INSTRUMENTAL RELATIONS IN ARISTOTLE'S INTRINSIC TELEOLOGY

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Abstract

This thesis examines the scope of Aristotelian teleology. It challenges a narrowly intrinsic interpretation which rests on a dichotomous conception that only admits of two kinds of goal-directed movements, namely the actualization of one's own nature, or the artificial and arbitrary use of another substance. The thesis aims at overcoming this dichotomy by highlighting the fact that there are intermediary cases according to Aristotle, *i.e.* that the relation between agent and patient is not always strictly intrinsic or extrinsic. The first chapter examines instrumental relations in *crafts* and the second chapter examines instrumental relations in *nature,* both of which are shown to have their place within Aristotle's intrinsic view of teleology. Simply, the thesis argues that the self-actualization of natural substances should be viewed as the focal point rather than the exclusive subject of teleological accounts.

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Introduction

Over the last century, a growing number of scholars[1] have been calling for a renewed interpretation of Aristotle's teleology because, it is argued, it has been misunderstood both by its advocates and deterrents who have attributed to him a view of teleology which is *extrinsic* in one or both of two senses:[2] *first*, in that the goal-directedness of natural substances has its source in an agent which is external to the natural world (*e.g.* an intelligent designer whose *intentions* for each natural substance is the cause of their respective tendency to realize some goal); and *second* in the sense that the purpose of natural substances is the benefit of an external entity for whose good the intelligent designer has ordered the world (e.g. God, humans, or the whole cosmos). It is said, for instance, that medieval thinkers, in an effort to reconcile Aristotelian teleology with the biblical notion of God as creator and providential supervisor of the world, have attributed to Aristotle a view of teleology which entails an intelligent designer,[3] whereas modern mechanical philosophers[4] and scientists[5] have turned away from Aristotelian philosophy of nature on the account that the appeal to divine design to explain the natural order is unjustified and unscientific.[6]

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[1] We have in mind mainly the contributions of Zeller, 1883/95**;** Gomperz, 1909**;** Ross, 1923**;** Goudge, 1961**;** Balme, 1965**;** Ayala, 1970**;** Grene, 1972**;** Hull, 1973**;** Nussbaum, 1978**;** Lennox, 1992**;** Wardy, 1993**;** Johnson, 2005**;** Byrne, 2018**;** Gonzalez, 2020.

[2] Lennox, 1992, p. 325.

[3] See Saint Thomas's 5ft way for instance; Kahn, 1985 p. 185.

[4] Grene, 1972, p. 397**;** Lennox, 1992, p. 327-28**;** Gonzalez, 2020, p. 155.

[5] Gonzalez notes how some contemporary biologists renamed teleology in order to distance themselves from the so-called Aristotelian view, and defend what is in fact Aristotle's position. (2020, p. 155).

[6] Some scholars also note other – less significant – reappropriations in (so-called) Aristotelian vitalist (or animistic) views of nature developed in the 19th and 20th century. (Lennox, 1992, p. 326; Balme, 1987, p. 279-81).

By contrast, scholars have recently argued that the extrinsic view is un-Aristotelian because it entails a view of nature as a product of craft[7], reverses the Aristotelian understanding of the relation of nature and the arts, and psychologizes purposes.[8] In an effort to move away from such interpretations, it is often noted that Aristotle in fact deliberately distanced himself from those of his predecessors, like Anaxagoras,[9] Socrates, and Plato,[10] who attempted to explain the order and beauty of nature by appealing to the intentions and deliberative efforts of a divine artist. In short, scholars highlight the contrast between Aristotle's intrinsic and natural teleology and the extrinsic and artificial accounts of his predecessors in order to emphasize a view of teleology which grounds goal-directedness in *organic* forces rather than artificial *organization*, and which constitute a third option besides *"blind material determination and intelligent design"*.[11]

The rediscovery of Aristotle's intrinsic teleology usually emphasizes one of four corrections to the extrinsic interpretation. (1) First, it is argued that ends are species specific on Aristotle's account,[12] and that the directionality of natural substances is not towards a uniform purpose such as 'serving humanity'. Rather, nature is specifically differentiated and each kind of being[13] has an end which is *"better thus (not without qualification, but with reference to the substance in each case)"* (*Ph.* II 7 198b7-8).[14] This principle is expressed in both ethics[15] in the form of what is commonly called the

[7] Gonzalez 2020, p. 167**;** Leunissen 2020, p. 42.
[8] Many scholars involved in the task of rediscovering Aristotle's intrinsic teleology emphasize his non psychological understanding of purposiveness. (Gonzalez, 2020, p. 156; Ross, 1923, p. 126; Charles, 1991 p. 114**;** Kahn, 1985, p. 196**;** Broadie, 1987, p. 43; Grene, 1972, p. 398).
[9] Johnson, 2005, p. 113, 284.
[10] Leroi, 2014, p. 85; Johnson, 2005, p. 113, 123, 127, 284-6 **;** Leunissen, 2020.
[11] Gonzalez, 2020, p. 171.
[12] Johnson, 2005, p. 84; Gonzalez, 2020; Byrne, 2018, p. 34, 148; Lennox, 1992, p. 328; Nussbaum, 1978, p. 95, 100; Ross, 1923, p. 126.
[13] Gonzalez, 2020, p. 151; Johnson, 2005, p. 84-85; Grene, 1972, p. 398.
[14]Aristotle. (1984). *Physics* (R.P. Hardie & R.K. Gaye, Trans.). In *The complete works of Aristotle : the revised Oxford translation* (J. Barnes, Ed.). Princeton University Press.
[15] *EE,* II 1 and *NE,* I 7.

ergon argument,[16] which states that the good of each kind of thing corresponds to its specific function. For instance, while the excellence proper to the heart is the ability to pump blood, that of a kidney resides in its ability to filter it. Since a substance's function is intimately related to its nature, it follows that the good is as diversified as being. Thus, it is argued, Aristotle is not concerned with explaining the purpose of animals generally in the sense of providing a reason for the existence of various animal species; but rather with explaining how the internal constitution and functioning of parts contributes to the actualization of a specific mature organism.[17] (1.1) Consequently, some scholars emphasize the fact that Aristotle is not a global teleologist, at least not in a strong sense[18] which entails that all natural substances aim at some general or common good[19] or that there is an ultimate Good which is desired over and above the respective ends of natural substances.[20] In short, Aristotle's teleology is contrasted with extrinsic accounts on the basis that it rests on an immanent rather than a transcendent view of the good as a cause. (2) Consequently, the achievement of the end of a given natural substance is said to be inherently valuable on Aristotle's account. The goodness of natural substances does not have instrumental value *i.e.* it is not an

[16] Johnson, 2005, p. 218-219; Nussbaum, 1978, p. 100-101

[17] Leroi compares Plato's very general account of the purposes of creatures with the specificity of Aristotle's account. (Leroi, 2014, p. 87) See also Ross, 1923, p.126; Gonzalez, 2020, p. 148 Nussbaum, 1978, p. 81, p.95, 100; Lennox, 1992, p. 328; Johnson, 2005, p. 84-85, p.222.

[18] In short, *strong* global teleologists take all things to have the exact same purpose; to serve/please God or Humans, and thus do not do justice to the specific differentiation of the ends of natural substances. Weak global teleologists, on the other hand, do not see an opposition between the diversity and unity of natural purposes. Instead of being grounded in uniformity, they take the unity of the *specifically distinct* ends of natural substances to be grounded in the *inner directedness* towards an overarching good order, as is the case with the unity of the specifically distinct ends of the organs constituting a body. Gonzalez (2020), Leroi (2014) and Sedley (2008) do make this distinction and only reject the former definitively.

[19] Leroi, 2014, p. 87; Gonzalez, 2020**;** Scharle, 2008 p. 148**;** Nussbaum, 1978, p. 100**;** Lennox, 1992, p. 328**;** Wardy, 1993, p. 12-14; Broadie, 1987, p.41.

[20] This is because the good is always practicable according to Aristotle (Johnson, 2005, p. 247).

expression of their usefulness to God, Man, or the cosmos. This, it is argued, is a point of contrast with artificial teleology,[21] for in the craft paradigm, value is measured in relation to something external (*e.g.* it is 'better' for the knife to be sharp, *not* because cutting is good for the knife itself, but rather in relation to the artisant who makes or uses the knife); consequently those who make natural substances into a product of divine craftsmanship tend to conceive of natural substances as *instrumental* in the realization of a divine plan, thus depriving them of inherent value.

(3) Aristotle's teleology is also contrasted with extrinsic models with respect to the identification of the beneficiary of teleological change.[22] Since (1) purposes are species specific, *i.e.* since natural goal-directedness is a tendency proper to each kind of thing to actualize its nature, and since (2) the realization of this end is inherently valuable on Aristotle's account; it follows that (3) it would be a mistake to say that a natural substance strives to achieve its end *for the sake of* another entity. For instance, if a frog goes through specific developmental steps *for the sake of* actualizing its nature (*i.e.* realizing the state of affairs which is best - not absolutely, but for the kind of being that frogs are), and if this is inherently valuable, then the beneficiary of this developmental process is the frog itself. If however – as artificial teleologist assert – (1) natural substances are ordered for the sake of the realization of a universal purpose, and if (2) their value is only instrumental, then we should maintain that the beneficiary of the development of frogs is an external entity for whose good the cosmos has been designed.

(4) Lastly, Aristotle's teleology is contrasted with extrinsic and artificial accounts with regards to the location of the cause of teleological motion. An intelligent designer is the external cause of the good order of the natural world, similar to how an artisant is the external cause of its

[21] Johnson, 2005, p. 124-125**;** Wardy, 1993, p. 13-14.
[22] Johnson, 2005, p.62, 234**;** Gonzalez, 2020, p. 151.

production. By contrast, it is said that Aristotelian teleology locates the cause of the teleological motion or change *within*[23] natural substances. In short, since Aristotle distinguishes nature from crafts with respect to the location of the principle of motion,[24] and since he does not conceive of nature as a product of craft, it is argued that the principle of teleological change must be located within natural substances on his account.[25]

This brief summary makes it apparent that references to Aristotle's *intrinsic* teleology can mean different things. Aristotle's teleology is considered intrinsic *first*, in the sense that it rests on an immanent rather than transcendent view of the good; *second,* in the sense that it takes the realization of the respective telos of natural substances to be *inherently* valuable; *third* because the beneficiary of teleological motion is the natural substance itself, not another (external) entity; and *fourth,* because it locates the cause of teleological change within natural substances rather than in an external organizer.

The narrow view

The scholars mentioned above do not always explicitly distinguish these different meanings, nor do they examine their relation thoroughly, and although they manifest a desire to move past an inaccurate understanding of Aristotle's position, they usually do not provide an exhaustive discussion of the implications and presuppositions of his perspective. In most cases, their contribution is limited by the fact that teleology is not the primary object of their inquiry.

[23] Johnson, 2005, p. 76-77, 85-90, 100-101**;** Gonzalez, 2020, p. 165**;** Johansen, 2004, p.77, 86**;** Depew, 1997, p. 221-222 Broadie, 1990, p. 91**;** Gotthelf, 1987**;** Blair, 1992, p. 17-31.
[24] *Ph*. II, 1, 192b12 **;** *Ph.* IV 3 210a22**;** *GA* II 1,735a2.
[25] Johnson, 2005, p. 126, 286.

Nussbaum, for instance, in her first interpretative essay,[26] is concerned mainly with answering the Democritean mechanistic view of nature, and only clarifies things related to the intrinsic nature of teleological explanations in passing.[27] Byrne, Broadie, Grene, Ross, Gomperz and Zeller treat the matter similarly; they emphasize the importance of moving away from artificial and extrinsic interpretation of Aristotelian teleology, but their main focus is not to provide a detailed interpretation. While Lennox and Gonzalez's work is centered on Aristotelian teleology, it is limited in scope both by the size of their articles and by the fact that they do not confine themselves to the investigation of the intrinsic nature of goal-directedness. Apart from Johnson, Leroi and Kahn are the ones who grant this question the most attention, but their investigations are also limited by the nature of their work and their respective interest with the biological[28] and metaphysical[29] dimension of the topic.

