into real substantial integral parts.

4.1. Quantitative Parts (Elements) and the Status of Form

According to my reading of Z 17 1041b11–33, form is not a part: form as a unifier of elements, i.e. quantitative parts, is not itself a part of the resulting unity, i.e. the composite substance as a compound of elements. However, this does not preclude the fact that form is a part of the composite substance as a form–matter compound. I hold that the composite substance regarded as a form–matter compound is a different sort of entity than the composite substance as a compound of elements. Although we are talking

about the same item, say, this flesh or that syllable, under different divisions this item exhibits different categories. The division into elements and the division into form and matter are different divisions.

4.1.1. Regress in Met Z 17 1041b11–33

In order to tackle the announced issue, I will fully quote 1041b11–33 in which it is presented and which is also important for understanding the questions of the further chapters. I have divided the fragment into three sections each representing a separate point. I will go through each section and lay out the arguments.

1041b11–19

(41b11) /When/ what is compounded /*σύνθετον*/ 'out of' something in such a way so that the whole /i.e. totality or 'all' – *τὸ πᾶν* / is one, not like a heap but like the syllable –

(41b12) /./ the syllable is not its elements /*στοιχεῖα* – letters/, *βα* is not the same as *β* and *α*, nor is flesh fire and earth

/41b14/ (for when they have been sundered /*διαλυθέντων*/, the wholes, e.g. the flesh and the syllable, no longer exist, but the elements [of the syllable] exist, and so do the fire and the earth);

(41b16) /-/ the syllable /then/ is something, not just the elements, the sounded [= a vowel, *α*] and the unsounded [a consonant, *β*] but also something else, and the flesh is not just fire and earth, or hot and cold, but also something else /./.

1041b19–25

(41b19) /If/, then, that further thing /i.e. 'something else' – *κάκεῖνο*/ itself has to be either an element or composed 'out of' elements, then [a] if it's an element, the same argument will apply again – for the flesh will be made of this [further thing] + fire + earth, and something else again [will be needed], and so on indefinitely.

(41b22) [b] And if it's made 'out of' an element, clearly it won't be 'out of' one but more than one, or else [if of only one] that one will be the thing itself, so that again we can make for this case the same argument as for the flesh, and the syllable.

1041b25–33

(41b25) It would seem rather that this further thing is something and is not an element, and is the cause of this-being-flesh, and that-being-a-syllable; and likewise for the other cases.

(41b27) And this is the substance of each thing, the primary cause of its being; but while some things aren't substances, still such substances as there are, are composited in accordance with a nature and by way of a nature of their own,

(41b30) and that very nature would appear to be [their] substance, and that's not an element, but a principle [arkhē],

(41b31) an 'element' being that into which a thing can be divided, being present in it as matter, like the *α* and the *β* of the syllable.

4.1.1.1. There Is 'Something Else' Above the Sum of the Elements

Section 1041b11–19 gives us an argument that a whole in the strict sense and not as a heap or an aggregate is not merely a sum of its elements. Aristotle starts out by stating the thesis that will be proved: if the whole is one, not like a heap but like a syllable (41b11–12), then it is also 'something else' besides the elements: the syllable ' $\beta\alpha$ ' is not just α and β . The same argument applies to flesh: the flesh is not just fire and earth (41b12–14, repeated 41b16–19); it is not a mere heap.

The explanation that the whole is also 'something else' is provided at 1041b14–16; it is added as a note in parenthesis starting at 41b12. Aristotle says here very little: if the elements are separated, the wholes no longer exist, but the elements do exist. This accords with his conviction (*Top Z* 13 150a14–21; cf. *Alex. In Top* 486.14–23) that if there are parts, it is not necessary that there is also the whole (v.s. **2.3.3.2**).¹¹¹

Presumably what Aristotle says at 1041b14–16 is that if the whole (*per impossibile*) were a sum of its elements, it would not cease to exist even when its elements were separated from each other. However, when the whole is divided, it ceases to exist, while its elements still continue to exist. If the sum of its elements is not the same as the whole itself, then there is 'something else' present in the whole over and above the sum of its elements.¹¹² Thus, a thing that is composed of many elements is not a heap because there is 'something else' present beyond and above the elements, which is absent in heaps (cf. *H 6* 1045a8–12; *A 6* 1016b11–17).

Notice that Aristotle talks about 'whole as one'.¹¹³ There are two variants of 'whole as one': integral and universal wholes (*A 26* 1023b28–9; v.s. **2.3.1**). The integral whole is such that it contains its contents so as to make up one thing. This kind of whole is at issue here, comprising both the syllable ' $\beta\alpha$ ' and flesh, on the one hand, and the heaps, ' $\alpha + \beta$ ' and 'earth + fire', on the other. Heaps are 'alls' which can survive the transposition of their constituents (1024a1–8). Since flesh is homoiomereous, Aristotle would classify it as something which can be called both 'all' and 'whole' (v.s. **2.3.1.1**).

¹¹¹ The proposition "if there are parts, it is not necessary that there is also the whole" should not be taken to imply that the parts *qua* parts can exist without the whole, for this would run against Aristotle's conviction that parts and wholes are relatives (q. v. 2.1.2.).

¹¹² This is in ways similar to the argument that Tibbles is not identical with Tib+Tail (v.s. **1.1.2**).

¹¹³ Interestingly, instead of using *holon* at 1041b11, Aristotle uses the word *pān*, of which a literal translation should be 'all'. We saw that 'all' was reserved for totals or mere sums; now the terminological distinction is blurred. Aquinas (*In Met* 7.17.27) immediately substitutes 'omne' with 'totum'.

Aristotle mentions flesh on a par with ' $\beta\alpha$ ' to stress that the requirement that the constituents cannot be sundered applies also to weaker wholes, such as flesh. Syllable ' $\beta\alpha$ ' has the additional requirement that α and β cannot switch places within $\beta\alpha$. In contrast, heaps being mere sums fulfill neither requirement. Aquinas (*In Met* 7.17.25) remarks that heaps are 'one' only in a qualified way and 'many' in an unqualified way, e.g. a pile of stones is qualifiedly 'one' in so far as the stones are located in close proximity to one another. Note that the example suggests still treating the heap as some kind of whole, since its parts are aggregated together in the same place. Aquinas adds a further remark that heaps belong to a certain species (i.e. form) in virtue of the fact that their species (i.e. form) is derived from multitude of collected parts (7.17.26), which at least theoretically broadens the scope of summation. But it is not unrestricted, since the multitude is still 'collected': a heap of things piled up or a group of people is a much stricter sum than the combination of the Arctic sea and a speck of dust in the Sahara (v.s. 1.1.2). It would seem preposterous to either Aquinas or Aristotle that a heap could be the result of unrestricted summation.

Unqualified unities, i.e. those wholes which are one due to their form, are not the same as their components. What Aristotle means by this difference between the compound and its components, firstly, is that the compound cannot be synonymous with each of its constituents, e.g. $\beta\alpha$ is neither just α nor just β ; flesh is neither just fire nor just earth (v.s. 2.3.3.8). However, flesh is synonymous with parts of flesh, when it is divided into pieces, i.e. this piece of flesh is synonymous with that piece of flesh, and not when flesh is divided into constituents (fire and earth). Interestingly, the division of $\beta\alpha$ allows only division into constituents. The reason for the discrepancy between flesh and syllable is that the syllable is a *syntheton* which is such that its ingredients are present actually, while flesh is a *mixis* which is such that its ingredients are present only potentially.

Secondly, the difference between the compound and its components presupposes not only that each constituent is non-synonymous with the compound but also that the constituents taken together (their sum) are non-synonymous with the compound, as it is manifest from the argument at 1041b14–16. Thus, a whole in the strict sense (an unqualified unity) and a sum (a qualified unity) share the same parts, i.e. ' $\beta\alpha$ ' and ' $\alpha + \beta$ ' share α and β ; 'flesh' and 'fire + earth' share fire and earth, but nevertheless the whole and the sum differ from each other, since the whole has 'something else' but the sum does not; the sum is identical to the constituents, i.e. ' $\alpha + \beta$ ' is α and β (and nothing else).

4.1.1.2. The 'Something Else' Is Neither an Element Nor a Sum of Elements

Section 1041b19–25 tells us that the 'something else' beyond and above the elements is neither (i) another element (41b19–22) nor (ii) a composite of elements (41b22–25). Since the case of flesh is already manifest in the quotation, let us inspect the case of ' $\beta\alpha$ '.

(i) The syllable, $\beta\alpha$, consists of α and β or, what amounts to the same thing, ' $\alpha + \beta$ '. But $\beta\alpha$ has also 'something else' besides ' $\alpha + \beta$ ', or else ' $\beta\alpha = \alpha + \beta$ '. If the 'something else' were another element, say, $\beta\alpha$ besides ' $\alpha + \beta$ ', the result would be ' $\beta\alpha + \alpha + \beta$ '. On the assumption that there must be 'something else' which makes a whole out of a heap of elements, why not posit yet another element $\beta\alpha$ to bind ' $\beta\alpha + \alpha + \beta$ '? The result would then be ' $\beta\alpha + \beta\alpha + \alpha + \beta$ ' and so *ad infinitum*. There would be an infinite regress.

(ii) The same argument would apply, if the 'something else' were composed out of an element. To make the regress run again – now within the 'something else' itself, Aristotle assumes that the 'something else' is composed of more than one element. (For more detail with respect to this assumption see 3.2.2.) If $\beta\alpha$ consists of α and β and yet is a unity, it must contain 'something else', i.e. $\beta\alpha$; but then again we have ' $\beta\alpha + \alpha + \beta$ ' and the question arises what binds these elements, and so on *ad infinitum*.

At *H* 3 1043b4–8 the issue is resumed. The 'something else' is called 'composition' and 'mixing':

"Now, it's apparent to those who investigate that the syllable is not out of the phonetic elements *and* their composition, nor is the house bricks *and* composition. And this is right – neither the composition nor the mixing is among [= is one of] the things they are composition or mixing *of*."

To say that $\beta\alpha$ consists of α and β *and* their composition amounts to treating the composition as one of the elements. It is not that the syllable literally *has* the composition (although Aristotle sometimes talks about wholes in that way, e.g. in *A* 6 1016b16); the syllable is itself the composition of α and β . Flesh, in contrast, should not be called 'composition' (*σύνθεσις*), since it is a *mixis* whose ingredients (fire and earth) are merged together and not merely juxtaposed as in $\beta\alpha$. But in the case of flesh (as in the case of $\beta\alpha$) it should be emphasized that flesh *is* mixture (not flesh *has* mixture). Thus, x is a whole and not a heap if x is a composition or a mixture *of* its ingredients; whereas x would be merely a heap if x was the composition (or mixture) *and* its ingredients (cf. 2.3.3.10).

4.1.1.3. The 'Something Else' Is the Substance of Each Thing

In 1041b25–33 the 'something else' is called 'substance of each thing', 'nature', 'cause' and 'principle'. The description 'substance of each thing' prompts to think that the talk is about the form, which is often characterized in such a way. The lines immediately preceding 1041b11–33 connect the 'substance of each thing' with 'form' and also with 'cause', when Aristotle writes:

"So the cause is being sought (and this is the form) of the matter's being some [definite] thing [*ti*]; and this is the substance."
(1041b7–9)

Form is the substance of each thing in the sense that it causes the matter to be a definite thing. In 1041b31 we are given extra information on how to understand the nature of the elements: elements are present in the whole as matter, i.e. as the totality of its constituents. The talk is about a heap of quantitative parts, since continuous wholes are quantities, and quantities which do not possess the 'something else' are heaps (cf. Δ 6 1016b11–13). The elements are contrasted with the 'something else' compelling them to make up a whole and not a heap.

Although 'cause' is again an ambiguous term, supposedly, the cause here is form in the sense of a unifier of the elements, which operates so that a whole (not a heap) results. Anything that has elements and is a whole has to have something else in addition that binds them, and that is form. This insight is affirmed several times:

"Again, although in a way we assert that anything whatever is one which is a quantity and continuous, in a way we do not if it is not some kind of whole, that is, if it does not possess one form; as for instance if we observed the parts of a shoe put together anyhow we should not so readily assert that they were one (unless on account of their continuity), but only if they were put together in such a way as to be a shoe and thereby possess some one form." (Δ 6 1016b11–17)

"For of all things having a number of parts, and where the totality isn't like a *heap*, but the whole is something besides [*para*] the parts, there's some cause; since even among bodies, in some cases *contact* is cause of their unity, in other cases *stickiness*, or some other such affliction." (*H* 6 1045a8–12)

"It is reasonable for things around us to be one in virtue of soul or a part of soul or something else – otherwise there is <not one but> many, and the thing is divided up." (*M* 2 1077a21–3)

The form of a biological organism, namely, its soul, 'concocts' the ingredients in such a way that when a bodily part is severed, it ceases to be a part of that whole due to the loss of its proper function. Even in

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weaker compounds there is some form, e.g. 'contact' or 'stickiness'. Contact is insufficient for, e.g. a shoe, since the parts of a shoe 'put together anyhow' is not a shoe; so we need proper arrangement (*τάξις*, *A* 19 1022b1; cf. *Phys A* 7 190b28). The importance of arrangement is evident with respect to the syllable $\beta\alpha$, since both $\beta\alpha$ and $\alpha\beta$ come to be out of the same letters. Similarly, when describing the role of arrangement in Democritus' and Leucippus' atomism, Aristotle in the *GC A* 2 315b14–15 says that "'tragedy' and 'tragedy' /i.e. comedy/ come into existence from the same letters" (tr. Williams 1982, p. 4). But arrangement is insufficient for organisms, since a dead Socrates, although properly 'arranged', is not himself anymore, so eventually what is necessary is that the properly arranged parts merge and function in the right way. Mere contact and arrangement does not generate a thing that is truly one, "for it is quite foolish <to think> that two or more things could ever come to be one" (*Simpl. In Cael* 7.295.13–14, tr. McKirahan 2010, p. 305). Thus the form as a unifier is that which guarantees function of the whole by imposing structure upon parts that are in contact with one another.