As a result, discussions of Aristotle's intrinsic teleology are often incomplete, and we find in the majority of cases a tendency to adopt a narrow view of its scope, perhaps in order to emphasize

[26] Nussbaum, 1978, p. 59-106.

[27] She explains that Aristotle is not a global teleologist in the strong sense of the word, and opens the door to the possibility to interpret him as a weak global teleologist, but then does not elaborate much on what this weaker view of the unity of natural purposes might look like or entail. (Nussbaum, 1978, p. 95-6).

[28] Leroi's project is to help the readers familiarize themselves with Aristotle's biology. His work is not intended to be an exhaustive account of Aristotelian teleology. Of course, his project does require dealing with many important aspects of teleology, which is why he is one of the scholars whose contribution is the most substantial, but inevitably he leaves many important questions unanswered. (Leroi, 2014).

[29] Kahn's project is to clarify the role of the prime mover in Aristotelian teleology. Consequently, there are important aspects of Aristotle's teleology which he is not concerned with, such as the internality of natural causes, the contrast with artificial causes, the nature of the beneficiary of teleological change, etc. (Kahn, 1985)

the contrast with extrinsic and artificial interpretations.[30] Ross[31] and Lennox,[32] for instance, make the assumption that Aristotle's rejection of Plato's creationist model implies a radical denial of cosmic teleology, as if only an intelligent designer could ground the unity of purposiveness found in the natural world.[33] In other cases, the scope of teleological accounts is restricted to the internal functioning of middle sized substances such as plants and animals, on account of the fact that Aristotle considers the purpose of a natural substance to be the fulfillment of their respective nature rather than to serve an external entity.[34] In other words, because Aristotle does not consider that the primary function of animals and plants is to serve another substance (e.g. humans), it is inferred that animals can never be said to act *for the sake of* anything besides their own self-actualization. In these and similar cases, the tendency is to reject the strong sense of transcendent[35], global[36], instrumental[37] or external[38] conceptions of final causes and to infer that Aristotle's view rests on a *strictly* immanent, local, inherently valuable, or internal conception, thus excluding without adequately considering[39] more nuanced senses of the terms.

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[30] There are some who open the door to wider views of the scope of teleology, but do not develop them in a systematic and exhaustive manner (Zeller, 1883**;** Gomprez, 1909**;** Grene, 1972**;** Leroi, 2014**;** Baghdassarian, 2016**;** Morel, 2016)

[31] Ross, 1923, p. 126.

[32] Lennox, 1992, p. 325-26.

[33] Wardy (1993), although he claims otherwise (p.19), often seems to rely on a dichotomous view of strictly local and strong global teleological perspectives. See for instance his discussion of "suicidal deers" on p.26-7 which suggests a lack of nuance in thinking about the way in which entities may serve external ends, as well as his concluding thoughts (p.29).

[34] Ross, 1923, p.126**;** Nussbaum, 1978, p. 95-96**;** Lennox, 1992, p. 326**;** Johnson, 2005, p. 62, p.234**;** Gonzalez, 2020, p. 151.

[35] The notion that the good exists separately, in another realm.

[36] A view which grounds the unity of purposes in uniformity and presupposes that it is incompatible with their specific differentiation.

[37] The notion that the *primary* function of natural substances is to serve another entity (God, humans, or the cosmos).

[38] A view which reduces natural substances to products of (divine) craft.

[39] Occasionally, other, more nuanced, senses of the terms are mentioned, but their signification and implications are not thoroughly explored. For instance Nussbaum (1978), although she advocates for

The task ahead

We consider that these scholars have successfully shown why the extrinsic and artificial interpretations of Aristotle's teleology are problematic. For this reason, their contribution is a positive advance on the road to the discovery of Aristotle's teleology. The next natural step should be to investigate the presuppositions and implications of Aristotle's intrinsic teleology in a more systematic way. To our knowledge, M.R. Johnson is the only scholar who has undertaken this task in his book *Aristotle on Teleology*.[40] Johnson argues for an intrinsic interpretation of Aristotelian teleology which he develops in close dialogue with the Aristotelian corpus. A virtue of his approach is that he treats Aristotle's works as a unity with which one must engage as a whole.[41] Despite his exhaustive treatment of the question and the vital clarifications and textual references he provides, we contend that Johnson's interpretation cannot be the final word on the subject because it is too narrowly intrinsic and contradicts important Aristotelian doctrines. Johnson's interpretation relies on an unbalanced view of hylomorphic compounds. In an effort to avoid extrinsic accounts of the internal functioning of natural substances, he undermines the role of the material cause, and consequently, the Aristotelian view of the dual nature of hylomorphic compounds. His interpretation also relies on a restricted view of the beneficiary of teleological change which results

narrowing the scope of teleological accounts to the explanation of the functional parts of biological organisms, does remark that Aristotle's recognition of interspecies (or as we would say today, ecological) relations might complicate the matter and raise some questions for the narrowly intrinsic account (p.97), but she does not clearly formulate or engage with these questions.

[40] Johnson, 2005.

[41] This is often considered a weakness by those who review Johnson's work. The worry is that he does not do justice to important and difficult passages when he deals with them in only a few pages. We find it appreciable that his interpretation is grounded, not only in the small bits of texts that concern final causes explicitly, but in the many treatises in which we find traces, applications, and implications of Aristotle's teleological perspective.

in a limited understanding of the way natural entities can relate to one another, and in the exclusion of natural systems (*e.g.* food chains) from the field of study of natural philosophy. His interpretation also presupposes a view of the accidental which is too broad and extends to the regular and beneficial relationships of natural substances (*e.g.* the order of the food chain is just an *accidental* result of the respective activities of natural substances on his account) thus violating the principle of causal adequacy.[42] Finally, Johnson presents a strictly immanent and local interpretation of Aristotle's teleology[43] which is not easily reconciled with Aristotle's teachings on the unity of the good.[44] We will develop some[45] of these points in due time, for now let this be a sufficient overview of the ways in which we consider Johnson's interpretation to be narrowly intrinsic.

Our project

Our project is to contribute to the systematic investigation of Aristotle's intrinsic teleology which has been initiated by Johnson.[46] While we generally agree with the intrinsic interpretation outlined above, we seek to highlight its limitations in order to come up with a view that preserves its truth while overcoming its shortcomings. Given spatio-temporal constraints, our work will necessarily be incomplete. In order to be exhaustive, we would need to address the premises and implications of

[42] A principle which Johnson (2005) does, in some contexts, recognize to be at the heart of Aristotle's thought, and which he invokes in distinguishing Aristotle's teleology from Empedocles' position (p.99) as well as that of Anaxagoras and Plato (p.125)

[43] A view which he develops in contrast with an incomplete and simplistic view of what global teleology entails.

[44] Consider the way in which he systematically undermines the analogies used by Aristotle to teach us about the unity found at higher levels of organization (Johnson, 2005, p.229-246, 271-286)

[45] Let us insist that we will not address all of these points within the context of this thesis; we will be concerned mainly with the first limitation (Johnson's unbalanced view of hylomorphic compounds) and will consider the second (his restricted view of the beneficiary) only in a preliminary manner, in our conclusion.

[46] To be clear, our project is not to dispute extrinsic or artificial interpretation of Aristotle's teleology, for as we have said, this has already been done successfully.

Aristotle's intrinsic teleology in all the senses laid out above. We should (1) first establish what it means for Aristotelian teleology to be grounded in inner (natural) principles. In light of this, we should then (2) establish what can constitute the beneficiary of teleological change,[47] and (3) investigate Aristotle's view on the unity of the good as a cause; both within nature, and the whole cosmos. Lastly, we should explore (4) the fundamental place of activity (*energeia*) in Aristotelian teleology, and inquire into the explanatory role of the prime mover. In this paper, we will undertake only the first of these steps. Our research will consist in an investigation of the foundations and ramifications of a view of teleology which is said to be intrinsic because it has its foundation in natural (inner) causes. More precisely, our purpose is to clarify the place of instrumental relations within Aristotle's naturalistic perspective on teleology. This is a point of contention because instrumental relations presuppose *alterity*, meaning that they involve two separate entities, one of which imposes a purpose which does not belong to the other intrinsically. Because this is not easily reconciled with the intrinsic conception of final causes, many scholars simply exclude all instrumentalization processes from the scope of Aristotelian teleology. This simplistic solution rests on a dichotomous conception which only admits of two kinds of goal-directed movements, namely the actualization of one's own nature, or the artificial and arbitrary use of another substance.

The internality of natural causes

Throughout our work, we will challenge the dichotomous conception of natural and artificial causes which, we will argue, gives rise to a mistaken view of the contrast between Aristotle's natural

[47] More precisely, we should determine whether the scope of Aristotle's teleology must be restricted to the realm of middle-sized organisms, as many argue.

teleology with the artificial accounts of his predecessors. It is common[48] to establish the distinction between natural and artificial schemes of explanation *first,* with regards to the location of the principle of organization, and *second* with respect to the role played by psychological attitudes such as intentions and desires. In short, the common view is that (1) Aristotelian teleology grounds explanations in the nature of substances *i.e.* in an *internal* principle of organization, whereas artificial teleologists explain the order and beauty of the natural world with reference to an *external* organizer; and that (2) while Aristotle conceives goal-directedness as a self-actualization process *i.e.* as the expression of the being of the substance which changes *for the sake of* something, artificial teleologists rather consider it to be an expression of divine intentions *i.e.* 'purpose' is understood psychologically, while for Aristotle it has an ontological meaning.

Although there is some truth to this way of presenting the contrast, it is important to establish in what sense it is true and to draw the right conclusions, for we notice that a failure to establish certain nuances sometimes lead to simplistic and problematic views of the opposition of craft and nature and to an impoverished understanding of both. Johnson for instance concludes that (a) nature is to be understood *exclusively* in terms of internally caused self-actualization processes; and that (b) instrumentalization processes – which he confines to the domain of craft[49] – remain outside the scope of genuine teleological explanations. This leads him to (a) undermine the hylomorphic conception of natural substances, and to (b) distort the Aristotelian view of crafts by divorcing them from their ontological basis (and consequently, emphasizing their psychological dimension). We will challenge both these suppositions (and the resulting restrictions of the scope

[48] Common amongst the scholars who are invested in the task of rediscovering Aristotle's intrinsic teleology (Ross, 1923**;** Grene, 1972**;** Broadie, 1987, 1990**;** Sedley, 2008**;** Johnson, 2005**;** Gonzalez, 2020).

[49] In his view, instrumentalization processes are not natural because of the externality of agent and patient that they entail.

of teleology) throughout our work. Our first chapter will challenge the (b) exclusion of artificial goal-directed processes from the scope of Aristotelian teleology and our second chapter will contest the (a) strictly internalist view of natural change.

Because of the exhaustive nature of Johnson's work, he will be our primary interlocutor. Let us therefore provide a more comprehensive account of his view in order to delineate the contrast with our own. Fundamentally, Johnson's view rests on three premises; the priority of nature over the arts, the internality of natural causes, and the identification of internal and explanatory causes.[50] From these he concludes that Aristotle's natural teleology is rooted exclusively in internal causes and consequently excludes instrumental relations from its scope. In the course of our work, we will contest the third premise and challenge the resulting limitations of the scope of Aristotelian teleology. Johnson rightly insists that the distinction between natural and artificial causes lies in the location of the principle of motion.[51] He also does well to highlight the distinction between intrinsic and incidental causes; the former being explanatory and therefore relevant to scientific investigations, and the latter not suitable for grounding a teleological (or any kind of scientific) explanation.[52] However, we will argue that his account becomes problematic when[53] he treats these two distinctions as coextensive,[54] and infers that only internal causes are explanatory and can ground scientific explanations. We find in Johnson's work no satisfactory justification for treating these distinctions as coextensive, yet the consequences he draws from this are significant, namely that any good a natural substance may contribute to is incidental to it, and thus irrelevant

[50] Johnson, 2005, p.77, 100-101, 203.
[51] Ibid p.77, p.81, 123-124, 133-134, 280.
[52] Ibid p.60-62,102,104, 203, 237, 280.
[53] We say 'when', because in some contexts he does differentiate them *e.g.* p.104, 237, 280.
[54] See for instance Johnson, 2005, p.77, 100-101, 203.

to theoretical science. The result is a polarizing view of nature and the arts where nature is the domain of strictly intrinsic principles, whereas crafts is associated with extrinsic and incidental causes. This antithetical view of nature and the arts is best illustrated by the table he includes on top of p.203 where he compares the intrinsic and internal final causes of a horse (*e.g.* life and reproduction) with its incidental and external ends (*e.g.* gambling and racing). While Johnson is right to insist that the latter have no place in the scientific explanation of horses, we contend it is a mistake to suppose that *all* external goods to which a horse may contribute are equally arbitrary and scientifically irrelevant. In simple terms, it rests on the premise that there exists no middle ground between the self-actualization and arbitrary use of a natural substance.[55]

We will challenge this premise and Johnson's defense of it in due time but first, let us consider Aristotle's own discussion of the internality of natural causes and attempt to shed light on his view of their opposition to artificial ones, for once we have a firmer grasp of Aristotle's perspective, we will be in a better position to determine the limits of Johnson's interpretation. In the opening section of book II of the *Physics*, Aristotle defines nature as an inner principle of motion and rest.[56] This is often interpreted as meaning that the distinction between natural and artificial change is grounded in the spatial location[57] of the principle of motion. For instance, while a puppy has within itself the cause of its development into a dog (its soul), the cause of a bed is outside the bed, in the builder. The soul, being *in* the dog, is an internal, thus *natural* cause, whereas the builder is an external, thus *artificial* cause. Although there is some truth to this view, we will argue that it does not constitute the whole truth, for the internality of natural causes should

[55] Although this premise is for the most part implicit, it is often strongly suggested. See for instance Johnson, 2005, p. 6, 61-62, 77, 98, 202.
[56] *Ph*. II, 1, 192b12-19 See also *Ph.* IV 3 210a22 and *GA* II 1,735a2.
[57] Byrne, 2018, p. 90.

not be understood only in a physical sense. This is made manifest by the fact that, according to Aristotle, (1) some causes are physically internal yet not natural, and (2) some natural changes have a cause which is located 'in other things'.

Let us first consider the rest of the opening passage of *Physics* II 1 which suggests that *physical* internality does not, in and of itself, make a cause the *natural* principle of the motion it initiates:

> nature is a cause of being moved and of being at rest in that to which it belongs primarily, in virtue of itself and not accidentally. I say 'not accidentally' because (for instance) a man who is a doctor might cure himself. Nevertheless it is not insofar as he is a patient that he possesses the art of medicine: it merely has happened that the same man is doctor and patient – and that is why these attributes are not always found together. So it is with all other artificial products. None of them has in itself the principle of its own production. But while in some cases (for instance houses and other products of manual labour) that principle is in something else external to the thing, in others – those which may cause a change in themselves accidentally – it lies in the things themselves (but not in virtue of what they are). (*Ph*. II 1, 192 b 24-34)[58].

Aristotle thus adds a criterion for the delimitation of natural causes; the principle must be internal *in virtue of what it is* (intrinsically). The doctor who heals himself is not the natural cause of the process he initiates for the same reason that a builder who happens to stand inside the house he builds is not the natural cause of the house; in these and similar cases, being 'in' the patient is incidental to the agent. The builder is not in the house *because* he is a builder, nor does he build *because* he is in the house. In such a case, the internality of the agent is as irrelevant as its color ; in short, the internality of the builder is an *incidental* cause of the house. The distinction between

[58] Aristotle. (1984). *Physics* (Hardie & Gaye, Trans.).

intrinsic and incidental causes is most clearly laid out in the fifth chapter of the second book of the *Physics* where it is established that intrinsic causes are essentially (*in virtue of what they are*) related to the result they produce (and are therefore causally relevant) whereas incidental causes are accidentally connected to the effect *"For example, the intrinsic cause of a house is the builder, but coincidentally it is the pale or the musical."* (*Ph*. II 5, 196b25).[59] The builder is the intrinsic cause of the house because he is essentially related to the house *qua* builder and the art of building (which makes him a builder) explains the production of the house. By contrast, there is no necessary connection between being pale and the production of a house, thus the pale is an incidental (non-explanatory) cause of the house. As attested by his choice of example, in this passage Aristotle is not opposing art to nature as a cause; rather, insofar as they are intrinsically related to their effect both are opposed to chance.

In the passage from *Physics* II 1 cited above, however, Aristotle is contrasting art and nature, and in that context, he is not simply affirming that natural principles are intrinsic in the general sense that they are causally relevant. In addition to being essentially related to their effect, Aristotle establishes that natural causes are intrinsically (*by virtue of what they are*) internal. It is in this respect that they can be contrasted with artificial causes, since the latter are either external, or they are within the patient but only coincidentally. By contrast, it is not by chance that a natural cause is internal. The soul for instance, cannot possibly exist outside the body and shape it from the outside; it is an internal cause by its very nature (intrinsically). But what does it mean for natural causes to be internal *in virtue of what they are*? Why is the soul (and natural causes generally) necessarily *in* the patient? Is the soul glued to the body with a very strong type of glue *i.e.* is it just

[59] Ibid.

physically inseparable from the body? The soul, Aristotle says on multiple occasions,[60] constitutes the formal, final, and efficient principle of the living body, which means the efficient and final principles are identified to the formal cause of the body. Thus the final and efficient principles of the living body are necessarily *in* it because of their identity with its essence. In the second book of the treatise *On the Soul*, Aristotle defines the soul as *"an actuality of the first kind of a natural organized body"* (*De An.* II 1, 412b5).[61] Thus it is clear that the inseparability of body and soul is not only physical, for the soul is *"substance in the sense which corresponds to the account of a thing. That means that it is what it is to be for a body of the character just assigned."* (*De An.* II 1, 412b10).[62] In other words, the soul and the living body are not just necessarily connected, they are *one*.[63] In this resides the contrast with crafts, for an artist and its product, although they are essentially related, are nonetheless distinct entities. Generally then, a natural cause is *intrinsically* internal because agent and patient are *in a sense*[64] identical.

If what we have said up to this point is correct, it should follow that the cause of a natural change cannot, in any circumstance, be physically external. Yet in book VIII ch.4 of the *Physics*, Aristotle clearly asserts that some natural motions can be initiated 'by something else'; *"And the motion of things that derive their motion from something else is in some cases natural, in others unnatural."* (*Ph.* VIII 4, 254b20).[65] Consider for instance the case of elemental motion; the

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[60] *De Anima* II, 4, 415b9-11**;** *PA* I 1, 641a 25 **;** *Ph*. II 7, 198a24.

[61] Aristotle. (1984). *On The Soul* (J.A. Smith, Trans.). In *The complete works of Aristotle : the revised Oxford translation* (J. Barnes, Ed.). Princeton University Press.

[62] Ibid.

[63] This, Aristotle says, makes the question of the separability of body and soul irrelevant (in fact nonsensical), for unity is said in many ways and *"the controlling way is actuality"*. In other words, the relation of the soul to the organized body is the primary instantiation of 'unity'.

[64] We say *in a sense,* for surely Aristotle does not consider agent and patient to be *absolutely* identical. We will elaborate on the nature and degrees of identity relations below.

[65]Aristotle. (1984). *Physics* (Hardie & Gaye, Trans.).

elements, although they are set in motion 'by something else', are moved *naturally*, says Aristotle, when the motion is in accordance with their inner inclination. *"When fire and earth, then, are by force moved by something, they move contrary to nature, but they do so by nature when they are engaged in the activities that, in potentiality, are their own."* (*Ph*. VIII, 4, 255 a25-27)[66] Elemental motion can be natural even if it is initiated by an external cause according to Aristotle, for although the proximate efficient cause of the motion is physically external to the elements, they nonetheless have within themselves[67] a (passive) principle, which is the explanatory (intrinsic) cause of their motion. In this, Aristotle says, elemental motion is analogous to the fall of a heavy object; in a sense it is caused by the agent who removes what was preventing it from falling but in truth, this agent *"is the accidental cause of motion; and in the same way the rebounding ball is moved not by the wall but by the thrower."*(*Ph*. VIII, 4, 255 b25)[68]; in such a case, the explanatory cause of the motion is *"a source of motion – not of moving something or of causing motion, but of suffering it."* (*Ph*. VIII 4, 255 b30)[69]; a principle which, in the case of elements, is *internal* (and not incidentally, for this natural tendency constitutes their essence). Therefore, although they are in a sense moved by something else, the explanatory cause of their motion is an *intrinsically* internal principle.

To clarify what this means, it will be useful to consider the passage[70] which precedes the one just cited, where Aristotle distinguishes between two kinds or degrees of potency. Something may be called potential (1)in the sense that it is receptive of a given determination or capacity *e.g.* the bronze is potentially a statue or (2) in the sense that it has a capacity, but is being prevented from

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[66] Ibid.
[67] *Ph*. VIII, 4, 255 a22-25.
[68] Aristotle. (1984). *Physics* (Hardie & Gaye, Trans.).
[69] Ibid.
[70] *Ph*. VIII 4, 254 b 30**;** 255 b 4.

actualizing it *e.g.* a heavy object held up in the air is potentially on the ground. The second sense is more 'actual', and in fact corresponds to what Aristotle elsewhere calls 'first actuality'.[71] To illustrate this contrast, he suggests that we compare the way in which an ignorant man and a scientist who is not actively contemplating (say, because he is sleeping) are said to be 'capable' of scientific contemplation.[72] Things which are *naturally* moved by something else have a potency which, Aristotle says, is akin to that of the sleeping scientist rather than that of the ignorant man. The passive principle present in the elements thus corresponds to a first degree of actuality. To elaborate on the analogy, if someone were to wake up the scientist, we should call him the incidental cause of the scientific contemplation which then occurs, for he is not *by virtue of what he is* a cause of scientific contemplation. The explanatory cause in this case is rather the knowledge *in* the former sleeper. Thus the actualization of scientific contemplation, although initiated by an external agent, is natural because the explanatory cause is *intrinsically* internal to the scientist. Similarly, although the motion of elements towards their natural place is initiated by something external, the explanatory cause is their inner inclination, which is *intrinsically* internal, for it constitutes their essence. In short, elemental motion is natural because the external mover is only an incidental cause of the motion.