4.1.2. The Implications of the Resolution of the Regress

The entire *Met Z* 17 1041b11–33 is an argument towards the idea that the whole is something else besides the parts. Aristotle not only says that the elements are present as matter but in 1041b25–33 we can also learn that the elements result from a division which is such that the whole is destroyed. Thus, any part resulting from a destructive division counts as matter, and, conversely, the designation 'form' applies to the whole. There is evidence elsewhere in Aristotle that confirms such a reading:

"For one kind of starting point is the form or substance, the other the part or matter." (*M* 8 1084b20, tr. Ross 1995, p. 1714.)

"For elements are causes of syllables, and matter of artifacts, and fire and earth and all such things of bodies, and parts of wholes, and hypotheses of a conclusion, as being that out of which [the latter proceed]; and of them some, e.g. parts, [are cause] as *subject*, others – the whole and the composition and the form – as *what it is to be*." (*A* 2 1013b17–23; cf. *Phys B* 3 195a16–21)

It has to be immediately stressed that the result of *Met Z* 17 1041b11–33 must not be stretched as to fit any talk about form and matter. Since quantitative dispersal is not the only way to divide a whole, it is

wrong to infer (as it appears to have happened in some commentaries¹¹⁴) that 'form' is always on a par with 'whole' and 'matter' with 'parts'. There is also the reverse talk of form and matter as parts and the substance as the whole that emerges from both; but this is a result of a different kind of split (v.s. 2.2.3). If Aristotle thought that any kind of division yielded only matter, he could not meaningfully talk about substances as form–matter compounds. If something is a composite, then clearly it can be divided, although not necessarily in a quantitative fashion.

The claim that the whole is something else besides the parts needs to be qualified to exclude misunderstanding: the whole is something besides those parts which are yielded by *quantitative division*, viz. division into constitutive parts, i.e. elements.

The temptation to read Aristotle as saying "Unqualifiedly, the whole is 'more' than the parts" is probably a product of the modern approach that comes with scientific discoveries of the properties of chemical compounds that are distinct from the properties of their constituents. The distinct properties of an H₂O molecule supervene on the combination of two hydrogen atoms and an oxygen atom but the supervening properties are not further constituents of the whole. Thus, it is inferred that the whole is 'more' than the parts.

I think that Aristotle would agree that the 'supervening' properties are not further *material* constituents.¹¹⁵ However, we should be cautious to identify the supervening properties with the form of the whole, for these properties might as well be accidental to the whole. Moreover, the arrangement of material constituents is not an entity on a par with those properties that arise when the arrangement is implemented: the material constituents are arranged in such and such a way and only *then* other properties emerge. At the same time, the nature of the form (e.g. arrangement) is akin to the nature of these properties, not to the nature of elements.

As stated beforehand, the whole can undergo a different kind of split besides quantitative division into elements. When the whole is divided into form and matter, these two entities (form and matter) have a

¹¹⁴ Bogaard (1979, p. 14) assumes without second thought that matter is to form as parts are to whole. Cf. Sellars 1967; Scaltsas 1994; Wedin 2000.

¹¹⁵ It is a controversial question whether we should impose the idea of supervenience on Aristotle, even if it makes Aristotle's theory more appealing to the modern reader. Arguments against attributing supervenience to Aristotle are given in Granger 1993.

similar nature or status due to the nature of the division itself, viz. form and matter are the result of substantial (not quantitative) division.

The justification to call this kind of division 'substantial' is related to the idea that 'substance' has several senses: firstly, matter, which in virtue of itself (i.e. without the form) is not a this, secondly, shape or form, in virtue of which a thing is called 'a this', and which is separate in formula, and, thirdly, that which is compounded of both matter and form, which alone comes to be and perishes, and is separate *simpliciter* (*Met H* 1 1042a26–31; *DA B* 1 412a6–9). (See also 2.2.3.)

The recognition that within substantial division form and matter are on a par by no means implies their equalization, as there is also no equalization of quantitative parts (v.s. 2.3.3.8). Matter *qua* the result of substantial division is on a par with form, whereas matter *qua* quantity (a heap of quantitative parts) excludes form.

One may argue that matter cannot be on a par with form, since "form and matter are other in genus" (*Met Δ* 28 1024b12) and therefore represent different types of part. I reply to this that form is other in genus than matter, not *simpliciter* but as the plurality of elements, i.e. material parts.¹¹⁶

The term 'genus' is used in a broad sense here: 'x is different in genus from y' means 'x does not share material parts with y'. The inability to share material parts is characteristic of entities that represent distinct categories. This is lucidly explained by Aristotle as follows:

"/For/ everything that differs, differs either in genus or in /form/, [1] in genus those things of which [a] the matter is not common, and [b] there is not coming-to-be into each other, e.g. things whose schema of predication /σχῆμα τῆς κατηγορίας/ is not the same, [2] in /form/ those things whose genus is the same /./." (*Met I* 3 1054b27–30)

Things whose schema of predication is not the same are things belonging to *different categories* or highest genera. Presumably, 'schema of predication' has the same meaning as 'column of predication' (*συστοιχία*, *I* 8 1058a13), i.e. line of subordination of a form under a genus.¹¹⁷ Matter as a plurality of

¹¹⁶ Form is also other in genus than the compound of elements: "the perishable /i.e. compound/ is necessarily *other in genus* than the imperishable /i.e. form/" (*Met I* 10 1058b28–9, my tr. – L. M.). Since the quantitative dispersal of the whole yields only elements and the whole as it was is lost upon the dispersal, Aristotle holds that compounds are perishable (cf. *H* 3 1043b14f). Upon quantitative splitting the whole loses its form which is itself imperishable.

¹¹⁷ Cf. Furth's (1985, p. 138) commentary on 1054b29–30. Tredennick (Armstrong & Tredennick 2006, p. 21) translates unhesitatingly "οἷον ὅσων ἄλλο σχῆμα τῆς κατηγορίας" as "things which belong to different categories".

elements belongs to the category of quantity; in so far as matter is regarded as a quantity it is different in genus from form. But matter *qua* the result of substantial division belongs to the category of substance; in this sense it is not different in genus from form.

The fact that two items belong to the same category (form and matter as the outcomes of a substantial division) is in no way sufficient for these items' sharing a part. As two elements, say, α and β , do not share parts, similarly matter and form fail to do so. Needless to say, form as a substantial part does not have any part in common with the elements, which are quantitative parts. The part that form could have in common with elements would be an element, which cannot happen, since the division into elements does not yield form as a part.

To sum up, the difference between the form and the elements is a difference between senses of part-whole. This does not imply that form is a part in one sense and matter a part in another; rather, the quantitative division of a substance into elements yields parts in one sense, i.e. quantitative parts, but the division of a substance into form and matter is a different division which yields parts in another sense, i.e. two substantial parts: form *and* matter (all elements taken together but not as a plurality but as the material aspect of the substance). This means that form-matter compounds have to include matter in their definition, but this matter is not the quantitative sum of elements (4.2.2).

4.1.3. Koslicki's Reading of *Met Z 17 1041b11–33*

In *Met Z 17 1041b11–33* Aristotle argues that there is 'something else' present in wholes, which is absent in heaps. This argument can be read as a testimony that this 'something else', viz. the form, is a part of the whole.¹¹⁸ Recently Koslicki (2006; 2008) has read the passage as stating that form is a part of the composite substance as a compound of elements. Koslicki does not, of course, hold the view that form is an element – that would be the exact opposite of what Aristotle is demonstrating. Rather, Koslicki argues that form is a cause and a principle (*versus* element) but nevertheless form is a part of the composite substance *in the same sense* of 'parthood' as the elements are parts of the composite substance. Namely, she claims that both when the form is called a part and when the elements are called parts, 'part' represents a sense of parthood which is equally shared between both form and elements, i.e. quantitative parts. This

¹¹⁸ For instance, Haslanger (1994, p. 132) stresses that the text in *Z 17* does not preclude matter and form from being genuine parts. However, she does not develop her reading further.

implies that both quantitative parts (elements) and the form obey the same mereological principles. We have seen, however, that this is not the case: different divisions obey different mereological principles (v.s. 3.4). Thus, there is a flaw in Koslicki's reading – the conflation of distinct senses of part–whole. I will investigate Koslicki's interpretation and show where I disagree with her. As a result, it will become clear that *Z* 17 1041b11–33 is not a proof that form is a part on a par with matter.

Koslicki presents her interpretation of *Z* 17 1041b11–33 in her article "Aristotle's Mereology and the Status of Form" (2006, pp. 725–6). She repeats the same argument in her book "The Structure of Objects" (2008, pp. 179–181), where the purpose is not to attribute the outcome to Aristotle, but to defend the position that form is a proper part of the substance. I will take both texts into account.

Koslicki (2006, p. 725) attributes the following commitments to Aristotle:

- (i) The Weak Supplementation Principle (WSP);
- (ii) Leibniz's Law-style argument, which leads to the conclusion that wholes are numerically distinct from their elements;
- (iii) The view that matter is a part of the form–matter compound.

Koslicki (2006, p. 719 n. 14) thinks that the justification for the attribution of WSP to Aristotle is found in 1041b23, where, as she thinks, it is stated that a compound cannot be composed of just one element, otherwise the compound would be identical to the element and thus it would be no compound at all.

Leibniz's Law-style argument, according to Koslicki (2006, p. 718 n. 13), appears in 1041b12–16. Since a whole and its elements do not share the same properties, i.e. persistence conditions, they are not numerically identical. The whole cannot persist, if it is dissolved into elements, but (the sum of) the elements can.

The attribution of the view that matter is a part of the form–matter compound is justified (2006, pp. 724 – 725 n. 25) by reference to *A* 25 1023b19–22; *Z* 8 1033b13–19; *Z* 7 1032b32–33.

Taking into account these commitments, which Aristotle supposedly endorses, we can outline five steps of Koslicki's argument. A lucid reconstruction of Koslicki's argument is offered by Maureen Donnelly (2010, p. 4), which I have largely followed. However, the evaluation of the steps is mine.

(1) By LL the form–matter compound is not numerically identical to its matter. The term 'matter' is taken to mean 'the sum of elements'. If a whole and its elements, i.e. the form–matter compound and the matter, were identical, they would share all of the same characteristics. But they do not share all of the same characteristics. Therefore the form–matter compound is not numerically identical to its matter (Koslicki 2008, p. 108 n. 17).

(2) Matter is a part of the form–matter compound. Some of the properties of the compound characterize its matter.

(3) From (1) and (2) and from the definition of proper parthood (x is a proper part of y if and only if x is a part of y and x is not identical to y) it follows that the matter is a proper part of the form–matter compound.¹¹⁹

(4) By WSP, if matter is a proper part of the compound, then there is a z such that z is a proper part of the compound and z is disjoint from matter. From (3) by WSP the inference is made that the form–matter compound must have some additional proper part besides matter.

(5) Thereby the additional proper part of the form–matter compound is its form.

Step (1) is flawed. It is not at all clear that 'matter' should be read as 'the sum of elements'. The latter is not matter, which counts as a part of the form–matter compound, but a plurality of items, which are yielded by quantitative division. When the form–matter compound is split in a quantitative way, what remains is not the same matter as that which results upon substantial division. The former kind of matter is that into which the composite substance perishes: it arises when "the clay statue is destroyed into clay and the [bronze] sphere into bronze and Callias into flesh and bones, even the circle into the segments" (Z 10 1035a31–4). Strictly speaking, these items are not matter of the substance anymore but independent form–matter compounds.

¹¹⁹ Frank Lewis (1996, p. 71, n. 19) similarly points out that to refer to a thing's material aspect is to refer to something non-identical with the thing.

Steps (2) and (3) seem acceptable, if the criticism of (1) is bracketed. Granting that 'matter' means 'the sum of elements', if the form–matter compound were identical to its matter, the matter of the compound would be an improper part of the compound.

Step (4) is objectionable. Without WSP we cannot get to the conclusion that the compound has another proper part that is disjoint from matter. We already saw (v.s. 3.2.2) that WSP can be used to prove a rather different point, viz. not that there is another proper part besides matter, but that the same material parts can compose different wholes. This result in a way accords with those interpreters, who think that the regress argument proves that the whole is 'more' than the parts. I think, in fact, that it is the correct way to read the argument; however, the conclusion of this argument cannot be accepted unqualifiedly (as these commentators seem to do), because the fragment (1041b11–33) talks about the quantitative division of a substance which yields *only* quantitative parts. But when Aristotle talks about substantial parts, such as form and matter (A 25 1023b19–21), the whole is not 'more' than its parts.

Donnelly (2010, p. 6) attacks step (4) in Koslicki's argument, disavowing the validity of WSP in such cases. She argues that nothing is left of the compound when its matter is subtracted. Matter is (spatially) co-extensive with the compound. For instance, the lump of clay is co-extensive with the statue. The statue does not have to have a proper part which is disjoint from the lump of clay. If the lump is subtracted from the statue, there should be nothing left of the statue.

Donnelly obviously understands 'subtraction' as physical division. But if 'subtraction' is abstraction, i.e. substantial division, then it is not the case that there is nothing left of the statue when the lump is 'subtracted'. There *is* something more within a statue than the lump of clay. The incapability of the statue to exist without the lump does not rule out that the extra something which is pertinent to statues (and not to the lump) is a proper part.

Donnelly (2010, p. 11), however, thinks that this is another weak point of the argument. Why can the statue have parts (like the lump of clay) with persistence conditions different from its own but the lump cannot? If the lump could have parts with persistence conditions different from its own, why should not one conclude (as Donnelly does) that the statue is also a part of the lump?

My answer to this question (I guess Koslicki would agree with me) is that the statue can have (and must have) parts with persistence conditions different from its own, because the statue depends on its matter for

its existence while the lump does not depend on the statue for its existence. The lump indeed has parts with different persistence conditions from its own, i.e. the (chemical) constituents of lump (not the statue!), on which the lump depends for its existence. We can see that the lump has such parts when the lump is physically subtracted from the statue. When the statue is broken, the shreds have different persistence conditions than the lump that is not subtracted from the shreds, since the shreds could be smashed even into smaller pieces, which would have different structure than the bigger shreds. The pulverized lump could be split into chemical constituents, each of which has parts with different persistence conditions etc. Indeed, this is common sense that compounds have parts with different persistence conditions from their own.

The last step (5) in Koslicki's argument is also suspicious. Even if the regress argument could be read as a proof that whatever is disjoint from the sum of elements is a proper part of the whole, I am not convinced that Aristotle thought about it in that way. If Aristotle thought that everything which does not belong to matter is the form and it is a proper part along the other proper part – matter, it would turn out that the whole consists only of two proper parts, form and matter. This is, in fact, true upon the division of a whole into form and matter (*A* 25 1023b19–21), where it is already presupposed that this kind of division yields two parts. But why should such a presupposition be made before embarking to analyze the regress argument, which looks at a different division, i.e. division into elements?

It might be the case that the whole has a part (a property or a set of properties) that none of its components has separately. We should not infer that this further part or this set of further properties of the whole automatically is the form of the whole. It is true to say, as Koslicki (2008, p. 180) herself admits, that among the characteristics not shared by the whole and the elements is also the property of being constituted by the elements, which is a property had by the whole and not the elements. Koslicki surely would also admit the falsity that results if the property of being constituted by the elements is attributed to the form of the whole. Flesh has the property of being constituted by fire and earth, each of which do not have that property. The property of being constituted by fire and earth belongs solely to flesh and not to the form of flesh. The whole could have a part which does not belong to the elements and yet fails to be

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the form of the whole or fails to exhaust the form of the whole. Even if it may be proved (through WSP) to be a proper part besides matter, it does not follow that it is form.¹²⁰

On the basis of these objections it is safe to conclude that the argument in *Z* 17 1041b11–33 does not serve as a proof for the proposition that form is a part of the whole as a compound of elements.

¹²⁰ Casati and Varzi (2006, p. 68–70) develop an interesting argument that a whole is identical with the sum of its parts, even if the whole and the sum of its parts do not have the same properties. The failure to identify the whole with the sum of its parts results from a conflation of a real and a conceptual distinction. Thus, according to them, the distinction between a whole and the sum of its parts is merely a conceptual distinction, therefore the whole and the sum of its parts are not two distinct entities. Two conceptually distinct things do not amount to two things in reality. In their argument the whole/part distinction is reduced to difference in description: *x* as a judge and *x* as a man is the same *x* differently described. Likewise, ingredients assembled (a whole) and ingredients disassembled (the set of parts of the whole) amount to the same thing differently arranged and thus differently described: the whole is nothing over and above its parts arranged in a certain way; different arrangements require different descriptions. But different descriptions do not entail that there are distinct things. However, to me it does not seem to be a good analogy: composition is not just re-description; it is a metaphysical and not a semantic enterprise. (This resembles Scaltsas (1994) approach to composition as re-identification.)

4.2. Form and Matter as Parts and their Unity

4.2.1. Form and Matter as Parts

The stance towards the issue whether or not form and matter are parts can be characterized by two mutually exclusive positions. The view that both form and matter are parts of the composite substance is mereologicalhylomorphism. The opposite view that form and matter are not parts is non-mereologicalhylomorphism. My aim is not to focus on the doctrine of hylomorphism, which is a complicated topic in itself,¹²¹ but rather evaluate the connection of hylomorphism to mereology.

4.2.1.1. Non-mereological Hylomorphism

Among Aristotelian scholars there are, as Frank Lewis (1996, p. 45) calls them, "pseudo-ontologists" about form and matter, who think that form and matter are not really parts of the substance.

Wilfried Sellars (1967, pp.117–8) argues that form and matter are merely descriptive expressions that differently refer to one and the same thing. Thus, there are not two different things, form and matter, that satisfy the descriptions 'form' and 'matter' respectively; there is just one thing, the substance, which may be described in two different ways.

"It is essential to see that if a changeable thing is a (composite) or "whole," its "parts," in the primary sense, are an individual form and an individual piece of matter. ... But how is this "part-whole" relationship to be understood? ... What, then, is the difference between individual form and matter of this shoe if they are the same *thing*? ... The individual form of this shoe is the shoe *qua*

(piece of some appropriate material or other – in this case leather) *-serving the purpose of protecting and embellishing the feet.*

The individual matter of this shoe is the shoe *qua*

piece of leather (so worked as to serve some purpose or other – in this case to protect and embellish the feet).

Thus, the "parts" involved are not incomplete individuals in the real order, but the importantly different parts of the formula (piece of leather) (serving to protect and embellish the feet)

projected on the individual thing of which they are true." (My emphasis – L.M.)

¹²¹ D. C. Williams (1958, p. 291) has pointed out: "Few doctrines are easier to explain in a textbook paragraph; almost none is harder to understand in detail and principle". This unfortunately makes him rush to the conclusion that it is maliciously delusive (p. 292).

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Sellars does not provide an argument why parts "are not incomplete individuals in the real order" but only "different parts of the formula". It is easy to refute his position. He has confounded real parts (parts of a thing) with conceptual parts (parts of the formula) and concluded that both the material aspect 'shoe *qua* piece of leather' and the formal aspect 'shoe *qua* feet-protector and embellisher' are identical with the compound. In brief, he has confused identity with ontological dependence.

Somewhat similarly to Sellars, Ackrill (1972–3, pp. 124–5) urges us to avoid calling matter and form 'constituents' of the substance:

"Constituent' is no doubt an unhappy word: it is because matter and form are not in the ordinary sense constituents that no question arises as to how they combine into a unity. We might speak of the material 'aspect'."

Moreover, Ackrill assumes that these 'aspects' ward off the question of their unity, for presumably 'aspects' are not distinct entities. Thus Aristotle's talk of compositionality is merely metaphorical. At the same time, Ackrill's account of these 'aspects' suggests that they are parts, not just descriptive expressions in Sellars' sense. In that case it conforms well to my view, since my usage of '*qua*' to describe the way matter is a part on a par with form invites talk in terms of aspects.

Scaltsas (1994a, p. 109; cf. p. 128; p. 107; 1994b, p. 3) defends a claim that also sounds pseudo-ontological in spirit:

"For/ Aristotle a substance is complex, not because it is a conglomeration of distinct abstract components like matter, form, or properties; a substance is complex because such items can be separated out by abstraction, which is a kind of division of the unified substance."

If Scaltsas implies that the complexity of the composite substance depends on the cognitive operation of abstraction and not on some fact about the object itself, then his position is pseudo-ontological. It is confirmed by his suggestion (1994b, p. 3) that the components are identity-dependent on the already unified whole. Their unification is merely their re-identification with the whole and their abstraction is the dispersal of the identity of the whole.

A somewhat softer version of non-mereological hylomorphism is defended by Kosman (1994, p.198): form and matter are not parts of a substance, since entities in which form and matter are separable are not substances. For instance, it is easy to separate matter and form in case of a lintel and of a threshold,

because they differ only with respect to position, i.e. the position is their form, whereas the matter of both of them might be the same oak beam.

All these readings are akin to what David Charles (1994, p. 79) calls the non-explanatory theory where the unity of the composite substance is taken as basic and not explained in terms of its components. If the unity of the composite substance is taken as a brute fact, the question of how its alleged components hold together is a nonstarter.

If one thinks that form and matter are identical to each other and to the substance, one is compelled to accept the consequence that the substance is not really composed out of form and matter and thus there is no genuine part-whole relation between form, matter and the composite. According to the pseudo-ontological reading, form and matter turn out to be merely improper parts of the substance. I defend the position that Aristotelian form and matter are distinct, i.e. disjoint entities that make up another entity and therefore they count as genuine, i.e. proper parts of the composite substance. It is due to their disjointness that the question 'What is the relation that obtains between matter and form so that the composite is a unity and not a mere plurality?' arises and deserves to be pursued, in contrast to the non-mereological hylomorphism where the problem of unity does not arise. If form and matter are not distinct entities, there is nothing to be unified.

4.2.1.2. Mereological Hylomorphism

Aristotle tells us many times that form and matter are parts of the composite substance.¹²²

"/For/ the substance is the form within /τὸ εἶδος τὸ ἐνόν/ 'out of' which and the matter the composite substance is said to be."
(*Met. Z* 11 1037a29)

The notion 'composite substance' analytically entails that the substance is complex and not simple – an entity without parts. Despite this analytical truth few scholars think that form and matter can be treated mereologically as constituents of a thing.¹²³

¹²² E.g.: *Met A* 25 1023b19–22; *A* 24 1023a31–34; *Z* 8 1033b14–16; *Z* 11 1036b3; 1037a29; *M* 8 1084b11–12; *Phys A* 3 210a21; cf. Aquinas *In Met* 5.21.11–13; 5.21.3; Alex. *In Met* 422.6ff; Simpl. *In Cat* 46.23–30. (See 2.2.3.)

¹²³ Bäck 2011; De Castro 2003; Fine, K. 1992; 1994; Furth 1988; Gill 1989; 2005; Haslanger 1994; Koslicki 2006; 2007; 2008; Lewis, F. 1996.

The idea that form and matter are parts is unpopular because "the sense in which matter and form are parts of the composite is a sense that does not accord neatly with our 'ordinary' notion of part" (Haslanger 1994, p. 132). This notion of 'part' presupposes reification, i.e. turning entities whose ontological status is not clear yet into thing-like objects.

But this move does not have to be made. Aristotle emphasizes that the elements and principles that constitute things are not themselves necessarily 'thingy', i.e. 'corporeal' (cf. *Met A* 8 988b25–6) or 'perceptible' (989b25). Form and matter do not have to be reified in order to be parts of a whole.

Despite the fact that the mereological status of form and matter may seem puzzling in terms of currently prevailing conceptions of parthood and composition, it does not justify a condescending attitude towards a theory which allows a richer tapestry of part–whole relations. The preclusion of form and matter from being parts and the subsequent exclusion of form–matter relation from mereology might suit the contemporary theorist, although I think that it cannot be taken for granted and has to be recognized as a conceptual bias which should not be withheld from doubt. I side with Haslanger¹²⁴ (1994, p. 132) that we would rather gain than lose as theorists by appreciating Aristotle's proposal, since "our own conception of part is sufficiently ill-formulated".

The defense of mereological hylomorphism is not uniform. Not many versions of it in the secondary literature are compatible with the view that I attribute to Aristotle, viz. that form and matter are parts of the composite substance only according to the division of the substance into real substantial integral parts. Koslicki's (2006, pp. 725–6; 2008, pp. 179–181) position that form is a part in the same sense as an element is a part is therefore not acceptable. She argues that form as a principle is a different *type* of part than an element due to having distinct persistence conditions, but both – the principle and the elements – are parts in the same *sense*. This, however, cannot be the case, since the division into elements and the division into form and matter yield parts in different senses: these are different senses because distinct sets of mereological principles apply to them (v.s. 3.4).¹²⁵

Koslicki 2008 develops a Neo-Aristotelian mereology based on hylomorphism: "(NAT) Neo-Aristotelian Thesis: The material and formal components of a mereologically complex object are proper parts of the whole they compose" (2008, p. 181). Roots of such a position one can find in Ross' commentary on the *Metaphysics*.

¹²⁴ I do not agree with Haslanger's interpretation fully. In some respects it accords with Koslicki's proposal, which I criticize.

¹²⁵ Interestingly, Koslicki (2007, p. 135 n. 11) has noticed that one and the same mereological principle has to work in terms of one and the same sense of part, to which I undoubtedly agree. The argument goes as follows. Since the list of the senses of 'part'

Frank Lewis' (1996, p. 48) remark that the difference between form and matter is substantial hits the nail on the head. However, I cannot accept the way Lewis interprets form and matter in terms of actuality and potentiality. Matter and form differ within a bronze sphere "in that the matter actually is (a) sphere thanks to some *other* entity, namely the form, while the form *in itself* is actually (a) sphere" (1996, p. 58). I agree with Bostock (1994, p. 284) that to assume that the form is actually a sphere is to commit a category mistake on a par with the supposition generated by Plato's puzzles that the form of largeness is a large thing.

4.2.2. Disjointness of Form and Matter: the 'Separateness' of Form

I will present yet different evidence that form and matter are parts by paying attention to *Met Z* 10–11. The evidence is Aristotle's conviction that form and matter are 'separate', i.e. disjoint from each other. If form is disjoint from matter, then there are two things and not one. Two objects are disjoint if and only if they do not overlap, i.e. not have any common content. Disjointness precludes objects from sharing parts.