Let us also note that even in the case of living things, Aristotle thinks many natural functions have their source in a physically external principle.[73] Respiration, increase and decrease (development and deterioration), and other such natural activities are said to have their source in

[71] In *De Anima* II 1 he distinguishes between first actuality (a capacity to engage in an activity) and second actuality (the active exercise of that capacity) and identifies soul with first.
[72] *Ph.* VIII 5, 255 b1.
[73] The contribution of external factors to the natural motion of even living things is noted both by Johnson (2005, p. 141) and Cooper (2004, p. 108).

external environmental factors,[74] and the generation of animals and plants is in a sense externally caused because the parent is (numerically) distinct from the offspring. In the treatise on the *Generation of Animals,* Aristotle says the following concerning the externality of the cause of natural generation:

> In what way exactly is it not possible for the coming to be of the parts to be due to something external? For there is a way in which it is possible, and another way in which it is not. Now, whether we speak of the seed, or of what the seed comes from, makes no difference, insofar as the seed has within it the movement with which that other moved it. And it is possible for this to have moved that, and that this other, and for it to be like those wondrous automata. For their parts somehow contain a capacity when at rest, and when something external has moved the first of them immediately the contiguous one becomes so actively. As, then, in the case of these automata the external thing is in a certain way moving them, not by making contact with any part now, but by having made contact with one, it is likewise in the case of what the seed came from, or that which produced the seed, it moves by having once made contact, not by making contact still. In another way, however, it is the internal movement that does this, as building does the house. (*GA* II 1, 734 b5-10)[75]

The meaning of the last sentence becomes clear if we bear in mind the passage from *Physics* II 5 cited above, which establishes the contrast between explanatory and incidental causes. In that passage, the art of building was said to be the explanatory cause of the house by contrast with the pale and the musical. Thus it is plausible to think that when he says *"it is the internal movement that does this, as building does the house"*, he is identifying the internal movement with the builder (the intrinsic cause of the house), thus implicitly comparing the parent (external mover) to the pale

[74] *Ph*. VIII 2, 253 a12-15**;** VIII 4, 259 b10-15.
[75] Aristotle. (1984). *Generation of Animals* (A. Platt, Trans.). In *The complete works of Aristotle : the revised Oxford translation* (J. Barnes, Ed.). Princeton University Press.

or musical (the incidental cause of the house). The outcome of the argument is therefore that the parent (external mover) is only an incidental cause of the generation of parts; whereas the principle of motion which is *in* the semen is the explanatory cause of the process. This aligns with what we have said about elemental motion. The generation of parts is natural even if the parent is external because the explanatory cause is *by virtue of what it is* in the semen. The semen, like the elements (and also like the parts of the automaton) *"somehow contain a capacity when at rest"*, a capacity which we have said corresponds to a first degree of actuality. The difference between the case of the movement of automata and that of natural generation or elemental motion lies in the relation which holds between the passive and active principles.[76] A potentiality is somehow contained in the parts of the automaton, but this is the result of the organizing activity of an external agent. Later in the passage from the *Generation of Animals*, Aristotle says that *"whatever comes to be by nature or by craft comes to be due to something actively being, from something potentially being, of the relevant sort."* (*GA* II 1, 734 b25)[77] By 'principles of the relevant sort' he means explanatory principles, by contrast with irrelevant (incidental) "causes". While it is possible to identify explanatory ('relevant') causes in both art and nature, the difference lies in the fact that in nature, the active and passive principles are one and the same whereas in craft they are different. A form is already present in the semen, which is *potentially* an organism, whereas the form of the machine is different from and external to the metal which is *potentially* the automaton (for it resides in the soul of the engineer). In other words, in nature the passive principle already contains within itself a certain capacity - which corresponds to a first degree of actuality, thus the active and passive principles are *one*. The

[76] *GA* II 1, 734 b30.
[77] Aristotle. (1984). *Generation of Animals* (Platt, Trans.).

potentiality of the semen is therefore akin to that of the sleeping scientist, whereas that of metal is akin to the capacity of the ignorant man.

We can now go back to the passage from *Physics* II 1 where nature is defined as an inner principle of motion and state with clarity what it means. The internality of natural causes has to be understood both physically and essentially, for as we have said, natural causes are *intrinsically* internal. Let us reemphasize the fact that natural causes can be described as intrinsic in two ways. First, generally, in the sense that they are *by virtue of what they are* related to the result they produce. In this respect, they are like artificial causes and unlike chance (and other *incidental* causes). Second, natural causes are said to be *by virtue of what they are*, internal to the patient in which they produce a change. This second qualification indicates a deeper unity of mover and moved. It is in this respect that natural principles can be contrasted with artificial causes, for the latter can be internal only *incidentally*. In short, agent-patient relations in craft are intrinsic only in the first sense, whereas in nature, the relation is intrinsic in both senses. Thus when qualifying natural causes as 'intrinsic', it is important to specify which of these senses we have in mind, for their confusion may lead to unclarity regarding the differentiation of natural, artificial, and incidental causes. In order to avoid confusion, we have adopted the term *explanatory* to refer to the general sense in which both natural and artificial causes are contrasted with incidental causes because they are intrinsically *(in virtue of what they are*) related to their effects. We reserve the term *intrinsic* specifically for the relation which holds between a natural principle and its effect.

On our interpretation therefore, we may distinguish natural, artificial, and incidental causes with regards to three types of relations, namely (1) an explanatory or incidental relation (2) a

physical relation of internality or externality, and (3) an intrinsic or extrinsic essential relation (see the table below).

	Explanatory / Incidental	Intrinsic / Extrinsic	Internal/ External
Chance	Incidental	Extrinsic	Either
Art	Explanatory	Extrinsic	Either
Nature	Explanatory	Intrinsic	Internal*

Note that the physical location of causes is not, in and of itself, a determining factor in differentiating causes. Indeed as established above, some natural processes may involve external causes (*so long as they correspond to a principle intrinsic to the patient[78]), and some artificial causes may happen to be within the patient.

Johnson's interpretation

Let us now return to Johnson's perspective and attempt a more detailed account of its shortcomings. First, it may be useful to include a comparative table in order to illustrate the contrast between his view and our own. Notice that the first two columns are merged into one, for as we have said, Johnson treats the two distinctions as coextensive. Note also that the physical location of causes does play a role in the differentiation of causes on his account.

	Intrinsic / Incidental	Internal/ External
Chance	Incidental	External

[78] As established in *Ph.* VIII, 4, 255a 25-30.

Art	Incidental	External
Nature	Intrinsic	Internal

We have said above that Johnson correctly establishes the internal and explanatory[79] character of natural causes, but then proceeds to use the terms interchangeably, and we are now in a position to examine and challenge this last step. In section 2.7 of his book, Johnson contrasts explanatory causes with incidental ones. In addressing the difficulty of delineating between the two, he claims that *"the solution is to come up with a means of distinguishing between uses of an eye that are natural from those that are incidental"* [80] thus contrasting natural and incidental causes, seemingly forgetting that Aristotle's own illustration of explanatory causes (cited by Johnson himself on the previous page) is taken from the domain of craft. A charitable reading of Johnson's comment could suppose that he uses 'natural' loosely, in the sense of 'essential' and not specifically in opposition to craft *i.e.* that he means to say that the solution is to come up with a means of distinguishing between uses of an eye which are essentially related to eyeness from those which are merely incidental. However, what he says elsewhere indicates that he does mean to oppose natural and incidental causes and consequently, explanatory and artificial ones.[81] Johnson's reason for

[79] Johnson (2005) uses the term intrinsic, but we will use the term explanatory (even for referring to his interpretation) when he means intrinsic in the general sense which applies to both artificial and natural causes.

[80] Johnson, 2005, p. 61.

[81] For instance, on the next page Johnson (2005) says that: *"Knowing the causes of something belongs to theoretical knowledge, the objects of which are* ***intrinsic causes or natures.*** *Knowing the uses of something, on the other hand, is practical knowledge."* (p. 62) In the next chapter we can read; "*practical knowledge which, like art, knows how to use things and is concerned not with* ***internal and intrinsic forms*** *but with a form and a principle in another."* (p. 77) Again, in discussing Aristotle's critique of Empedocles, Johnson first notes that Aristotle considered Empedocles' account of nature to be problematic because it rests on incidental rather than explanatory causes, (p. 98) but then goes on to cite a passage from *Physics* II 6 (p.

identifying internal and explanatory causes is most clearly laid out on p.202-203, where he cites a passage from *De Anima* which establishes that self-movers cannot be moved by something else intrinsically, and that similarly, a process which is *for the sake of* an intrinsic final cause cannot occur *for the sake of* an external good.

> An animal may be pushed along by force but something that has been moved by itself included in its substance cannot be moved by something else except coincidentally - just as what is intrinsically good because of itself cannot be good because of something else or for the sake of something else. (*De An.* I 3, 406 b8)[82]

From this, Johnson infers that, since natural substances have intrinsic purposes, any other good they contribute to is incidental to them. On this view, internal, natural, and explanatory causes are equivalent *i.e.* to have a nature is to have an internal cause, and this is the same as to say an explanatory cause; whereas all external causes are incidental, and thus scientifically irrelevant.

The problem with Johnson's interpretation of the *De Anima* passage cited above becomes clear if we pay attention to the context of Aristotle's remark and consequently, to the restricted sense in which we are to understand them. The first part of the analogy establishes that the external efficient cause of an animal's locomotion is necessarily incidental because animals are by nature self-movers *in this respect*. Recall however, that Aristotle says elsewhere that some animal motions (in fact all but locomotion) require the intervention of an external force.[83] Thus when he says that self-movers cannot be moved intrinsically by external agents, it is clear that he has in mind only the restricted sense in which animals move themselves (locally), and that it would be a mistake to

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100) where Aristotle contrasts the internality of natural causes with the externality of luck, without noting that they are different (although related) points.

[82] Aristotle. (1984). *On The Soul* (Smith, Trans.).

[83] *Ph*. VIII, 259b10-15 – This is something Johnson (2005) himself notes (p. 141).

interpret him as asserting that any change which is externally caused (*e.g.* respiration) is incidental to animals.

Bearing this in mind, if we now consider the second part of the analogy which concerns final causes, it becomes apparent that Aristotle's claim that *"what is intrinsically good because of itself cannot be good because of something else or for the sake of something else"* does not entail, as Johnson argues, that a natural substance can never be said to act *for the sake of* another substance except incidentally. Rather, we should understand this affirmation in the limited sense that the self-actualization of natural substances, because it is *for the sake of* an intrinsic final cause, does not have instrumental value. For instance, we should say that the growth of a horse, because it is *for the sake of* an intrinsic purpose (the actualization of its form), cannot be explained with reference to an external good. However, the fact that its growth is not *for the sake of* an external good does not exclude the possibility that *other aspects* of its natural life (*e.g.* some features of its feeding habits) may be explained with reference to an end which does not, strictly speaking, belong to the horse intrinsically (*e.g.* the good order of the ecosystem it inhabits). Consequently, we contend that the *De Anima* passage which Johnson cites in support for his identification of internal and explanatory causes does not in fact exclude the possibility that *some* external causes may be scientifically relevant, and therefore does not give ground to his implicit premise that there exists no middle ground between the self-actualization and arbitrary use of natural substances.[84]

[84] On Johnson's (2005) account, the horse's contribution to the good order of its ecosystem is just as incidental as its contribution in the racing event. Both ends, because they do not constitute the intrinsic end of the horse, are equally irrelevant scientifically. The consequence of this view is that a natural scientist should not, for instance, be concerned with the horse's place in the food chain and other such *relational* aspects of its natural life. In other words, Johnson's identification of internal, natural, and explanatory (intrinsic) causes leads him to deny the possibility for Aristotelian teleology to be reconciled with a science of ecology. Here we are getting ahead of ourselves, for this question belongs to the second of the four-step

Thus far, we have challenged an interpretation[85] of the internality of natural causes and of their opposition to artificial ones which, we contend, does not capture the nuances of Aristotle's perspective. In what follows, we will contest two reductions of the scope of teleology which follow naturally from the dichotomous interpretation examined above. We will argue for a broader view of the scope of Aristotle's teleology which encompasses instrumentalization processes in both craft (chapter one) and nature (chapter two). We will then conclude with an overview of the consequences of our work for future research. We will emphasize the fact that our perspective helps us to reframe some of the questions outlined above in a more fruitful way.

project outlined in the introduction. For now, let us simply note that Johnson's identification of internal and explanatory causes leads him to make significant claims and that his justification for doing so is unconvincing.