Z 10 asks two interrelated questions by turns: Must the *logoi* of the parts be present in the *logos* of a substance? Are parts of a substance prior to the whole? Both questions relate further to *Z* 11 which is an inquiry on the following issue: What is a part of form, and what are not parts of form but of the composite whole?

Aristotle emphasizes that matter is not a part of form but a part of the composite. Flesh is not a part of concavity but a part of snubness, and bronze is a part of statue as a composite but not a part of statue as form, i.e. bronze is a part of bronze statue but bronze is not a part of the form (statue-like arrangement) of the bronze statue (*Z* 10 1035a4–6).

Aristotle argues that a circle can be made out of various materials, therefore these materials cannot be a part of the form of the circle:

at *A* 25 does not include a separate sense of form as a part apart from that of matter (i.e. both form and matter as parts are mentioned in one and the same sense of parthood) and since, as she supposes, Aristotle accepts WSP, then both form and matter are mutually supplemented parts. If form were a part in a different sense than that in which matter is a part, Aristotle would violate WSP twice: the substance would be two times composed of only one proper part, i.e. of matter in one sense of part, and of form in another sense of part.

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"Now, as for things [=forms] that are found to supervene /ἐπιγγνόμενα/ upon [materials] that are specifically different /ἐτέρον τῷ εἶδει/, as *circle* does in bronze and stone and wood, it seems clear for these that neither the bronze nor stone belongs at all to the substance of the circle, because it /i.e. the substance of the circle/ is separate from them." (Z 11 1036a31–34)

Separateness in existence: if x can exist apart from y , then y is not a part of x .¹²⁶

But there are things which never exist apart from their material and yet the material is not a part of their form. Even if circle never occurred apart from bronze (just as man does not occur apart from his flesh), bronze would not be a part of the form of the circle:

"...but as for the things that are *not* seen separated, nothing prevents the case from being likewise for them also, just as even if all the circles that had ever been seen were of bronze; for no less in that case, the bronze would still be no [part] of the form; but it would be hard to abstract it in thought." (Z 11 1036a34–b3)

Bronze is not a part of the form of the circle, because a circle can be conceived as realized in, say, stone or wood. The separateness of form and matter can be taken to mean the conceivability of form as realized in a different material.

Separateness in thought: if x can be conceived apart from y , then y is not a part of x .¹²⁷

There is a condition upon which y is not a part of x that overrides conceivability. In Z 10 1034b20–4 Aristotle poses the issue whether parts of the thing should be mentioned in the definition (he uses 'formula' instead of 'definition') and if so, which parts should.

"Since the definition is a formula, and every formula has parts, and as the formula is to the thing, so the part of the formula is to the part of the thing, – the *aporia* already arises: must the formula /λόγος/ of the parts be present in the formula of the whole or not?"

Besides posing the question of the presence of the formulae of the parts in the formula of the whole, this passage contains a compressed proof of the complexity of form, which will be investigated in **4.3.1**.

I am interpreting the *aporia* as asking "Must the expressions designating the parts be present in the expression designating the whole?" – in other words "Must the parts of the thing be mentioned in its

¹²⁶ This criterion of separateness is adapted from Granger (1999, p. 44): "CRITERION: if x occurs apart from y , then y is not part of the nature of x ."

¹²⁷ Cf. Granger (1999, p. 44): "CRITERION: if x can be imagined apart from y , then y is not part of the nature of x ."

formula?" The *aporia* arises because in some cases, but not in others, the formula of the whole requires mentioning the parts. Although a circle is divided into segments, just as a syllable is divided into letters, the formula of a circle does not mention the segments but the formula of the syllable does mention the letters.¹²⁸

The answer to the question whether parts should be mentioned in the definition is "yes and no". Since 'part' is ambiguous, the question cannot be answered unqualifiedly.

"Or is "part" being said here in a variety of ways, of which *one* is: "What measures [a thing] in respect of quantity"? – this, let's drop. But: "Those things 'out of which' the *substance* [is constituted], as *its* parts"? – this, let's investigate." (Z 10 1034b32–4)

Not quantitative parts but those parts which make up the substance of the thing, i.e. *substantial parts* should be mentioned in the definition of the whole. According to one sense of 'substance', such parts are themselves substances, i.e. "those constituent portions /../ with whose elimination the whole thing is eliminated" (A 8 1017b17–19).

"...there's a sense in which even the matter is called 'part' of a thing, and another sense in which it is not, but rather those things 'out of which' the *formula* of the form [is composed] [are called "parts"]." (1035a2–4)

But how do we sort out what belongs to form and what does not?

"...the formula of the circle doesn't contain that of the segments, but that of the syllable does contain that of the /letters/; for the /letters/ *are* parts of the formula of the form, and aren't matter, whereas the segments are parts in the sense of matter upon which [the form] supervenes – although they're "nearer" to the form than the bronze is, when roundness is engendered in bronze." (Z 10 1035a9–14)

The segments do not count as a part of the form of the circle, even if circle is inconceivable apart from the segments. But β and α are conceivable apart from $\beta\alpha$, yet they are parts of the form of $\beta\alpha$. There is an additional criterion for the separateness of form:

Separateness in definition: if x can be defined apart from y , then y is not a part of x .

¹²⁸ This somewhat differs with Aquinas' reading (*In Met* 7.9.2) that "we give in the definition of a syllable the letter and, consequently, its definition" but "in the definition of a circle the definition "of the segments of a circle" is not present". Namely, *logos* at 1034b23 is read as 'definition'. Aquinas explains that each of the parts of definition themselves are definitions "because we can always substitute the definition for the word".

The circle is defined apart from the segments; the segments are not parts of the form of the circle. But $\beta\alpha$ cannot be defined apart from the letters, β and α , and thus β and α have to be parts of the form of $\beta\alpha$. Aristotle is not talking about a perceptible circle, e.g. a bronze circle which has perceptible matter, viz. bronze. He is talking about a mathematical circle whose segments do not enter into the formula of the circle because the segments constitute 'intelligible matter' upon which the circle comes to be (*Z 10* 1036a2–7; cf. *H 6* 1045a33). Aristotle criticizes the Pythagoreans who define the circle (and other geometrical figures) in terms of lines and the continuum. These things should not appear in the definition because lines (or segments) are related to the circle as flesh and bones are related to a man or bronze and stone to a (bronze or stone) statue (*Z 11* 1036b7–12). Aristotle does not give an illustration of a proper definition of a circle, but he gives a definition of the sphere as a figure equidistant from the center (*Z 8* 1033b14). This suggests that a circle should not be defined in terms of its segments.

The segments of the circle are material parts of a kind that has to be dismissed from the formula because these are accidental or posterior to the circle in the sense that segments are defined in reference to the circle and not vice versa. One might reasonably ask: Do β and α of the $\beta\alpha$ which is not in the air or in wax count as the intelligible matter of $\beta\alpha$? The answer is negative, since $\beta\alpha$ is defined in reference to β and α , whereas β and α are not defined in reference to $\beta\alpha$. There are things (such as $\beta\alpha$) which have to be defined by mentioning the origins (β and α) into which they are properly divided (cf. *Z 10* 1035a24–5). These origins are not disqualified from the formula due to being essential or prior to the thing defined.

Aquinas explains (*In Met* 5.21.5) the distinction between parts of form (he uses the term 'species') and parts which do not belong to the form as follows: "parts of a species are those on which the perfection of the species depends and without which it cannot be a species" but parts which do not belong to the form (he calls them 'parts of matter') are "those on which the species does not depend but are in a sense accidental to the species". Thus, x is a part of form if and only if x is essential to the form. Only parts of form are placed in the definition of the whole.

However, there are forms which do contain matter essentially. It is accidental to a statue that it is made out of bronze but it is not accidental to a bronze statue (cf. *In Met* 5.21.11). Matter is not accidental to the compound 'bronze statue' but statue as such does not have to contain bronze in its substance. Likewise, if body (along the soul) is placed in the definition of animal, or an angle in the definition of a triangle, or a letter in the definition of a syllable, those parts are essential to the whole, and thus prior to the whole.

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Parts of matter which are accidental to the form are parts that are posterior to the thing defined: the acute angle is not placed in the definition of the right angle; semicircles are not included in the definition of a circle.

According to the criterion of separateness in definition, if some matter is a part of form, then such forms cannot be defined apart from matter. These forms then are themselves composite substances. Neglect of matter would be possible only in the case of pure forms. Thus, matter is essentially included in the definitions of composites, since the latter perish into their constituents, while the inclusion of matter is not necessary in the definitions of forms *without matter*.

"In one sort of case, then, the formula of these sorts of parts will be present, yet in the other [such a formula] must not be present unless [the whole formula] be [of] the whole object taken together /συνειλημμένον/; for this is why some things arise 'out of these [parts] as origins /ἀρχαί/ into which they perish, while other things don't." (Z 10 1035a22–5)

Some things are such that their matter has to be mentioned in the definition *nolens volens*, since "the mind cannot conceive of a form without conceiving matter" (Aquinas *In Met* 7.9.18). In the latter case, when forms are taken along with matter, the definition now refers to the 'whole object taken together' (συνειλημμένον, 1035a23). Such a definition is achieved by addition (*definitio ex additione*): "just as accidents are defined by adding their subjects, so too a form is defined by adding its proper matter" (*In Met* 7.9.18).

Beware that form–matter compounds should not be identified with 'forms taken together with matter', since the former have matter essentially but the latter merely by addition. For instance, when soul is defined by mentioning the body, matter is present not because soul is a form–matter compound but because body helps to understand what soul is, in contrast to a soul–body compound which requires the mention of body essentially.

Separateness in definition is not sufficient for demonstrating the disjointness of form and matter, since, for some things, "even though matter is not part of a form, it must be given in the definition of a form" (*In Met* 7.9.18).

How then can the form be refined? Things which "arise 'out of' these [parts] as origins [*arkhai*] into which they perish" (Z 10 1035a24) are form–matter compounds (a25–6), and the matter is a part of them (a27), whereas the situation is different with pure forms:

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"././ but such things as haven't been taken together [*syneilēptai*] with a matter but are without matter, whose formulae are of the form alone, these things *don't* perish –either they don't at all or not in the same way ././" (Z 10 1035a27–30)

Imperishability: if *x* does not perish into *y*, then *y* is not a part of *x*.

The form cannot be decomposed into its parts in the way a form–matter compound can. Form is indestructible, because it is not generated. To be generated is to consist of, and to be divisible into, constituents.

"For that which comes-to-be will always have to be divisible, and be ... 'on one hand matter, on the other hand form'." (Z 8 1033b12–13)

When the constituents are set apart, the composite is destroyed, while the form itself is not destroyed. Things without matter do not perish (Z 10 1035a25–30), they are indivisible (*ἀδιαίρετον*, A 9 1075a6–7; A 7 1073a6–7), "atomic" (Z 8 1034a8) and are "all *simpliciter* 'just what is some one'" (H 6 1045b24).

4.2.3. Unity of Form and Matter

How do matter and form fit together to make up a whole? I will motivate the necessity for the explanation of form–matter unity and map out ways how the form–matter unity can be understood.

4.2.3.1. Alternative view

If one takes matter to mean 'the sum of elements', one might argue that the problem of unity in the context of matter and form regarded as proper parts looks immediately solvable, namely, the presence of form *eo ipso* guarantees the unity of the material parts of the substance and thus the unity between form and matter within the substance. Thus, having two separate parts – one that is united and other that unites – is sufficient for unity.

This appears to be Koslicki's solution, when she says that for Aristotle "genuinely unified wholes must be not only mereologically complex but also *ontologically complex*; ././ they must consist of entities which belong to distinct ontological categories, namely form and matter, or principle and element" (2006, p. 723). Koslicki argues that the distinction between elements and principles in Z 17 1041b25–33 has to be interpreted as marking a difference of form and matter in *ontological type* or *category*. By saying that form and matter are parts of the composite substance Aristotle means that matter and form belong to

different ontological types, viz. *Element* and *Principle* (*Met Z* 17 1041b30–31).¹²⁹ An element is something into which a thing is divided (1041b30–31) and a principle is something that unifies what can be divided. Thus, the problem is solved by proclaiming that there is no need for another unifier (a *tertium quid*), if the initial unifier has a distinct nature from that what is to be unified.

Haslanger (1994, p. 132) makes the same point: "Assuming that there are other kinds of part besides material parts, the claim that form is not an element of sensible substance still permits form to be *a part of a different kind*" (my italics – L.M.).

Bostock (1994, p. 289) also draws similar conclusions. Form and matter, as 'ingredients' of the form–matter compound, are not "on an equal footing", since form is not "as much an *element* of the compound as is the matter". Bostock supposes that the whole of matter is an element, presumably in the same sense as any part of matter is an element. He continues that "the two are quite different types of thing, and neither can exist without the other". Again, similarly to Koslicki, he does not think that the form–matter unity deserve further explanation besides the fact that both represent distinct types. Moreover, he thinks that the form–matter relation is generalizable to all other cases where there is an underlying subject and a property. Since 'subject' and 'property' are different types of entity, they "'fit together' without the need of anything further to effect the combination" (p. 289–90). This is contrasted with two entities of the same type which "can be put together to make one only by adding some extra thing to link the one to the other" (p. 290).

These ideas entail the attribution of the following theses to Aristotle:

- (1) If z consists of parts that represent distinct ontological categories or types, i.e. z has parts $x_1, x_2, x_3 \dots x_n$ that represent type X , and z has another part y that represents the type Y , then z is a unified whole.
- (2) If z consists of only one type of parts, i.e. z is such that all its parts $x_1, x_2, x_3 \dots x_n$ represent the type X , then z is merely an aggregate or a sum of $x_1, x_2, x_3 \dots x_n$.

According to (1), the composite substance qualifies as a genuinely unified whole, because it is composed of parts that represent different ontological categories or types. According to (2), an aggregate or a heap

¹²⁹ Koslicki 2006, pp. 724–5; 2007, p. 135 n. 11; 2008, p. 110 n. 22. Cf. Loux 1991, p. 258; p. 263; Caston 2006, p. 319.

does not qualify as a whole, because it consists of things that belong to one and the same ontological type. Letters, α and β , separated out from the syllable or fire and earth not mixed in a certain combination constitute just an aggregate. Only due to their unification with respect to a certain principle (i.e. the form of $\beta\alpha$) ' α ' and ' β ' become the (audible or visible) syllable ' $\beta\alpha$ '. Because there is the form, an object of a distinct ontological category, which figures as a principle of combination, there is in effect the whole whose components belong to different ontological types.

The solution in line with theses (1) and (2) is elegant but incorrect. Let me explain. Form and matter can be separated out in the already in-formed material substance by *substantial* division. When substantial division is effected, the result is two parts, form and matter. It is not merely that form is a different type of entity than the elements. Upon substantial division matter also is a different type of entity than these entities which were obtained by the quantitative division, i.e. the plurality of elements. When substance is divided into matter and form as substantial parts, *matter and form are entities of the same type*. But both can be neither literally added nor severed. We saw already in *Top Z 14 151a20–29* that the whole is not merely a composition ($\sigma\acute{\upsilon}\nu\theta\epsilon\sigma\iota\varsigma$) of matter and form. If it were, it could be literally decomposed into matter and form, which is impossible. For one cannot take form and matter apart, then put them side by side, and expect that the same composite substance will come again into existence.

Since the division of a substance into form *and* matter is a different division than the division of a substance into material (quantitative) parts, the unity of form and matter is also a different unity than the unity of material parts. I will argue that this unity is secured by way of dependence and look at ways of mapping out that dependence.

4.2.3.2. Form-to-Matter and Matter-to-Form Dependence

Aristotle has a concept of 'dependence', viz. an entity's incapacity to exist apart from another entity, which he describes as being 'in'. In the *Categories 2* Aristotle draws a contrast between being a part of a subject and being in a subject:

"By 'in a subject' I mean what is in something, not as a part, and cannot exist separately from what it is in." (*Cat 2 1a24–5*; cf. *5 3a29–33*)

The contrast – 'being in' *versus* 'being a part' – does not imply that 'being in' or inherence, as Aristotelian scholars call it (cf. Owen 1965b), precludes parthood. Aristotle uses 'part' here in a more restrictive sense

to signify an object that can exist separately, e.g. bricks and stones apart from a house, in contrast to an object that cannot exist separately, e.g. whiteness.¹³⁰

John Ackrill (1963) has correctly pointed out that 'subject' does not necessarily mean 'substance'. It is "a mere label for whatever has anything 'said of' it or 'in' it" (p. 76). When Aristotle says that the individual knowledge of grammar is in a subject, the soul, and the individual white is in a subject, the body (*Cat* 2 1a25–8), he does not imply that either soul or body is a substance in an unqualified sense as what can exist independently (cf. *Phys. A* 2 185a30–1).

Neither form nor matter can exist as separated, i.e. as independent objects, but form and matter are separate (disjoint) entities in the sense that they do not share parts with each other.

One might suppose that form is an independent part of the composite substance, for Aristotle sometimes talks about forms as imperishable (*Z* 10 1035a29). But it does not mean that they are really imperishable, as some (Platonists) maintain (*I* 10 1059a10–12).¹³¹ Form as a real part cannot be independent, because form is 'in' matter and 'in' the composite (*Z* 11 1037a29). For instance, in the bronze is the shape of the statue (*Simpl. In Cat* 46.13), health is in hot and cold things (*Arist. Phys* 210a21; cf. *Simpl. In Phys* 552.7). The form of the composite is such that it cannot exist without the matter for that composite (*Met Z* 17 1041b12–16).

The inherence of form does not exactly amount to 'being in a subject' as described in the *Categories*. Form is not any property, but an essential property (or a complex of essential properties) that makes the object what it is. In virtue of its form the object belongs to a certain kind (cf. *Met Z* 17 1041b7–9). The form is present in the matter and determines its membership into the kind. For Aristotle form serves a double function. It is not only a unifier of the material parts but also a factor that determines why bricks and stones are a house or why this flesh and these bones belong to the kind 'man'. Form is the final cause, i.e. the matter is arranged with a view to a certain purpose, e.g. bricks and stones of a house are arranged for

¹³⁰ Peter Simons (1982, p. 115; p. 156 n. 11) thinks that this distinction is akin to Husserl's distinction between pieces and moments.

¹³¹ It could be argued that Aristotle is a Platonist who thinks that forms do exist apart. Aristotle says in the *Metaphysics Z* 1 that "substance is primary in every way – in definition, in knowledge, and in time (1028a32–3)." Bostock (1994, p. 58) suggests that priority in time entails capability of independent existence, i.e. ontological priority. Since Aristotle argues that the substance of each thing is form, form has to be primary in every way, including independent existence.

the purpose of providing a shelter. Not any random arrangement counts as a house, because the form restricts the arrangement with regard to its purpose (cf. Koslicki 2006, p. 133–4).

At the same time, Aristotle is willing to attribute a different status to form than that of a property by saying, for instance, in *Z* 17 that form is a cause and a principle, which suggests that it is like an agent and thus a subject. But form is not the ultimate subject of properties in contrast to the composite substance. If form is a subject of properties at all, the properties belong to form in a different way than they belong to the composite: properties belong to form indirectly in contrast to the composite to which they belong directly (cf. Granger 1995, pp. 151–2). The reason for this is that the composite is separate absolutely, while the form is separate only qualifiedly.

The dependence of form on matter is governed by *Hypothetical Necessity*: on the hypothesis that there is a certain form, a certain matter is necessitated for the existence of that form (cf. Granger 1993, p. 168; *Phys B* 9 199b33–200a15; *PA A* 1 642a 10–14; cf. 639b24–640a6). Form provides a hypothesis according to which a certain kind of matter is necessary to constitute an object. On the hypothesis that one is building a house, it is necessary to look for bricks and stones, not paper.

Hypothetical Necessity is tied to the idea that form is 'that for the sake of which', i.e. the final cause, the goal (*telos*) of matter, which exists for the sake of form. Matter is for the sake of form in two senses: (i) form is the *purpose* for which the matter exists and (ii) form is the *beneficiary* of matter (*DA B* 4 415b1–2). Form is the purpose in the sense that it makes possible for perishable things to share in the eternal and divine through reproduction. Perishable things, i.e. things that have matter, cannot remain one and the same in number, but they can remain one in form (*DA B* 4 415a23–b7). Form is the beneficiary not in itself but as a part of a form–matter composite. A man and his soul is the beneficiary of the operations of the body (cf. Johnson 2005, p. 68). The bodily organs exist for the sake of the functions of the soul and for the sake of the organism which is the beneficiary of the bodily organs (Johnson 2005, p. 75, cf. p. 80). In *GA A* 2 716a25 Aristotle writes that "the instruments for physical faculties are the parts of the body" (tr. Peck 1942, p. 13; cf. *PA B* 2 647b30). The form in itself cannot be a beneficiary, because it is eternal and divine, and thus needs nothing.

One might think that matter is an independent part of the composite substance. The reason for this conclusion is the predominant use of artifact analogies to illustrate the form–matter relation. However, artifact analogies are ill-suited to describe the relation in biological organisms, which are the paradigmatic

substances. The form–matter relation in artifacts is plainly contingent, i.e. 'sphere' can be realized either in bronze or in wood, or in stone, whereas in the case of living things one must hesitate to ascribe the same contingency to it or even consider the relation to hold necessarily.¹³²

Although matter is not said to be 'in' the composite substance¹³³ but rather is the subject in which the form is (*Met a 3 983a30*), matter is a dependent part of the whole, because matter is dependent on form. The dependence of matter on form in the case of biological organisms is governed by the **Homonymy Principle**:¹³⁴ a part that is separated from the whole is a part in name only (*Met Z 11 1036b30*; *Pol A 2 1253a20–5*; *DA B 1 412b18–22*; *GA A 19 726b20ff*).

Suppose that the eye were an animal – sight would be its soul, for sight is the substance or the essence of the eye; the eye being merely the "matter" of seeing; when seeing is removed the eye is no longer an eye, except in name – it is no more a real eye than an eye of a statue or of a painted figure (*DA B 1 412b18–22*). The matter would not be what it is without the whole in which it exists. Matter is always molded by some form. The same thing applies not only to matter *en masse* but every material part severally: a material part that is literally separated from the composite is not a part of that composite but an independent composite substance (cf. *Met Z 11 1036b30–2*). Matter is separate in existence and can be called a subject only potentially in the sense that when a material part is separated from the composite it can exist as an independent entity but then it is not a part of the composite.

The relation between form and matter is analogous to Husserl's concept of **foundation**. Husserlian scholars Barry Smith and Kevin Mulligan (1982, p. 37; cf. Simons 1987, p. 292; p. 310) have pointed out

¹³² Nussbaum & Putnam (1995) think that the form–matter relation in living organisms is not substantially different from the relation in artifacts. They even suggest that Aristotle is a predecessor of modern functionalism, since "the organic parts of animals – the heart, the eye, the hand, etc. – are functionally defined" and "the material realization of that organic function at a lower level" is contingent., viz. "artificial skin, bone, blood is that person's blood, etc. – just in case it does the function that define each of these" (1995, 35 n. 17). Burnyeat (1995, p. 26) severely opposes this idea: "new functionalist minds do not fit into old Aristotelian bodies".

¹³³ Koslicki (2006, 725 n. 25) points out that in *Met Z 8 1033b13–19* both matter and form are said to be 'in' the composite substance. But Aristotle merely says that form is 'in' matter: "If, then, *sphere* is *figure equidistant from the center*, then of this one is *that in which* /=in matter/ what he makes will be, and the other part is what is *in that* /=in matter/, and the whole is what has come-to-be – like the brazen sphere" (1033b14–16).

¹³⁴ Ackrill thinks that by positing the principle of homonymy Aristotle is just blatantly inconsistent in having tried to mark of form from matter. If form is that what makes a bodily organ actually what it is, i.e. a living organ *x*, then there is no distinction between *x* in potentiality (*x qua* matter) and an actualized *x*: "If being alive, whether for an organ or for a whole body, is having certain powers (not necessarily exercising them) and to be an organ or a human body is to possess such powers, no distinction can be drawn for organs and bodies between their being potentially alive and their being actually alive. They are necessarily actually alive. If they lack the relevant powers they are just not organs or human bodies; if they have them they are eo ipso alive" (1972, p. 126).

that the III *Logical Investigation* is "the single most important contribution to realist (Aristotelian) ontology in the modern period".

Husserl's response to the puzzle of why something is a unity is similar to Aristotle's in the sense that there is no other cause that is responsible for the unification of dependent parts of a whole. There are entities that form a unity just by virtue of the fact that they are the kinds of entity that require partners by their very nature, i.e. some entities are founded upon other entities, and "for this reason they require no chains and bonds to chain or knit them together, or to bring them to one another" (*LI III* §22, p. 477). Two different kinds of objects form a unity because one kind presupposes another kind as its supplement. Since the only unifying factor is foundation, the whole emerges solely by virtue of the specific nature of the parts.¹³⁵

Husserl claims that s is founded on t if s cannot exist as such except in association with t . Foundation as a relation between individuals is a necessary association between objects each as belonging to a given kind, i.e. s , *qua* ξ , is founded on t , *qua* η . The species, ξ and η , are associated because of the very nature of ξ and η . The species ξ as such requires a supplementary species η . An object which cannot exist unless associated with another object is a dependent part of a more comprehensive whole in which it exists. The object in question is a dependent part because it belongs to some species which presupposes that there should be a supplement for it, i.e. another object which belongs to another species. The objects have to belong not just to some species or other, but to a definite species. If we say that, e.g. Jupiter is founded on the Sun, "it is not in virtue of Jupiter's being a heavenly body that it is founded on the Sun, but rather in virtue of its being a planet of the Sun" (Simons 1982, p. 132).¹³⁶ Simons (p. 131) points out that Husserl is "working within assumptions about logical form which are implicitly Aristotelian", namely, Husserl seems to insist that no individual can belong to two co-ordinate species or that there is some privileged species to which the individual belongs.

¹³⁵ Strictly speaking, the whole is not founded on its parts and the parts are not founded on the whole. Foundation obtains between parts and not between parts *and* the whole. If the foundationally related entities were founded on the whole of which they are parts, a regress would arise, i.e. the founded parts and the whole would have to be founded on a more comprehensive whole and so *ad infinitum*. (Sometimes Husserl is loose in his language and it appears that he violates these principles.)

¹³⁶ The expression 'in virtue of' creates an intensional context, i.e. equivalent sentences involving it are not interchangeable (Simons 1982, p. 132).

4.3. The Parts of Form and the Unity of Substance

How can the form being a compound provide the unity of another compound, the material substance? The unity of form is crucial for establishing the unity of the sensible substance, since form is the substance of the sensible substance, and the substance of what is a unity itself must be a unity (*Met I* 1 1052a33–4).