[85] A view which we said is common in the literature that aims at emphasizing the contrast between Aristotle's naturalistic perspective and the artificial view of his predecessors.

Chapter one

Craft

In our first chapter, we will investigate Aristotle's view of the relation of nature (*physis*) and the arts (*techne*) and clarify the nature of his objections to the *artificial* teleological accounts of his predecessors. This will allow us to develop a more accurate view of his primarily *natural* conception of goal-directedness. Through this, we will emphasize his non-psychological understanding of purposes (*telos*).

If Johnson and like-minded scholars are right that Aristotelian teleology (and science generally) is *strictly* concerned with intrinsic and natural causes, it is curious that Aristotle so frequently relies on craft analogies to teach us about teleological change.[86] Indeed, if Aristotle considered all external causes to be incidental, it is surprising that he considered craft-based examples to be so enlightening. We have indicated above that a common way to contrast natural and artificial teleology rests on a sharp demarcation between natural processes of self-actualization (which are *for the sake of* an end in an ontological sense) and artificial instrumentalization processes (which are *for the sake of* a goal in a psychological sense).[87] In this view, craft analogies can be useful insofar as artificial processes manifest a likeness to genuine (natural) goal-directedness, but accounts of their pedagogical value are often[88] accompanied by a warning that the comparison must not be taken too seriously, with a special emphasis on the fact that the analogy is *not* meant to establish that natural processes are the result of intentions or desires. This, it is argued, would constitute a

[86] In fact he relies on craft analogies to teach us about all four causes, see *Ph.* II 3 194 b18-35.
[87] Johnson, 2005, p. 203**;** Johansen, 2004, p. 69**;** Charles, 1991, p. 107**;** Cooper, 1982, p. 221-222.
[88] Furt, 1988, p. 181; Johnson, 2005, p. 126 ; Sedley, 2008, p. 174 ; Leunissen, 2010, p. 17.

dangerous overstretch of the analogy.[89] In this view, while it may at first[90] be useful for natural philosophers to consider cases of artificial goal-directedness in order to familiarize themselves with means-end relations, they should then leave these considerations behind as they move on to investigate natural goal-directedness. In short, this view presupposes that genuine teleological accounts do not, in truth, apply to the domain of craft. Because the scholars who adopt this view usually do not consider artificial causes to be genuine explanatory causes, the heuristic value of craft analogies rests on fairly superficial[91] similarities and it makes it questionable why Aristotle would so consistently rely on them all throughout the corpus (and not just at the very beginning of the *Physics* for instance).[92] In short, Aristotle's consistent use of craft analogies suggests that it rests on a more fundamental symmetry[93] of natural and artificial causes than their view allows.

In what follows we will challenge the dichotomous view of nature and the arts and try to provide a more accurate account of the analogy which Aristotle establishes between them. We will also clarify Aristotle's objection to artificial teleology which, we will argue, rests *not* on an exclusion of artificial processes from the scope of teleological explanations, but rather on his view of their relation to natural ones. We will suggest that Aristotle considered the similarities between craft and

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[89] In fact, it is noted that this mistake is at the heart of Aristotle's objection to his predecessors who, because they failed to identify the limits of craft analogies, developed an artificial view of nature which they viewed as resulting from divine intentions.

[90] *i.e.* Knowing the operation of artificial causes facilitates knowledge of the operation of natural causes, which are more knowable *per se* (Sedley, 2008, p. 174**;** Gonzalez, 2020, p. 162)

[91] Johnson, 2005, p. 126, 133**;** Gotthelf, 2012, p. 68-9; Cooper, 2004, p. 107-8**.**

[92] Additionally, as Witt (2015) points out, we do not find in Aristotle's work a consistent movement from a discussions of artifacts to the consideration of natural substances, rather "*Aristotle's exposition and argument weave back and forth between artifacts and natural beings in a free-flowing manner*" (p.111).

[93] Aristotle distinguishes between what is more knowable *for us*, and *per se* (absolutely) in *Posterior analytics* books I and II, *Metaphysics* book A and *De Anima* III. In all these cases, he emphasizes both the differentiation and continuity of the different objects and ways of knowing them. Charles (2002) brings this continuity into light when he explains how the engagement with the world through craft provides an opportunity for a first contact and apprehension of natural kinds. (p.358-62)

nature to be very profound and that reestablishing the priority of nature over the arts allows for a deeper grasp of their unity.

Craft analogies

In her article *Nature and Craft in Aristotelian teleology,* Sarah Broadie identifies the points of analogy and dis-analogy between craft and nature. Her contribution is significant because she addresses the question in a comprehensive manner and develops her analysis well beyond the common and simplistic view that the analogy is meant to establish that nature, like art, is purposeful. She notes that the goal-directedness of nature is in fact often taken as an established starting point, and that the analogy rather serves to specify what it means to say that natural substances are goal-directed. She notes five points of analogy,[94] *i.e.* five things which the craft analogy is meant to teach us about natural teleology, three of which are worth examining for our present purposes.

The first[95] is the species-specific character of artificial goal-directed processes. Broadie notes that crafts, unlike many activities, mirror the specific differentiation of the natural world. Accordingly, she thinks the craft analogy serves to establish that natural substances, like craftsmen, are agents which direct a developmental process towards a *specific* form or structure. Thus an important contribution of the craft analogy is that it allows us to grasp goal-directedness as a specifically differentiated rather than uniform phenomena. As she puts it; *"without the craft analogy, we should still have teleological explanation, but not the Aristotelian concept of natural substances."*[96] In short,

[94] Broadie, 1990, p.93-95.
[95] Ibid. p.93 - point (a).
[96] Ibid. p.92.

the craft analogy teaches us that goal-directedness is rooted in the specific nature of the being which is actualized through a teleological process. In line with this, consider the following craft analogy taken from the treatise on *Respiration :*

> The arts themselves achieve these different results, for that by using fire as an instrument they soften, liquefy, and desiccate substances, and some they temper. Individual natures work in the same way, and so they differ one from another; so that it is ridiculous to judge by externals; for whether we regard the heat as separating or refining, or whatever the effect of warming or burning is, the results will be different according to the different natures of the agencies which employ it. But while the crafts use the fire merely as an instrument, nature uses it as a material as well. (*Resp.* 485 a30-b5)[97]

Notice the point of disanalogy suggested by the last sentence, which contrasts the essential relation which holds between patient and agent in both cases. While craft uses fire as an instrument *i.e.* as something different from itself, nature *"uses it as a material as well".* This suggests, as we argued in our introduction, that natural change is characterized – and differentiated from craft –with regards to the intrinsic relation of agent and patient. Let us recall however that although artificial causes are not intrinsic, they are, like natural causes, essentially related to their effect in the general sense that they are explanatory rather than incidental causes. In this resides the second[98] point of analogy highlighted by Broadie. She notes that many goal-directed activities are incidental to the agent; she mentions for instance going to the neighbor's house to inquire about recent news, an activity which does not belong to man *in virtue of what he is*. She highlights the fact that the cognitive faculties which make this activity possible (*e.g.* language and social skills) are not meant directly or

[97] Aristotle. (1984). *On Breath* (J.F. Dobson, Trans.). In *The complete works of Aristotle : the revised Oxford translation* (J. Barnes, Ed.). Princeton University Press.
[98] Broadie, 1990, p. 93 - point (d).

primarily for this activity. In short, gossiping is only a possible use of these faculties, and thus constitutes an incidental end of man. By contrast, the cognitive faculties which allow a craftsman to practice his art are essentially related to the production of a specific artifact. Broadie argues that Aristotle deliberately establishes the comparison with craft instead of other goal-directed activities because he wants to emphasize the explanatory character of natural causes.[99] This second point of analogy thus reemphasizes what the first one established, namely that goal-directedness must be understood in relation to the nature of specific beings.

The third[100] point of analogy is the secondary place of desires and intentions. This is an important and somewhat controversial point. As noted above, it is common to consider the place of deliberation to be a point of *dis-analogy* between craft and nature, and to insist that the two must be distinguished in this respect in order to avoid importing psychological views of goal-directedness which lead to extrinsic and artificial views of nature. As Broadie rightly notes,[101] Aristotle in fact considers psychological attitudes such as intending or desiring to be secondary even in crafts. This, she says, is part of what makes them helpful in understanding natural goal-directedness.[102] She notes, for instance, that according to Aristotle, a builder *qua* builder is not said to build because of his intentions or desires, rather *"a man builds because he is a builder, but the builder builds in virtue of the building craft." (Ph.* II 3, 195b22)[103] Thus she challenges a misconception[104] of artificial goal-directedness which identifies the personal motivations of the

[99] This aligns well with the fact that Aristotle relies on an example taken from craft for illustrating the essential relation which unites an explanatory cause and its effect in *Ph.* II 5, 196 b25.
[100] Broadie, 1990, p. 94 - point (e).
[101] As does Gonzalez (2020, p. 162-163). See also Sedley (2008, p. 178).
[102] Broadie, 1990, p. 95.
[103] Aristotle. (1984). *Physics* (Hardie & Gaye, Trans.).
[104] See for instance Sedley (2008, p. 174).

craftsman[105] with the final cause of his activity. This is an important point which merits a more exhaustive discussion.

A non psychological conception of purposes

In *Physics* II 8, Aristotle seems to bridge a gap between nature and the arts by claiming that in crafts, as in nature, goal directedness is ***not*** rooted in deliberation. *"It is ridiculous for people not to believe that something is coming about for the sake of something if they do not see that the moving cause has deliberated. Yet craft too does not deliberate."* (Ph. II 8, 199b 26)[106] Of course, Aristotle is not denying that there is a place for deliberation in the arts. Rather, he challenges the view that the presence of deliberation is what grounds the claim that artificial processes are goal-directed.[107] To clarify the proper role of deliberation in the arts, let us remember that for Aristotle, deliberation always concerns means, never ends.[108] It follows that even in craft the end is prior to, and therefore not grounded in deliberation. This clarification might not satisfy those who wish to deny goal-directedness to non-human nature; they may still object that although deliberation is posterior to purposes, these purposes are grounded in psychological attitudes such as intending or desiring – and since these cannot bring about good results in and of themselves (without the deliberation and intervention of an agent) the question remains as to how nature can be said to act *for the sake of something* if it does not deliberate. In other words, clarifying the secondary role of deliberation does not address the fundamental mistake of those to whom the comments from *Physics* II 8 are

[105] Accordingly, Ravilochan (2023) rightly notes that the analogy is established between nature and the craft, rather than the craftsman.
[106] Aristotle. (1984). *Physics* (Hardie & Gaye, Trans.).
[107] For a similar interpretation of the passage from *Ph.* II 8 see Sedley (2008, p. 178-181).
[108] *NE* III 3, 1112b 12–20

directed; what needs to be addressed is their psychological understanding of purposes *i.e.* the view that a purpose is 'something desired'.[109]

In what follows, we will argue that Aristotle's view is that intentions, far from being the cause of purposes, are in fact subordinated to them and cannot exist independently. In short, Aristotle considers purposes to be primarily rooted in the notion of the good, not in psychological attitudes such as intending or desiring.[110] Purposes are desired by conscious agents because they are good, not the other way around, and teleological accounts in both craft and nature are explanations of something happening because it is good, not because someone intended or desired it. In book VII of the *Metaphysics,*[111] Aristotle explains that health, not the doctor's intention, constitutes the end of the medical art. The doctor takes a series of steps *for the sake of* restoring health, and this can be understood independently of the intentions of the doctor. According to Aristotle, everything about the medical art, including the artists' intentions and deliberative efforts, is grounded in a definite form (in this case, health).[112] Thus even in artificial teleological accounts, purposes are grounded in *being* and should not be psychologized. In other words, it would be a mistake to think that the doctor chooses the end to be pursued in the sense that his choice explains or determines the end of the medical art. This is why, as we'll see below, one cannot invent[113] a new craft simply by deciding to pursue an arbitrary "goal". According to the Aristotelian view of crafts, the artist neither creates the material nor the formal principle of artifacts,[114] his role is simply to deliberate on

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[109] Not in the sense that purposes are things which can be desired, but in the sense that desires are the cause of purposes.

[110] Cameron, 2010 p.1098**;** Cooper, 2004, p. 107**;** Broadie, 1990, p. 94 **;** Woodfield, 1976, p. 204-5.

[111] *Metaph*. VII, 7 1032b5–14.

[112] Everything in the medical art, including the disposition of the doctor, is *"related to one central point, one definite kind of thing".* (*Metaph*. IV, 2, 1003 a32-37). Aristotle. (1984). *Metaphysics* (Ross, Trans.).

[113] Aristotle's view appears to be that humans discover rather than invent crafts, more on this below.

[114] *Metaph.* VII 15, 1039 b25**;** XII 3 1070 a15-20.

the best way to instantiate pre-existing forms in pre-existing materials. Thus the intentions of craftsmen are subordinated to, and cannot be understood apart from the specific forms of artifacts. In her discussion of the craft analogy, Broadie[115] notes that Aristotle focuses on craft at the expense of a myriad of human activities whose intentional character should make them just as relevant if purposes were grounded in intentions. We have already explored some of the reasons why Aristotle considers some intentional actions to be better illustrations of teleological processes. We shall now go one step further and ask whether all intentional actions can even be said to be purposeful. Take for instance the extreme case of the behavior of mad people. Their actions, although intentional, are 'senseless'. Their intentional and deliberate nature might make them *appear* goal-oriented, but most people would agree that they are no more 'purposeful' than the severed member is 'a hand'. We suggest it is the nature of their 'goals' which makes these actions senseless. Because he is out of touch with reality the madman's goals are not rooted in being, they are 'not real goals'.[116] To illustrate what we mean, let us imagine that the madman set out to build an object known by the name of a *vistemboir,*[117] whose shape and function are ambiguous and controversial. If intentions are primary and constitute a starting-point of goal-directedness, there is no reason to deny that such a building project is purposeful. Those who have a psychological conception of purposes should say that the shape which the madman *intends* to instantiate constitutes a goal, and that there can be a teleological account of his deliberate actions, which are means to achieve this *desired* end. By contrast, Aristotle would say that regardless of his intentions and deliberative efforts, the madman is not acting purposefully because his goal is not grounded in being, and his actions do not

[115] Broadie, 1990, p.93**;** Sedley, 2008, p.178**;** Ross, 1923, p. 77.

[116] See *NE* I 1, 1094 a1-9 where Aristotle establishes that goal-directed activities have an end which is a determinate form or nature.

[117] For an exhaustive discussion of the nature of such an indefinite object, see Jacques Perret's *Le machin.*

contribute to the actualization of a specific form. In short, given the secondary place of desires and intentions in Aristotle's account, there can be no genuine intention in the absence of a real end. The upshot is that intentions and goal-directedness are indeed intimately related, but not because the former is a cause of the latter. On the contrary, the dependence runs in the opposite direction.[118] It follows that, according to Aristotle, those who grant that human actions are teleologically explicable only because they see an agent deliberating have misunderstood what makes even these actions purposeful. According to Aristotle, this misunderstanding is characteristic of both teleological deniers (those who think nature can only be purposeful if it deliberates) and artificial teleologists (those who explain the purposiveness of natural substances with reference to the intentions of a divine artist), both of whom fail to identify the proper cause of goal-directedness.[119]

The mistake of artificial teleologists

Simply, the mistake is to think that to answer the 'why question', one must investigate the motives of the agent rather than the nature of the good result. In this view, health is not a cause *for the sake of which*, except accidentally; purposes are not causes in their own right, they are the secondary cause of a good result insofar as they belong to/are attributes of the "real cause" (the efficient cause). This is the mistake Aristotle attributes to his predecessors in book A of the *Metaphysics*:

> That for whose sake actions and changes and movements take place, they assert to be a cause in a way, but not in this way, i.e. not in the way in which it is its *nature* to be a cause.

[118] See *NE* VI 2, 1139a 31-b5.

[119] Let us note that the narrow view of teleology defended by Johnson and others rests on the same premise (as well as the resulting divorce of artificial goal-directedness from its ontological basis). This is partly why they deem it necessary to exclude crafts from the scope of Aristotelian teleology.

> For those who speak of reason or friendship class these causes as goods; they do not speak however, as if anything that exists either existed or came into being for the sake of these, but as if movements started from these. In the same way, those who say the One or the existent is the good, say that it is the cause of substance, but not that substance either is or comes to be for the sake of this. Therefore it turns out that in a sense they both say and do not say the good is a cause; for they do not call it a cause *qua* good but only incidentally. (*Metaph*. A 7, 988b 5-15)[120] [121]

For an artificial teleologist like Anaxagoras, the good is not a cause in its own right, it is rather a character of the moving cause; things are moved towards their respective ends because of a *good* or *well intentioned* efficient cause. This is why, although he recognized that some of his predecessors[122] had foreseen the need to resort to the good to explain the order and beauty of nature, Aristotle did not consider them to have developed an adequate understanding of the way in which the good is a cause. We have said that, according to Aristotle, the doctor's intentions are not the primary cause of the good realized through the practice of medicine,[123] health is. Health is *that for the sake of which* the process of healing takes place. Those who instead ground goal-directedness in the psychological attitudes of the agent confuse efficient and final causality and fail to grasp the true nature of goal-directedness. Also because of their assumption that purposes are psychological, they think that nature, if it can be explained teleologically, is either herself capable of deliberation, or is ordered by an agent capable of it. On Aristotle's account, by contrast, deliberation is not the only, nor the

[120] Aristotle. (1984). *Metaphysics* (Ross, Trans.).
[121] We find a similar account in *Metaph* XII 10, 1075 a35-b1.
[122] In book A of the *Metaphysics* Aristotle mentions Anaxagoras, Empedocles, Hesiod, Parmenides and Plato.
[123] It is true that in techne, since the materials are not *intrinsically* animated, the good cannot be realized independently from the deliberation and intervention of an outside agent, but it is crucial to keep in mind that this agent is the *efficient cause* of the change. Therefore, even if it is a necessary condition for artificial goal-directed motion, the agent is not the explanatory cause of the goal-directedness.

primary means of realizing an end. At the root of Aristotle's critique of his predecessor's teleological accounts is their inversion of the order of priority between nature and the arts[124] which results in their failure to grasp the nature of goal-directedness. Let us insist that the mistake is not the attempt to understand natural goal-directedness in light of craft, nor is it the physical externality of the mover which is entailed by their teleological views.[125] Rather, his critique concerns their mistaken view of the direction of the craft analogy and the *psychological* conception of final causes that this entails.

Naturalizing techne

As a concluding thought for this chapter, we would like to suggest that reestablishing the right order of priority between *techne* and *physis* is what makes the Aristotelian use of craft analogies more enlightening than that of artificial teleologists; for it allows us to perfect our understanding of both nature – by relying on the crafts whose essence is more knowable *for us* – and crafts – by identifying the true cause of their goal-directedness. If artificial teleologists can be accused of developing an artificial view of nature; Aristotle by contrast could be said to have developed a natural view of the arts. To clarify what this means, let us take a brief look at Aristotle's discussion of the art of accumulating wealth, in the first book of the *Politics*. The development of the

[124] Johnson (2005, p. 81) and Sedley (1991, p. 188) emphasize Aristotle's commitment to the priority of nature.

[125] While Johnson (2005) does recognize the fact that the disagreement has to do with a failure to identify the explanatory cause of teleological change (and consequently, to provide scientifically relevant teleological accounts) (p. 127), he insist on the physical separation of mover and moved which he says characterizes artificial teleology (p. 284-6). Although it is not unrelated, we contend it is not the heart of the matter.

argument throughout chapters 8-12 of book I of the *Politics* can be summarized as follows. First, Aristotle establishes the relation between an animal's natural needs and its way of life:

> For of beasts, some are gregarious, others are solitary; they live in the way which is adapted to sustain them, accordingly as they are carnivorous, or herbivorous or omnivorous: and their habits are determined for them by nature in such a manner that they may obtain with greater facility the food of their choice. (*Pol*. I 8, 1256 b25)[126]

The way in which an animal provides for itself is grounded in its nature – *e.g.* its hunting habits are derived from its nutritional needs, which are determined by its nature. Then, he extends this logic to the case of humans. Different arts are meant for satisfying our natural needs in ways appropriate to our nature – both in quantity and quality. Afterwards, he establishes that the purposes of acquisitive arts are natural when they are grounded in the essence of human communities (*e.g.* the family or the city) just as the natural needs of a given animal determines the nature of its feeding habits.[127] Then, in the 9th chapter, he contrasts these natural arts of acquisition with the unnatural arts of acquiring riches *for the sake of* accumulating wealth. The reason why this second kind of acquisitive art is unnatural is that its purpose is not borrowed from nature. Aristotle later implies that such arts, whose ends are arbitrary, are not genuine instances of the acquisitive arts when he says about their natural counterpart that *"These are the divisions of the* ***true or proper art*** *of wealth-getting and come first."* (*Pol.* I 9 1158 b20)[128] The second class of acquisitive arts are not 'true or proper' because they are not grounded in nature. The following passage clearly indicates

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[126] Aristotle. (1984). *Politics* (B. Jowett, Trans.). In *The complete works of Aristotle : the revised Oxford translation* (J. Barnes, Ed.). Princeton University Press.
[127] *Pol.* I 8, 1256 b27-31.
[128] Aristotle. (1984). *Politics* (Jowett, Trans.).

that Aristotle considers them to be arts only by name because their purposes, not being grounded in natural ones, are in a sense not 'true purposes':

> Others[129] maintain that coined money is a mere sham, a thing not natural, but conventional only, because, if the users substitute another commodity for it, it is worthless, and because it is not useful as a means to any of the necessities of life, and, indeed, he who is rich in coin may often be in want of necessary food. But how can that be wealth of which a man may have a great abundance and yet perish with hunger, like Midas in the fable whose insatiable prayer turned everything that was set before him into gold? (*Pol*. I 9 1257 b12-16)[130]

Why is seeking food a genuine purpose, but obtaining coins a mere sham? The value of food is rooted in our nature *qua* possessing a nutritive soul. Given our nature, we can benefit from food. Thus an art which aims at the acquisition of food is purposeful. The coin's value, on the other hand, is not rooted in any real natural need, its value is merely conventional. Coins *qua* coin do not contribute to the actualization of our nature. By telling us that coins are not true riches because they do not provide us with the necessities for living a human life, Aristotle is implying that we cannot arbitrarily decide that something has value and purposefully pursue it. In other words, he is here restating the necessity for the purposes of arts to be rooted in the nature of specific substances.[131] He who wishes to acquire coins *for the sake of* accumulating them acts as foolishly as the madman who tries to build a *vistemboir*. Because their 'goals' are not genuine purposes (because not grounded in being), neither can truly be said to be practicing an art, or to act purposefully.[132]

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[129] The fact that Aristotle shares their perspective is made clear in the next paragraph *"Hence men seek after a better notion of riches and of the art of getting wealth, and they are right."* (*Pol.* I 9, 1257b17-18).
[130] Aristotle. (1984). *Politics* (Jowett, Trans.).
[131] Let us note also that the violent arts which are practiced *for the sake of* attaining non-substantial ends are unnatural in more than one way. First, as we have said, in the sense that their end is not borrowed from nature, and second in the sense that it leads the so-called artist to make unnatural (violent) use of things through his practice. See *Pol.* I,9 1157a7-12 **;** 1158a7-13.
[132] Sedley, 1991, p. 187.