This chapter will reveal the complexity of form and ways in which this complexity allegedly endangers the unity of the substance, and resolve the putative pressure between the complexity of form and the unity of the substance. I will show that albeit form itself has parts this poses no menace to the unity of the substance. I will solve the problem of unity by arguing that form can be complex in one sense and simple in another, because (i) there are different ways of dividing the form, which are not equivalent to the sense in which the substance is divided into elements and to the sense in which form and matter are parts of the substance; (ii) parts of form achieve unity differently than parts of the substance.

4.3.1. Complexity of Form

I am taking Aristotle's statements that the form itself also is a compound and is divisible seriously, despite the amount of literature devoted to arguments for the simplicity of form.¹³⁷ I agree that forms "lack the internal structural complexity of things that have something else as their *ousia*" (Loux 1991, p. 9) but I cannot accept that forms therefore are simple in every respect. On the contrary, definable forms cannot be entirely without parts, even if they seem to be simple. As Deslauriers (2007, p. 101; cf. p. 114) has put it: "But the simplicity of a simple item is not a question of being without parts; it is a question of the unity of those parts." Let us first examine the alternative view.

4.3.1.1. Alternative View

Let us return to the two theses outlined at **4.2.3.1**:

- (1) If something consists of parts that represent distinct ontological types, then it is a unified whole.
- (2) If something consists of only one type of parts, then it is merely a heap.

The solution in line with theses (1) and (2) leads to the result that forms cannot have parts, since any parts of form would be parts of the same type, i.e. the same ontological category. So unlike form and matter,

¹³⁷ Cf. Burnyeat 1979; Frede & Patzig 1988; Harte 1996; Koslicki 2006; 2008; Haslanger 1994.

which, according to this view, represent distinct ontological types, Element and Principle, if there were parts of form, they would represent the same type, Principle, and Aristotle would have to look for an additional unifier or a meta-form that unifies the parts of the form and thus slip into an infinite regress. If form itself consisted of further parts, then it would not be possible for it to be a unity, since then it would be composed of objects that represent one and the same ontological type, viz. Principle. Here the same argument would apply that holds in the case of elements. In line with (2) form would be an aggregate. But form cannot be an aggregate. For how would an aggregate do its job as a unifier of the substance? Thus the distinct nature of the unifier involves the idea that the unifier is simple, non-complex.

Koslicki thinks that form is the ultimate mereological atom (2008, p. 159ff; 2006, pp. 732–3). If non-unified things are unified only by something that is a unity and the more something is a unity the better it fulfills the task of a unifier, then in the extreme version it is plausible to conclude that complex objects must derive their unity from an object that itself is simple. But if form is a compound, it is no longer clear how it could serve as a unifier of another compound, the composite substance. So Aristotle must think that there are no parts of form, although the form itself is a part of the substance.

I have already argued that the view above is incorrect (v.s. 4.2.3.1). But according to the view which I am defending, form and matter represent the same type and their composition fails to be a heap, because both are dependent on each other in their own ways (v.s. 4.2.3.2). Elements also represent the same type, but their composition is a heap, because they are independent substances themselves. For this reason they need a unifier to integrate them into a whole and upon this whole then they are dependent. Now, the question with respect to the parts of form is solvable by finding out whether these are dependent or independent, and if dependent, whether they are dependent in the same way as form and matter are or in a different way. Nothing prevents the parts of form to be parts of the same type. If the parts of form turn out to be like elements, then form itself needs a further unifier and it is a fair question how form thus divided would function as a unifier. But if the parts of form are entirely distinct from these and achieved by a different division, then nothing hinders form from being the unifier of the composite substance.

4.3.1.2. Argument for the Complexity of Form

We saw that the form is not quantitatively divisible, i.e. divisible into elements (Z 17 1041b19–25), for otherwise there would have to be a meta-form that unifies the elements of the form. The form is not quantitatively divisible, for the simple reason that the form is not a quantity.¹³⁸ The form is the cause of being and the substance of each thing (1041b26–7). But does this mean that the form does not have any kind of parts at all?

The statement that form has parts gains support from the premises stated in Z 10 1034b20–2: "[a] the definition is a formula, and [b] every formula has parts, and [c] as the formula is to the thing, so the part of the formula is to the part of the thing". The conclusion can be reached by adding that the formula is of form (1035a4; a21).

Aquinas (*In Met* 7.9.1) provides a lucid explanation of the *definiens–definiendum* isomorphism, viz. "as the formula is to the thing, so the part of the formula is to the part of the thing" (1034b21–2). Since definition has to convey "distinct knowledge of the real principles which come together to constitute a thing's essence", definition cannot be grasped by a single word but it must be "a certain combination of words arranged by reason". Since each term picks out a distinct principle of the thing, the thing itself must be complex. As a definition is a combination of words, i.e. an expression having parts, so the thing to which the definition refers is a combination of principles, i.e. a complex essence. Aquinas refers to Book *A* of the *Physics*, where Aristotle writes that a definition divides the thing into its "separate elements": "A

¹³⁸ The form is neither a continuous quantity, i.e. spatial magnitude, nor a discrete quantity, i.e. number. It can be neither divided into extended parts, nor into units or points. In *DA A* 3 407a6–10 Aristotle brings forth several arguments against the view of the soul as a spatial magnitude, i.e. continuous quantity. This is Plato's view. Plato talks about the soul of the universe, which is exclusively intellectual, viz. reflective, and therefore its movement is circular (407b5–11). Apart from the other absurdities that follow from Plato's view (407a10ff), the main reason why the soul cannot be a magnitude is that the soul is quantitatively indivisible (cf. Aquinas *In DA* 1.8.11). Hicks (1907) thinks that the objection to Plato implies merely that "the soul is a mathematical object, but not necessarily that it is material or corporeal" (Hicks 1907, p. 254). However, I think that Aristotle's objection in fact addresses the issue of the corporeality of the soul. Aristotle treats mathematical objects as having matter. He calls the segments of a circle 'intelligible matter', because the segments do not enter into the formula of the circle but only constitute a condition upon which the circle comes to be (Z 10 1025a10ff; 1036a2–3; cf. *H* 6 1045a33). For Aristotle, one of the properties of a material object, either having intelligible or perceptible matter, is divisibility. Aristotle contrasts this divisibility with the indivisibility or unity of form. Form is indestructible (Z 10 1035a25ff) because it is not divisible in the same way as a material compound is. Such indivisibility and thus the incorporeality of the soul and its faculties is the true reason why Aristotle shuns Plato's view. Further, in *DA A* 4 408b32–409b18 Aristotle sets forth several arguments against the view that the form is a number. Aristotle attacks Xenocrates' view that soul is a self-moving number, where 'number' is a sum of units. The most interesting objection, if we want to understand why the form cannot be a number, is that the soul can in no way undergo subtraction or addition of units. Any subtraction or addition involves the body, while the soul remains the same in all its parts and in all parts of the body. If it were possible to subtract or add units to the soul, it would alter in kind, since the result of addition and subtraction is a number different in kind (409a7–10).

word like 'circle' indicates a whole indiscriminately /ἀδιορίστως/, whereas the definition of a circle divides it into particulars /τὰ καθ' ἕκαστα/" (*Phys A* 1 184b11–12). The 'particulars' are things which are simple in relation to the compound which is divided. Through the analysis of the compound we come to understand these (184a21–3).

Aquinas (*In Met* 7.9.3) solves a seeming difficulty pertaining to the isomorphism which arises due to the easily misunderstandable assumption that the definition is the 'same' as the thing. If (i) "a part of the definition of a thing is related to a part of the thing as the definition is related to the thing", and (ii) "the definition is the same as the thing", then "the parts of the definition are the same as the parts of the thing". The assumption (ii) is false, if interpreted as saying that the parts of the definition are identical to the parts of the thing. They cannot be identical, since "the parts of the definition are predicated of the thing defined, as animal and rational are predicated of man, but no [real] integral part is predicated of a whole". As Aquinas further notes (*In Met* 7.9.4), the parts of a definition *signify* the parts of a thing not because the former are identical to the latter but because the parts of a definition are derived from the parts of a thing.

However, Aristotle himself admits that in a sense form *is* definition, if genus and differentia, which are parts of definition, are parts of form (cf. *A* 25 1023b24). But in that case – to express it in Aquinas' terminology – form is a **conceptual** integral whole containing conceptual integral parts, genus and differentia, and these parts are not parts *of the thing*. Form as a real whole is not the same as definition but form as a conceptual whole is. In that case the conceptual parts are predicated of the conceptual whole: the parts of the *definiens* act as universal wholes being predicated of the *definiendum* as their subjective part. But if form is a real integral whole containing real integral parts, none of them severally are predicated of it.

Aquinas (*In Met* 7.9.4) construes a situation where the terms 'animal' and 'rational' are not parts of man (i.e. the real whole), but of the definition of man (the conceptual whole); 'animal' is taken from one part of man, i.e. the sentient nature, and 'rational' from another, i.e. reason. Aquinas equates sentient nature with matter and reason with form respectively, thereby drawing analogies between genus and matter, and differentia and form. As a result, man is a thing having reason (form) in a sentient nature (matter). However, these analogies should not be taken for granted, for we will see (4.3.4) that the relations between the parts of the soul are more complex.

4.3.2. Unity of Definition: Genus and Differentia

The parts of definition, e.g. of 'man', are genus 'animal' and differentia 'two-footed'. But "that whose formula we call a definition, why in the world is this *one*?" (*Met Z 12 1037b11–12*). If the definition of man is 'two-footed animal', the question is why are these two things ('two-footed' and 'animal') one thing?

"Why then this [=two-footed animal] is one and not many, animal and two-footed?" (*Met Z 12 1037b13*; cf. *An. Post B 6 92a29–30*)

For what reason is a two-footed animal a whole and not a heap which consists of two-footed and animal? A similar question is already posed in the *Int 5 17a13–15*, where Aristotle sets it aside for another inquiry. However, he notes there that 'two-footed footed animal' "will not be one simply through being said all together" (tr. Ackrill 1963, p. 46). The question is answered in *Met Z 12*. I will now follow Aristotle's path into the chapter. In order to answer the posed question, Aristotle chooses the following strategy. He shows that the question of unity of definition is problematic. The unity of definition is not similar to the unity of accidental properties and a subject. In addition, there is yet another problem of unity – the unity of multiple differentiae. Aristotle shows that the definition should be one nevertheless. This is done by demonstrating the peculiar way how genus and differentia are one, and how multiple differentiae are one.

4.3.2.1. The Unity of Genus and Differentia Must Not Be Accidental

Aristotle starts with accidental unity – 'pale man'. Both 'pale' and 'man' "are many when the one doesn't belong to the other" (1037b15), viz. "when one of them is not present in the other" (*In Met 7.12.2*). They, however, are one when 'pale' belongs to 'man' and "the subject, the man, suffers something" (1037b16), viz. 'man' participates in 'pale' (cf. b18) or 'pale' is predicated of 'man'.¹³⁹

In contrast, the unity of 'animal' and 'two footed' is not based on the participation of genus in the differentiae (b19). The reason for this is that the differentiae, by means of which the genus is divided, are contraries. If a genus participated in a differentia, then another contrary differentia could be said of the genus. Both 'two-footed' and 'four-footed', which are contraries, would be said of one genus 'animal' and thereby 'animal' would participate in contrary differentiae. The same genus would participate in contraries

¹³⁹ The English translation of *Z 12* and of Aquinas' commentary contains several expressions of the same relation. Thus, if X = Man and Y = White, all the following expressions have a similar meaning: Y is said of (about) X; Y is predicated of X; X participates in Y; Y is present in X; Y belongs to X; X is recipient of Y; X receives Y.

at the same time (*In Met* 7.12.2), which is a contradiction. The same item cannot be both two-footed and four-footed (not two-footed). Hence no unity of genus and differentia can arise by way of participation. It should be remarked, however, that it is permitted to predicate 'two-footed' of 'animal', if 'animal' is already taken as restricted to 'man'.

Further Aristotle indicates a more specific problem of unity – previously the unity of genus and *one* differentia was discussed but now he says that there is a problem of unity when *several* differentiae are included in the definition. Thus if 'man' were defined as a "footed–twofooted–featherless" animal, there would also be the question "why are all these [differentiae] one and not many?" (1037b23)

Aristotle shows that it is not enough to say that the reason for the unity of differentiae is the fact that they are present in one thing (b23). If belonging to one thing meant that the things form a unity, then, as Aquinas reasons in his commentary (*In Met* 7.12.4):

- (1) all accidental predicates of a thing would essentially form a unity;
- (2) common accidental predicates of different subjects would be the cause of the unity of these subjects, viz. the whiteness of snow and the whiteness of a swan would make one thing out of snow and a swan;
- (3) and not only these subjects would be one, but "there'll be a unity 'out of' everything" (1037b24).

Suppose that x has properties K and L and y has properties L and M . Because of L , x and y would be one. But then anything that has K or M would make up a unity, and so *ad infinitum*. This, however, is absurd. From this the conclusion is drawn that the unity of several differentiae cannot be effected and remains a problematic issue.

In this argument 'differentia' is understood akin to an accident, which is permissible, since every predicate is an accident in a broad sense.

But disregarding these problems, a definition should be one – its elements must form a unity, because "definition is one intelligible expression and [of] one substance" (1037b25), and 'substance' means 'some one' (b27).

4.3.2.2. In Diaretic Definitions the Differentiae Must Entail the Genus

In order to find a solution to the problem of unity, Aristotle delimits the inquiry to diaretic definitions, viz. "definitions obtained by [the method of] Divisions" (*διαίρεσις* – division, 1037b28). A definition without division is a definition outlined in *PA A 2–3* whose elements are selected by a "multiplicity of overlapping criteria" (Burnyeat 1979, p. 102). (We will look at this case in the next section.)