Also because of the divorce from natural aims these so-called arts are unlimited; there can be no end to the madman's building project nor to the rich man's accumulation of coins because their goals are not grounded in the nature of a specific being *i.e.* they are not undertaken *for the sake of* a determinate state of completion. Natural arts, on the other hand, are limited by the state of completion of natural substances; the limit and end of genuine acquisitive arts for instance is determined by the state of completion of the natural entities which benefit from it (*e.g.* the family or the city). Consequently, crafts, as Aristotle conceives them, are an extension of nature, and there can be no genuine (natural) art which is divorced from natural self-actualization processes.

The essence of artifacts

Although Johnson recognizes and discusses Aristotle's differentiation of natural and violent arts,[133] we contend that his view does not in fact provide the resources to establish a solid basis for this distinction. Because he thinks instrumentalization always involves the imposition of strictly extrinsic and incidental ends (*i.e.* because he does not recognize a middle ground between self-actualization and arbitrary use) there is no substantial difference between the natural and violent use of other substances on his account. As a result, he grounds the distinction between natural and violent use in a value judgment with no genuine ontological basis. In short, an art is natural, or as he says 'justifiable' if practiced *for the sake of* fulfilling a genuine need. Thus according to him, we can distinguish between natural and violent instrumentalization processes simply by

[133] Johnson, 2005, p. 235-237.

examining the *disposition* of the agent *i.e.* without considering the nature of the goal.[134] Because all instrumentalization processes are equally arbitrary on his account, there is no genuine difference between the products of natural and violent crafts; a house has no more being or unity than does a *vistemboir*. This is why he thinks we must look to the intentions of the artist in order to establish the status of productive arts. We, by contrast, have been arguing that the distinction is primarily grounded in the nature of the end, and only secondarily in the disposition of the artist.[135] In what follows, we will discuss the limitations of Johnson's view and address some questions raised by our own perspective.

The basis of the distinction between natural and violent art as we have portrayed it rests on the premise that a certain essential relation holds between substances and the product of natural crafts. The art of housebuilding for instance, is natural because houses are *in virtue of what they are* related to human nature. The end of the building craft (the completed house) is essentially related to man for it allows him to actualize his nature fully by providing shelter. Yet of course, the relation is not strictly intrinsic, because the house and the builder are distinct entities; thus we suggest that their relation is best described as quasi-extrinsic. By contrast, there can be no such relation between

[134] Johnson (2005) does not distinguish the arts with regards to the nature of their end results, or their relation to natural ends because according to him, there exists an unbridgeable gap between what something *is* (the object of theoretical knowledge) and what it is *used for* (object of practical knowledge) (p.78, 213-14) and consequently, no proportionality between natural and artificial ends.

[135] Of course these things are not unrelated, which is why we must insist once again that Johnson's position is limited rather than wrong. Indeed, in the vast majority of cases, a sane person whose intention is to satisfy a natural need will act purposefully *i.e.* take an appropriate series of steps *for the sake of* realizing a goal that has genuine being and unity. For instance if someone has the intention of providing shelter for his family, chances are that he will set out to build a house, not a *vistemboir*. However, because Johnson's view emphasizes the psychological dimension of artificial goal-directedness, it leaves room for cases where the intention is the fulfillment of a natural need, but the 'goal' is non-substantial. For instance, Johnson would have no ground to deny that a madman who sets out to build a vistemboir *for the sake of* providing shelter for his family is practicing a natural craft.

agent and patient in violent arts because unnatural ends lack substantiality; they are like aggregates in that, although they may appear to be unified, they in fact are not 'something' but rather 'some things'. In the case of the *vistemboir*, there can be no essential relation between the 'artist' and its 'product' for the simple reason that the latter has no *essence,* thus their relation is necessarily *strictly* extrinsic. This raises a question, for if (natural) artifacts can be *essentially* related to natural substances, then they must have an essence, at least in some limited sense. We know Aristotle is cautious about attributing the status of substance to artifacts, and according to some, this is because he does not think that the products of crafts have a nature. Johnson, for instance, says that artifacts can only be said to have a nature in the limited sense that they inherit properties which belong to their material constituents.[136] In other words, on his account artifacts have no nature *qua* whole, which in turn means that they are no more than the sum of their parts, and, as Johnson puts it :

> All functions of artifacts are ultimately incidental. That is why it is possible to construct for any artifact incidental functions that have an equivalent explanatory status to any purported 'essential' function they might have. For example, a chair can be used to prop open the door, or a pencil to scratch my ear.[137]

Johnson thinks the functions we attribute to artifacts are equally incidental because, as we have said, he does not consider that they have a nature. He is right, of course, that artifacts do not have a nature in the fullest sense *i.e.* they do not have an intrinsic principle of motion and rest - except in a

[136] Johnson, 2005, p. 101.
[137] Johnson, 2005, p.101 – footnote no.16. By contrast, Witt (2015) argues that Aristotle's 'argument from mistakes' in *Ph*. II 8 199a32b7 entails that we can discriminate between proper and improper uses of artifacts (p.115-117)

derivative way, insofar as their constitutive elements possess such a nature[138] - but we contend that they do, *qua* artifact, have more than a shape, which means that they are not mere aggregates. The distinction between a form and a shape is stated with clarity in *Metaphysics* VII 17:

> What is composed of something in such a way that the totality is one, not like a heap but like a syllable – The syllable is not its phonetic elements, BA is not the same as B and A, nor is flesh fire and earth. For when they – for example, the flesh and the syllable – are dissolved they no longer exist, whereas the phonetic elements do exist, and so do the fire and the earth. The syllable, then, is something – not its phonetic elements alone, the sounded (=A) and the unsounded (=B), but also something else, and the flesh is not only fire and earth or the hot and the cold but also something else. (*Metaph.* VII 17, 1041 b11-17)[139]

In this passage, Aristotle presents what is sometimes called a 'top down' view of composition, where the compound (the whole) is *something* more than the sum of its parts. He then goes on to establish that this *something* is not an element (1041 b25-20) but rather *"a cause in fact of this being flesh and this being a syllable"*[140] – *i.e.* a formal principle.[141] The contrast between such a principle and a mere shape is suggested by the very first line of the passage,[142] where he distinguishes composite wholes and heaps. A whole, Aristotle says, is composed in such a way that the totality is *one*, whereas a heap, it is implied, is a plurality. A heap is nothing other than its constitutive elements because it lacks a formal principle which would make it *this* or *that*. Because it has a shape, a heap may *appear* unified but in truth, Aristotle thinks it does not, *qua* heap, have being or unity. A heap is not a genuine whole because composition (and unity) is the result of an organizing

[138] Ibid. p.133, where he cites the passage from *Physics* II 2, where Aristotle notes that if one plants a bed, it sprouts as a tree rather than as a bed.
[139] Aristotle. (1984). *Metaphysics* (Ross, Trans.).
[140] Ibid.
[141] A similar account can be found in *Metaph.* VIII 3, 1043 b5-15.
[142] *Metaph.* VII 17, 1041 a5-6.

(formal) principle. The shape of a heap is not a cause of the arrangement of the elements, on the contrary, it is a *result* of the respective motions of its "parts". Thus the arrangement of heaps is a case of so-called bottom up composition, which Aristotle does not consider to be genuine composition *i.e.* to result in *being* and *unity.* This being said, while we agree with Johnson that Aristotle does not consider artifacts to have a nature in the fullest sense of the term, we want to argue that the status of artifacts constitutes a middle ground between genuine substances and mere heaps. We contend that we must adopt this view, *first*, because treating artifacts as mere heaps undermines the distinction between natural and violent arts, but also because it is strongly suggested by textual evidence. In the passage from *Metaphysics* VII 17 which we were just examining, for instance, Aristotle relies on examples taken from both craft and nature:

> the question is *why* the matter is some individual thing, e.g. why are these materials a house? Because that which was the essence of a house is present. And why is this individual thing, or this body in this state, a man? Therefore what we seek is the cause, i.e. the form, by reason of which the matter is some definite thing; and this is the substance of the thing. (*Metaph.* VII 17, 1041 b5-7)[143]

This suggests that a house is indeed *something*, and not just *some things i.e.* it has a formal principle which grounds its being and unity as a whole. It may be added that the way in which Aristotle speaks of artifacts in different contexts also suggests that he does not consider them to be a mere superposition of their material constituents. Consider the case of the automata which Aristotle invokes in the *Generation of Animals.*[144] It is clear that Aristotle considers it to have unity and being *as a whole*, for there is a specific set of motions that belongs to the machine because of the way in

[143] Aristotle. (1984). *Metaphysics* (Ross, Trans.).
[144] *GA* II 1, 734 b5-10.

which its parts are organized. Even in the case of simpler tools such as a saw, it is clear that it has capacities over and above those it inherits from its constitutive elements. The hardness of the saw, and consequently its capacity to cut for instance, relies on, but is not completely explained by the nature of iron, for if it was informed differently (say, if it was a ball, or a very thin sheet) iron may not exhibit these characters; thus we should say that it is the tool as a whole which possesses the hardness and the resulting capacity to cut in the specific way which serves the artisant's needs.[145] It is clear, therefore, that artifacts, like natural substances, exhibit some features which are due to their material constituents, and others which are due to their form. This means that unlike heaps, artifacts do have a formal principle and consequently have being and unity *qua* artifact. Byrne[146] rightly emphasizes the similarity between Aristotle's portrayal of the relation of material and formal principles in natural and artificial contexts;[147] and argues that, if Aristotle considered artifacts to be mere heaps (with a shape rather than a form) he would not rely on examples taken from craft to teach us about composition. Indeed the constitution of heaps is, as we have said, a case of 'bottom-up' composition which results in the mere appearance of being and unity. In short, Aristotle's use of craft analogies in this context is yet another indication that Aristotle indeed considers artifacts to be more than aggregates.

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[145] While Byrne (2018) does well to insist that some essential features of hylomorphic compounds must be explained with reference to the material principle *i.e* to resist the unilateral reduction to formal explanations; he sometimes seems to fall in the opposite extreme and neglect the explanatory role of formal principles (something which is reflected by his view of hypothetical necessity – more on this later). Consider for instance his discussion of the hardness of saw blades which he often reminds us is explained by the nature of the metal, not the other way around. (p. 85, 88, 112) We contend that in truth it is also the other way around; indeed, the way in which the metal is informed (the thickness, shape etc.) can also affect its hardness, degree of pliability, and other such features which belong to the compound.

[146] Byrne, 2018, p. 91.

[147] Byrne (2018) provides abundant textual references in support for this, see p.91 footnote no.27; See also Witt (2015, p.114).