Diaretic definitions contain a primary genus and differentiae. Such a structure of definition is true for each member of the chain of genera, because "a subsequent genus always includes a prior genus along with some difference" (*In Met 7.12.7*). Thus in the following chain of genera 'animal' – 'footed animal' – 'two-footed animal' – 'two-footed featherless animal' the primary genus is 'animal' and each subsequent genus has the primary genus as specified to a greater detail with the help of certain differentiae.

Thus Aristotle, firstly, claims that all formulae must have the same structure – genus and differentia. It does not matter whether the definition is expressed by many or by few, or by few or by two terms (1038a1). In case of 'footed animal' there are two terms, but in case of 'two-footed featherless animal' there are three terms. But in both cases this is a definition as it contains a primary genus ('animal') and a differentia ('footed' in the first case, and 'two-footed featherless' in the second case).

Secondly, Aristotle claims that "the genus absolutely doesn't exist apart from [*para*] the /forms/ [*eidē*]" (1038a5). There is no animal which is not also a man, an ox or any other animal. Aristotle escapes the problem of unity of 'animal' and 'two-footed' by saying that the genus 'animal' does not exist separately from the specific differentia 'two-footed' which delineates the relevant form 'man'. The genus is implied by the specific differentia.

If genus exists apart from the form, it exists "as matter" (1038a6): "voiced sound" is the genus and matter of phonetic elements, i.e. letters. One thing (voiced sound) is taken in two different meanings (*In Met 7.12.10*): (1) as a universal whole (or as a conceptual part which can be said of the whole); (2) as a real integral part (*pars integralis rei*), i.e. a part which cannot be said of the whole. When 'voiced sound' is taken as a genus, it is something that signifies the whole thing; when 'voiced sound' is taken as matter, it cannot be predicated of the letters, just as flesh and bones cannot be said of a man.

Thirdly, Aristotle concludes that "it's plain that the definition in the formula /../ 'out of the differentiae" (1038a8–9). This is because, as mentioned before, a genus does not exist apart from its form; and thus the differentiae, which determine the form, are not something essentially distinct from the genus. The "difference is added to genus /../ as though it were contained implicitly in the genus" (*In Met* 7.12.13).

Thus the question raised above is solved – a definition is one (and not many) because, firstly, genus can contain in itself various differentia "as the indeterminate contains within itself various determinate things" and, secondly, "a difference does not accrue to a genus as constituting an essence distinct from it, as white accrues to man" (*In Met* 7.12.14).

Aristotle arrives at the solution in the following way. It was shown that it is impossible that the cause of unity of the definition is that the differentiae are said of a genus, because in that case contrary differentiae would be said of one genus. Now it is shown that a differentia is a sufficient condition of its genus. What Aristotle previously was claiming was that the implication "if genus, then differentia" is false, because such an implication would include contrary consequents ("if 'animal', then 'two footed'" and "if 'animal', then 'four footed'"). Now he has demonstrated that an inverse implication is true: "if 'differentia', then 'genus'". This does not produce contradictory expressions, because both "if 'two footed', then 'animal'" and "if 'four footed', then 'animal'" are true. Since differentia is a sufficient condition of genus, various (even contrary) differentiae can be said of a genus.

4.3.2.3. In Diairetic Definitions the Ultimate Differentia Must Entail the Other Differentiae

Next Aristotle shows how multiple differentiae of one form should be treated. First, he shows the proper way to devise a chain of differentiae: "the division has to be by the differentiae of the differentia" (1038a9–10). If the first differentia is 'footed', the second differentia should be 'cloven-footed' or 'not cloven-footed'. The second differentia should be a differentia that takes into consideration the previous differentia 'footed'. Thus, when one looks for a definition, one should take into account a series of differentiae, where the subordinate differentia is more determinate than the superordinate. One differentia should be divided by other more determinate differentiae.

Why is not the differentia 'two-footed' and the differentia 'cloven-footed' merely a sum of those two differentiae? Each differentia should come from the previous differentia *essentially*, not accidentally.

Therefore, it would not be correct to say that the second differentia for footed animals would be 'feathered' or 'featherless' (a12–13). Having wings is accidental to having feet.

Aristotle's admonition is implicitly directed at Plato's method of dichotomy where the differentiae are arbitrarily chosen. Plato divides the class 'animal' into two parts – 'footed' and 'without feet' and then the class 'footed' into 'feathered' and 'featherless'. Such an arbitrary specification of differentiae cannot claim to be a consistent division.

In a consistent division every subsequent differentia must entail the preceding one. Such a chain of dependent differentiae should lead to a differentia which has no further differentia, i.e. to the ultimate and the indivisible differentia (*τὰ ἀδιάφορα*, a16), which would be "the substance of the thing and the definition" (a19–20). The number of such ultimate differentiae would be equal to the number of forms (a17–18). In the process of division one should find the last differentia that one cannot divide or differentiate any further.

Second, Aristotle shows that the principle that must be observed is "a differentia of a differentia" (a25), viz. the principle of selecting essential differentiae. If this principle is obeyed, the unity of various differentiae is achieved. This is because *the ultimate differentia entails all the previous differentiae*. The differentia 'two-footed' already entails the differentia 'footed', so it is superfluous to mention also 'footed', if 'two-footed' is already mentioned. In order to avoid expressing the same thing several times over in definitions (1038a21) one should simply give the genus and the ultimate differentia. If this is "a differentia of a differentia" (a25), then it is the form and the substance (a26).

This, however, is not the case, if accidental differentiae are included in the definition. If footed animals were differentiated by 'feathered' and 'featherless' or by 'pale' and 'dark', the ultimate differentia would not be one, but would be many, since the number of differentiae would be equal to the number of such accidental cuts (a26–28).

Aristotle concludes that the unity of definition comes from fact that, if formed correctly, the definition is out of the differentiae, and, more precisely, out of the ultimate differentia. Aristotle introduces an example, which strengthens his conclusion. He introduces 'two-footed animal endowed with feet' – a differentia where terms have switched places. This can be done, since "there is no 'order' in the substance"

(38a33), viz. it is not the case that one differentia is prior and another posterior (a34), since the "substance is completed all at once and not successively" (Aquinas *In Met* 7.12.27).

Thus, with respect to diairetic definitions which was the delimitation of discussion done by Aristotle at the beginning of the chapter (1037b28), all this discussion is merely a preliminary statement (1038a35).

4.3.3. Multiple Ultimate Differentiae

Consider a situation where there are several equally determinate differentiae, none of which are deducible from, or entailed by, the others. Aristotle neglects the possibility of multiple ultimate differentiae in the *Metaphysics*. But in the *Parts of Animals* he, in fact, stresses the need to take several non-subordinate differentiae into account:

"And if mankind were split-footed alone, by proceeding in this way one might arrive at this single difference. But since mankind is not merely split-footed, it is a necessity that there be many differences that are not under a single division. There cannot, however, be many differences under a single dichotomous division – at least not of the same thing. Rather, one must end with one difference according to one such division. So it is impossible for those who divide in two to grasp any of the particular animals." (*PA A 3* 644a6–11, tr. Lennox 2001, p. 11.)

Man is not only a cloven-footed ("split-footed") animal and bird is something more than just a feathered animal. Being a bird includes a number of specific differences. A bird has a beak, it lays eggs, etc. The final definition should "...involve specifying a variety of distinct differentiae arrived at by distinct diairetic procedures /../ no one of which is necessarily more basic than or prior to any of the others" (Hankinson 1995, p. 126).

Why is not the total of these differences but an arbitrary combination of several non-arbitrary lines of division? James G. Lennox (2001, p. 166) has pointed out that by emphasizing the necessity to use several differentiae Aristotle has created another problem of unity, namely, the problem of horizontal unity. Aristotle seems to have fallen in the snare set by him for the "dichotomists". If a conjunction (*σύνδεσμος*, 643b18) of final differentia is all that is required to define a certain kind of animal, then this procedure is no better than dichotomy, which arrives at accidental conjunctions, viz. animal is divided into feathered/featherless, feathered into tame/wild (643b19–23). Aristotle's new strategy of dividing by several final differentiae appears to be as vulnerable to criticism as dichotomy: these differentiae are merely "conjoined", not unified, since *none of them entails any other*. Lennox (2001, p. 166) crudely

steps on Aristotle's toes: "Allowing that 'bird is defined by many differences' (643b12), why is that not terrible news for a philosopher who wants definitions to reflect the unity of the beings defined?"

M. L. Gill (2005, p. 240–1) has noticed the same problem:

"Can/ form be composed of parts without being posterior to them? The last differentia entails further differentiae and the genus. But if we must divide by many differentia at once /../, 'What is the unity of the collection of final differentiae, all of which are actualities? Why should we think that form is prior to its actual conceptual parts? This question seems to me still a pressing one."

A plurality of equally determinate, non-subordinate differentiae is the result of several lines of division and therefore none of them implies the other as, for instance, 'two-footed' implies 'footed'. In the latter case, even if form has parts, their existence does not prevent form from being a unity: the last differentia or the last form implies all the superordinate differentiae. If the last, the most determinate differentia did not exist, all the rest, less determinate differentiae, would not exist either. The relationship of ever-increasing determination provides a kind of unity of form, namely, its vertical unity. But in the case of multiple differentia, which do not stand in any relation of implication, no vertical unity can be achieved.

If the last specific difference is identified with the form, and if there are several such differences, then there are several forms, i.e. the form is a sum of forms. If form makes substance what it is, each substance should have only one form. A plurality of forms lets substance consist of other substances, i.e. a substance becomes an aggregate. The problem can be reformulated as follows: If there are several last differentiae and there are no relations of implication among them, should not Aristotle come to the conclusion that form is not a unity and therefore cannot function as a unifier of the substance?

In *Met Z* 13 1038b14–15 it is emphasized that "those whose substance is one and whose Essence is one are themselves one". The unity of form (i.e. the substance of the substance) is both a necessary and a sufficient condition for the unity of the thing, i.e. the substance in question. Therefore Aristotle hereinafter argues that "it is impossible that substance be [composed] 'out of' substances that are present in it as in /actuality/" (1039a3–4). If they were so present, the thing, whose substance is so fragmented into many substances, would itself be a heap, "for things that are in /actuality/ two in this way are never in /actuality/ one" (1039a4–5). The mention of actuality (*ἐντελέχεια*) points at the direction of how to treat the multi-differentiae proposal. The several final differentiae obviously cannot be "in actuality", viz. exist as separate, viz. independent, complete substances, but must be merely potentially present in the thing whose

definition is being sought. The substance can consist of many substances in the sense that "if they are *potentially* /δυνάμει/ two they can be one (as the double is 'out of' two halves, only *potentially*, for the /actuality/ [of the halves] separates [the double, i.e. destroys it])" (1039a5–7). The step of explaining the unity of form via potentiality is taken in *De Anima*: the talk is about the capacities or potencies (δυνάμεις) of the soul which do not exist as actually separated from one another.

4.3.4. Unity of the Soul: the Capacities

In *DA A 5* Aristotle addresses the problem of horizontal unity of form, viz. soul:

"Now some say that the soul is divisible and that one part of it thinks, another desires. What is it then which holds the soul together, if naturally divisible? Assuredly it is not the body: on the contrary, the soul seems rather to hold the body together; at all events, when it has departed, the body disperses in air and rots away. If, then, the unity of soul is due to some other thing, that other thing would be, properly speaking, soul. We shall need, then, to repeat the enquiry respecting it also, whether it is one or manifold. For, if it has unity, why not attribute unity to the soul itself at the outset? If, however, it be divisible, then again reason will go on to ask what it is that holds it together, and so the enquiry will go on to infinity." (*DA A 5* 411b5–14, tr. Hicks 1907, p. 45)

This argument is analogous to the argument in *Met Z 17* 1041b19–25. If the soul, i.e. the form, is divisible in this way ("that one part of it thinks, another desires"), one should look for another higher-order soul that relates all of the psychic parts and is distinct from these psychic parts. But what prevents one from seeking yet another higher-order soul to unite these other psychic parts and what keeps it from going on *ad infinitum*? Aristotle is aware of the problem that would arise, if he admitted that form might consist of other forms in such a way. At least in this respect the soul is without parts. As form in general does not admit of division into elements, so also the soul does not admit of division into separately existing faculties or capacities.

In light of this acknowledgement (i.e. that the soul is *in a way* simple) we can reinterpret the suggestion in *PA A 3* 644a6–11 that a definition of *eidos* has to include several differentiae. It does not overthrow the horizontal unity of form. A reasonable option is to assume that the plurality of differentiae nonetheless turns out to be deducible from a single form. Although none of these differentiae entails the other, i.e. 'two-footed' does not entail 'feathered' (in contrast to the entailment of 'footed' by 'two-footed'), there is a single form that *somehow* includes both 'two-footed' and 'feathered'. Aristotle does not occupy himself with the investigation into birds' souls and it is not exactly clear how form of bird or birdhood implies the

combination of two-footedness and being feathered. We can assume that the form of bird includes both differentiae in the sense that 'two-footed' and 'feathered' represent the specific capacities of the soul of the bird prescribing a certain way of locomotion. Namely, ***the differentiae are not parts of form, but rather bodily features which refer or point to the form***, i.e. to the capacities of the soul. The capacities, in turn, do not exist parallel to each other as localized at different organs of the body, e.g. wings or feet. Rather, they constitute a hierarchy, where the lower provide a foundation for the higher so that the higher cannot exist without the lower. If one takes the hierarchy of capacities to be the entailment of the lower capacities by the higher and if one regards the differentiae as representations of these capacities, then it follows that form is not composed of parts in the way a composite substance is and thus it can serve as a unifier.

Aristotle in the *Nicomachean* and the *Eudemian Ethics* makes remarks about 'inseparable' yet distinct parts of form, i.e. capacities of the soul. One part of the soul is non-rational, while the other is rational (*EN A 13 1102a27–8*). The non-rational part is not irrational, since it in the perfectly virtuous agent obeys and listens what the rational part prescribes (*EE B 1 1219b29–31*). Non-rational part includes the capacity of desire and rational part includes the capacity of deliberation. Desire and deliberation are different capacities due to being products of different parts of the soul. Desire and deliberation are two components that result in choice and subsequently in action.

The two capacities of the soul are 'two in definition' but 'inseparable by nature' as whiteness and straightness of a body or as the convex and the concave. The capacities despite having different formulas are quantitatively the same (*λόγω ἕτερον, μετέθει δ' ἀχώριστον*, *DA Γ 10 433b22–5*).

"We have said, for instance, that one [part] of the soul is non-rational, while one has reason. Are these distinguished as parts of a body and everything divisible into parts are? Or are they two [only] in definition, and inseparable by nature, as the convex and the concave are in a surface?" (*EN A 13 1102a27–32*, tr. Irwin 1999, p. 17)

".../ just as in a curve the concave and the convex are inseparable, and the white and the straight may be, though the straight is not white, except incidentally, and not in its own nature." (*EE B 1 1219b33–6*, tr. Woods 1992, p. 14; cf. *DA Γ 2 427a3–5*)

There are two questions to be asked:

- (i) Under what conditions are the parts of the soul related so that they are as inseparable as the convex and the concave or as the white and the straight?
- (ii) What exactly is the nature of the relation between the parts of the soul?

My assumption regarding (i) is that the rational and the non-rational part of the soul are related appropriately only if they fulfill their respective functions properly, only if the part whose nature is to prescribe indeed prescribes rightly and the part whose nature is to obey and listen indeed obeys to the orders issued by the rational part. The converse would destabilize the close cooperation between the capacities, i.e. if the part whose nature is to prescribe would instead obey and the part whose nature is to obey and listen would issue orders to the rational part, the ties between the capacities would loosen up, and the subject who has the soul would be disunited or rather mis-united.¹⁴⁰

Regarding (ii) there are two answers. Firstly, one may treat the capacities as attributes, whose unity is achieved due to being in one and the same subject, secondly, and more accurately, as processes, whose unity is a coincidence in actuality. Let us look briefly at each option in turn.

The capacities of the soul are related as attributes of numerically one and the same subject and not as distinct subjects themselves. As the white and the straight or the convex and the concave are physically inseparable but separable in definition, so the soul has capacities distinct in definition but one in number. Otherwise the soul would consist of several quasi-subjects and it would not be clear why it is something one and not many (cf. *Met Z* 13 1039a3–4; *A* 9 991b22). Moreover, in *De Anima A* 4 we are reminded that attributes do not belong to the soul directly as they do in case of the composite substance, the compound of body and soul: "Doubtless it would be better not to say that the soul pities or learns or thinks, but that the man does so with the soul" (*DA A* 4 408b14–15, tr. Hicks 1907, p. 33).¹⁴¹

A more subtle solution is to be found in the *Physics I* 3 where Aristotle talks about the oneness of actualizations or realizations of different capacities. I conjecture that when Aristotle introduces the analogy of the concave and the convex what he has in mind is that the actualization of the capacity of desire presupposes the actualization of the capacity of deliberation and vice versa, and these two actualizations coincide, i.e. they are numerically one but different in being, i.e. in essence, and have

¹⁴⁰ *EN I* 4 Aristotle writes that base people are in constant disharmony with themselves:

"For they are at odds with themselves /διαφέρονται γὰρ ἑαυτοῖς/, and have an appetite for one thing and a wish for another, as incontinent people do" (*EN I* 4 1166b6–8, tr. Irwin 1999, p. 142).

"For his soul is in conflict, and because he is vicious one part is distressed at being restrained, and another is pleased [by the intended action]; and so each part pulls in a different direction, as though they were tearing him apart" (*EN I* 4 1166b19–22, tr. Irwin 1999, p. 143).

¹⁴¹ Cf.: "But reasoning, love and hatred are not attributes of the thinking faculty but of its individual possessor, in so far as he possesses it. Hence when this possessor perishes, there is neither memory nor love: for these never did belong to the thinking faculty, but to the composite whole which has perished /../" (*DA A* 4 408b25–9, tr. Hicks 1907, p. 33).

different definitions. The assumption is justified by the fact that when Aristotle talks about the actualizations of different capacities in *Phys I 3* he uses similar analogies to that of the concave and the convex. He says that two actualizations are numerically one in the sense of the interval between 1 and 2 and between 2 and 1 or the slope of a line up and down, or the road from Thebes to Athens and the road from Athens to Thebes (*Phys I 3* 202a15–20; 202b11–19).

Thus, the parts of the soul are not related merely as attributes of numerically one and the same subject, but rather ***there is a numerical oneness between two processes, whose actualizations coincide***. For instance, the actualization of deliberation coincides with the actualization of desire, where deliberation involves a subject and desire involves the same subject. The capacities are individuated by their respective actualizations and actualizations are individuated by their essential properties which in turn are specified by the proper functions of the capacities.

Hence the capacities of the soul are mutually necessary. Without desire there is no movement and without deliberation there are no rational desires, no desires for the good, and hence no actions that are the result of choice. The rational capacity of the soul has its object due to the capacity of desire and the object of desire is specified as good due to the rational capacity of the soul (cf. Deslauriers 2002, p. 112).

We saw earlier (in the chapter 0) that separateness in definition played a key role in demarcating form – as expressed in the formula or definition – from matter, which is not mentioned in the formula or definition. Here the same criterion (i.e. the separateness in definition) is applied to the formal parts themselves as a demarcation of one formal part from another (in this case one capacity of the soul from another).

Koslicki might argue here again that the complexity of form precludes it from being a unifier. If formal parts represent the same type, they constitute an aggregate, which fails to be a unifier. In line with this reasoning, Aristotle identifies parthood with plurality, i.e. anything having parts of the same type is an aggregate, and unity with strict oneness, i.e. anything that is a unity is one and simple. Thus, if form has parts, it *eo ipso* is a sum or an aggregate failing to be a unity and a unifier.

But we saw above that form can have parts of the same type and be a unity. The ***parts of form are parts in a different sense*** than the constituents of a quantitative whole (either aggregate or a composite substance). The parts of form are unified because the parts of form are not quantitative parts and the form itself is not such a whole. We saw that form as an integral whole (being the object of definition) is divisible into

conceptual integral parts (genus and differentia). Since the division into such parts is different from the division into form and matter and from the division into material parts, the unity of such parts is also different, i.e. the unity of genus and differentia is secured via the entailment of genus in the differentia.

We also saw another case of part–whole, which was not listed among the senses of part–whole in *Met A* 25–6, but which can be observed in *DA* and *EN*: the division of the soul into capacities. This also by no means resembles the division into quantitative parts, and is distinct from the division into form and matter. Moreover, it also differs from conceptual parthood, i.e. the relation between the parts of the soul is not such that one part entails the others. The parts of the soul form a hierarchy but this is more than entailment. In fact, the division of the soul into capacities presents a peculiar part–whole relation, which is not explored (or rather not explicable) in terms of the part–whole senses listed in *Met A* 25–6. Boethius in the *De Divisione* treats soul as a 'virtual whole' which is a hybrid between a universal whole and an integral whole. Soul is not an integral whole in so far as it is not composed of quantitative parts (*De Div* 888c–d). Soul has an affinity with genus in so far as the whole soul can be predicated of each of its parts. Whether or not this hybrid sense of part–whole can be attributed to Aristotle deserves a separate investigation.

4.4. Summary to Chapter 4

Upon the division of the composite substance into quantitative parts, form is not a part of that substance. But if the substance is divided into substantial parts – form and matter, then form is a part of the composite substance.

Quantitative parts are entities of the same type which therefore need a unifier – the form. Without the form these parts would merely bring about a sum of composite substances, every one of which can exist independently. Somewhat similarly, substantial parts – form and matter, are entities of the same type. But they are mutually dependent and for that reason they do not need a unifier. Form is dependent on matter because a certain matter is necessitated for the existence of that form. Matter is dependent on form because matter cannot be severed from the form still continuing to be the matter for that composite substance of which it is the matter.

The form itself may have parts in a different sense than the items which it unifies. If form has parts in a different sense, it is a whole in a different sense. In one sense, form is a conceptual integral whole containing conceptual integral parts – genus and differentia, and these parts are not parts of the thing, viz. these are not real parts. These parts are unified, because the ultimate differentia entails all the previous differentiae and the genus.

The case is different with multiple ultimate differentiae, where none of them entails any other. But their unity is possible, because these differentiae are not parts of form after all, but rather bodily features which refer to the form, i.e. to the soul. Form as soul is a virtual whole consisting of capacities. These capacities count as parts, because, even if some of these capacities coincide in actuality, they still preserve their distinctness in definition. The virtual whole is midway between the integral whole and the universal whole, and therefore somewhat overthrows our classification of parts. However, this does not disprove the fact that form still can serve as the unifier of the composite substance, since the capacities of the soul are parts in a different sense than quantitative parts, and the unifier is allowed to have different kind of parts. The form as a virtual whole is a unity, because the capacities coincide in the same subject (the composite substance) and the higher capacities cannot exist without the lower.

Conclusions

I have attempted to offer a dissection of the problem of unity of substance and to provide a solution of it using instruments shaped by Aristotle's remarks on parts and wholes. The key to the solution of the problem has been the attentiveness to the different senses of the part–whole relation in Aristotle's conception of substance.

I have argued that Aristotle has the following basic senses of the part–whole relation:

- quantitative integral part–whole: material parts bear this relation to the composite substance;
- subjective part–universal whole: forms bear this relation to their genus;
- real substantial integral part–whole: form and matter bear this relation to the composite substance;
- conceptual substantial integral part–whole: genus and differentia bear this relation to the form.

I have claimed that the various senses of the part–whole relation present different versions of the notion of 'proper part'. For Aristotle, 'whole' presupposes compositionality out of, or divisibility into, proper parts, albeit there is not a direct correspondence between the results of decomposition and of composition, i.e. those things into which a whole can be divided are not necessarily the same things out of which the whole can be composed. Universal wholes can be divided into, but cannot be composed out of, parts; only integral wholes can be both divided into and composed out of parts.

I have found out that the notion of 'proper part', as it is formulated in contemporary mereologies in terms of mereological principles, cannot be uniformly mapped onto Aristotle's theory. However, since Aristotle is unwilling to call those items 'parts' which are identical to the whole, and since some of the mereological principles which characterize proper parts or wholes consisting of proper parts are applicable to the Aristotelian senses of the part–whole relation, I have concluded that Aristotle conceives of 'part' as a 'proper part'. If Aristotle admitted improper parts in to his substance theory, the problem of unity of the composite substance would become a pseudo-problem.

I have shown that each Aristotelian sense of the part–whole relation obeys different sets of mereological principles. The attributions of mereological principles to Aristotle's theory were merely hypothetical in nature, since Aristotle himself does not offer any formalism of this kind. The comparison was fruitful,

since it strengthened the claim that the senses of the part–whole relation are distinct. Moreover, it deepened the understanding not only of Aristotle's part–whole theory but also of these principles themselves.

So I have defended the view that whenever the composite substance has parts it has proper parts, and the possession of such parts does not impinge upon its unity. It is precisely due to the fact that there are different senses of 'proper part' (different senses of the relation that a proper part bears to its whole) that the problem of unity of the composite substance is solvable. In so far as the composite substance has proper parts in different senses, it is also a unity in different senses.

Firstly, the composite substance can be split into quantitative integral parts (viz. elements, material parts), which then themselves are composite substances. These parts are of such a nature that they need a unifier. Form is their unifier. Upon this splitting form is not a part of the substance and form does not have any parts.

Secondly, the substance can be divided into real substantial integral parts: form and matter. Form and matter are unified within the composite substance because form and matter differ from the elements. Namely, the division of the composite substance into form and matter is a different division than the division of the composite substance into elements, i.e. quantitative integral parts of integral whole. As a result, the composite substance itself is a different kind of unity depending on whether it is regarded as a form–matter compound or as compound of elements. The unity of form and matter is secured upon the recognition that form and matter are parts that cannot exist without each other. In contrast to the view that the presence of form *eo ipso* guarantees the unity of the composite substance, the focus on the mutual dependence provides explanation how form and matter hold together instead of just positing that form and matter hold together. Upon the division into substantial parts, form is a part of the substance along matter, and form does not have parts.

Thirdly, the form is also divisible and exhibits a different kind of unity from the previous two kinds. Form as a conceptual integral whole is divisible into conceptual integral parts, genus and differentia. Upon the division into conceptual parts, form is not a part of the composite substance, i.e. form is not a real part, but form has parts. Division into such parts is different than the division into form and matter and also different than the division into elements, and therefore the unity in this case is also different. The unity of genus and differentia is secured upon the recognition that one of these conceptual integral parts, i.e.

differentia, behaves like a universal whole, and the other, i.e. genus, behaves like a subjective part. Thus form is unified, if genus is taken as a subjective part of differentia. Another way of how to look at the unity of form (which is not included in the broad division into four kinds of parts) is the unity of the capacities of the soul, which deserves a separate investigation.

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