Now that we have established the distinction between aggregates and artifacts, we must clarify the difference between the way in which natural and artificial wholes can be said to have an essence, for as we have said, Johnson is right to insist that artifacts do not have a nature in the fullest sense. In other words, if we are to maintain that artifacts have more than a shape, we must clarify why Aristotle is cautious about calling them substances. In short, we will argue that the reason why Aristotle denies them the status of substance is not that artifacts have no essence, but rather that their essence is somehow incomplete, and constitute some sort of middle ground between natural forms and mere shapes. This, we contend, is what is suggested by the passages which Johnson cites[148] in discussing the status of artifacts. The context of these passages[149] is a concern with the question of which entities – if any – may be said to exist separately (*auto kath auto*). Aristotle's answer is that although it is hard to deny with certainty the possibility that some natural forms may exist separately, we can definitely rule out this possibility in the case of artificial forms because they lack substantiality;[150] thus if they can be said to have a nature, it is a derived or secondary kind of nature, which is not self-sufficient and remains defined in relation to natural substances. The other side of this coin is that natural forms '*are*' in a fuller sense. This suggests a gradation in the being and unity of different entities, with, on one end of the spectrum, heaps (whose shape grants them the mere *appearance* of being and unity) and on the other end, natural substances (whose form is a principle of the kind of being and unity which makes them substances – and as a result, possible candidates for separate existence). We suggest that artifacts fall somewhere between those extremes because their formal principle causes being and unity in an incomplete way. The form of bodily

[148] Johnson, 2005, p. 133 – footnote no.4.
[149] *Metaph*. III 4, 999b4-20**;** V 8, 1017b21-23**;** XI 2,060b23-8**;** XII 3,1070a13-20.
[150] *Metaph.* VII 6, 1032b1-12**;** XII 3, 1070a 13.

organs should also occupy a middle position on this spectrum, for it would be a mistake to treat organs as mere heaps, surely they have some degree of integrity and to some extent they can be said to have an essence on the basis of which we can differentiate them and their respective functions, yet their form is not complete and does not make them into an autonomous self-subsisting whole. The way in which the form of internal organs and external tools relate to the formal principle of natural substances is surely different, and we shall discuss this in more detail in our next chapter when we turn to natural instrumental relations. For now let us focus on distinguishing natural and artificial formal principles

Artificial forms are subordinated to natural principles in many ways, the first and most commonly emphasized[151] being the dependence in formula; the definition of an artifact is derived and cannot be understood apart from that of a natural substance whose self-actualization it serves or imitates. Beyond this logical subordination, Aristotle suggests that artificial forms are 'existentially' dependent upon natural substances because they lack something of the actuality of natural forms. Consider for instance the following passage from *De Motu* which compares natural and artificial principles:

> The movements of animals can be compared with those of automatic puppets, which are set going on the occasion of a tiny movement (the strings are released, and the pegs strike again one another); or with the toy wagon (for the child mounts on it and moves it straight forward, and yet it is moved in a circle owing to its wheels being of unequal diameter – the smaller acts like a center on the same principle as cylinders.) Animals have parts of a similar kind, their organs, the sinewy tendons to wit and the bones; the bones are like the pegs and the iron; the tendons are like the strings; for when these are slackened or released movement begins. However, in the puppets and the toy wagon there is no change of quality since if

[151] This is something noted by Johnson (2005) himself on p.133, and which is in tension with his treatment of artifacts in other contexts.

> the inner wheels became smaller and greater by turns there would be the same circular movement set up. In an animal the same part has the power of becoming now larger and now smaller and greater, and changing its form, as the parts increase by warmth and contract by cold and change their quality. (*De Motu* 700 a1-15)

This suggests that artificial forms are somehow less complete and less 'powerful' than natural forms because they do not enable artifacts to maintain (or reproduce) their form. In the case of the toy wagon for instance, if it was put in different circumstances (if it were on an inclined surface for instance) it simply could not function properly. Artificial forms are the source of what Gill[152] calls a passive potency (*dunamis*), *i.e.* a capacity to *be moved* in specific ways.[153] As a result, the self-actualization of artifacts depends upon the intervention of an outside agent - in whom resides what Gill names the active form.[154] Natural forms, by contrast, are active and thus grant natural composites a different kind of *dunamis*.[155] A natural form makes the body 'capable' in a fuller, more actual sense. Let us note that our account of the distinction between natural and artificial forms does not reduce artifacts to mere heaps, for a passive (artificial) form is indeed more than a shape as it integrates the materials so as to make them into a *this* or a *that* with properties over and above those of the material constituents, and in some cases can even account for some types of simple behavior *e.g.* the locomotion of automata and toy wagons. Let this be a sufficient account of

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[152] Gill, 1991, p. 243-265

[153] The kind of capacity which he describes in *Metaph*. IX 1, 1046a10-12 as *"a starting point of change in another thing or in itself insofar as it is other".* Aristotle. (1984). *Metaphysics* (W.d. Ross, Trans.). In *The complete works of Aristotle : the revised Oxford translation* (J. Barnes, Ed.). Princeton University Press.

[154] Gill, 1991, p. 248-9.

[155] Natural forms are more 'powerful', not in the sense that they cause a greater *amount* of capacities, but in that they are the principle of a different *kind* of capacity. The active *dunamis* of natural composites is described by Aristotle in chapter 8 of book IX of the *Metaphysics* *"For nature also is in the same genus as potentiality ; for it is a principle of movement – not, however, in something else but in the thing itself qua itself."* (1049b5-10). Aristotle. (1984). *Metaphysics* (Ross, Trans.).

the distinction between artifacts, natural substances, and heaps; a distinction which grounds the possibility of distinguishing art and nature on the one hand; and natural and violent arts on the other.

Summary

Before we move on to the next chapter, let us provide a summary of the main points discussed thus far. The purpose of this chapter was to clarify how Aristotle's emphasis on nature as a cause should inform our understanding of artificial processes and their place within the scope of teleology. We have said that Aristotle considers nature to be an inner principle of motion, and that things which are naturally constituted are moved towards their end by an intrinsic cause. We said that this should not be understood merely in a physical sense, as the intrinsic character of final causes is due to their identity with the formal cause of the substance undergoing the change. Thus natural teleological accounts constitute explanations of how substances are moved towards their end, which is their state of completion *"For those things are natural which, by a continuous movement originated from an internal principle, arrive at some completion"* (*Ph.* II 8, 199 b15).[156] This state of completion constitutes both their formal and final cause because the form, given its essential identity with the final cause, acts as the end of the continuous movement. Consequently, we have argued that teleological explanations are rooted in the nature of specific beings, and that purposes should be understood ontologically, not psychologically. We have shown that this is so even in the case of the arts on Aristotle's account. We have said, for instance, that health (which is not an arbitrary goal, but a pre-existing end which is determined by the nature of the human organism) is the *telos* of the

[156] Aristotle. (1984). *Physics* (Hardie & Gaye, Trans.).

medical art whether a particular doctor desires to produce it or not. Thus purposiveness as it is found in the arts is either an imitation, or a completion of a specific natural self-actualization process.[157] We have said that in completing and imitating nature, the goal of the artist is determined by, and cannot be understood apart from natural ends. Through these considerations, we have offered an alternative to the dichotomous view of nature and the arts defended by Johnson and others. We have highlighted the subordination of artificial goal-directedness to natural teleology, and consequently have shown them to be intimately related.[158] We have also provided an alternative to a common view of Aristotle's objection to his predecessor's teleological principles which, we have said, does not lie in the fact that they established an analogy between natural and artificial goal-directedness. Rather, we argued his objection has to do with their inversion of the order of priority between the two, which in turn results in a failure to identify the explanatory cause of goal-directedness and to provide scientific accounts of teleological change. Finally, we have said that recognizing the secondary place of artificial goal-directedness does not undermine the value of craft analogies, but in fact makes these analogies all the more enlightening, both when it comes to understanding nature and the arts. The result is a view of crafts which is not opposed to,

[157] Sedley, 1991, p. 188.

[158] The close connection of nature and craft has been a *leitmotif* of this chapter. Let us note that there seems to be a tendency in the scholarship to accentuate the distinction, perhaps because of a desire to establish a firm distinction between natural and artificial teleology. In any case, it is frequent to compare unequal things in order to emphasize the contrast between nature and the arts. Consider for instance Gonzalez' (2020) discussion of the relation which holds between the formal and material principles in craft and nature. He compares the way in which the *telos* belongs to bricks and wood on one hand, and to natural bodies on the other (p. 164) Although his main point is one we agree with (namely that in crafts, the material cause is not intrinsically directed towards the state of completion of the artifacts and thus requires the intervention of an artist) the example on which rests his explanation does not compare like with like. As a result, the distinction between natural and artificial goal-directedness appears with – excessive– clarity and simplicity; and bypasses a series of questions which would be raised by establishing the comparison at the same level of organization *e.g* by comparing the use of wood to the way in which the elements are made to serve the organism's purpose. See also Kosman, 2013, p. 88-9.

but rather understood in relation to natural self-actualization processes, and consequently has its place within the scope of Aristotle's natural teleology.

Chapter two

Nature

In our introduction, we set out to challenge a dichotomous view of nature and the arts which (a) divorces craft from natural self-actualization processes, and (b) regards nature as the exclusive realm of intrinsic self-actualization processes. We have challenged the first (a) claim above and shall now turn our attention to the realm of natural change, and attempt to provide an alternative to (b) the narrowly internalist perspective.[159] In short, we will show that Aristotle's view of natural change extends to *some* instrumental relations, thus further developing our thesis that there does exist a middle-ground between self-actualization and arbitrary use. We have said that Johnson's strictly intrinsic view of natural change rests on the premise that the internal, intrinsic and explanatory characters of natural causes are equivalent. Simply, his view presupposes that if a cause is not internal, it is unnatural and scientifically irrelevant. As a result, he must deny the possibility of natural instrumental relations[160] because of the agent-patient differentiation they entail. Thus he establishes a sharp contrast between natural self-actualization (which is *for the sake of* an intrinsic end) and artificial instrumentalization (which is *for the sake of* an extrinsic end); and claims that Aristotelian teleology is exclusively concerned with the former. In this view, a substance either

[159] A view which, we have said, is discussed exhaustively by Johnson (2005), but shared by many (Cooper, 1982**;** Gotthelf, 1987**;** Broadie, 1990**;** Charles, 1991**;** Blair, 1992**;** Depew, 1997**;** Johansen, 2004**;** Gonzalez, 2020).

[160] Let us note that Johnson (2005) sometimes does recognize the existence of natural instrumental relations, for instance in his discussion of hypothetical necessity (p. 189-192); but this is at the expense of coherence with the view he adopts when discussing the scope of teleology. (p. 60-2, p.201-3)

naturally strives for its intrinsic *telos*, or it is artificially (which is the same as to say arbitrarily) assigned an extrinsic and incidental end.[161]

In what follows, we will argue that the main difficulty which faces this perspective is that it rests on an unbalanced view of composite substances.[162] Consider for instance Johnson's account of the relation between a living body and the elements which constitute it; in order to maintain his strictly internalist view of natural change, Johnson has to claim that the elements are destroyed or completely transformed when they become part of a higher level natural entity.[163] This is because the *telos* of the body does not belong to the elements intrinsically, and therefore if they retain their nature, Johnson thinks their contribution to the self-actualization of the body requires an extrinsic (thus artificial and incidental) teleological account. Once again, we will argue that Johnson's position is limited rather than wrong. He is right that, fundamentally, Aristotle's view of natural change must be understood in terms of the self-actualization of a specific nature; and to insist that the explanatory cause of natural change cannot be extrinsic on Aristotle's account. The mistake, we will argue, is to conclude that all instrumental relations are therefore unnatural and scientifically irrelevant. In short, we will argue that Johnson's view is too narrow because it ignores the possibility that some natural relations are neither straightforwardly intrinsic or extrinsic. Let us insist that we will not be defending a view of Aristotelian teleology which extends to strictly extrinsic instrumental relations. Rather, our aim is to expand our understanding of intrinsic teleology in order to encompass some processes which are typically excluded because they are thought to require extrinsic and artificial teleological explanations. In what follows, we will be

[161] Recall Johnson's (2005) table of comparison of the horses' intrinsic and incidental ends (p.203).
[162] Again, Johnson (2005) is not alone to hold this view, for exhaustive references to scholarly works which defend the same view of the unity of natural substances see Byrne, 2012, p.389 – footnote no.8.
[163] Johnson, 2005, p. 144.

concerned with three main questions; (1) does the Aristotelian view of nature include some instrumentalization processes, if so (2) what is their relation to self-actualization processes, and (3) are they teleologically explicable?

With regards to the first question, some scholars[164] have highlighted instances of instrumental relations which are presupposed by Aristotle's intrinsic teleological accounts such as the *use* of nutrients in digestion or the way the body *uses* elements to constitute its tissues and organs, etc.[165] A plant is no more intrinsically inclined to contribute to the nutrition and growth of the animal which eats it than is the water in the eye inwardly directed to the realization of sight. In these and similar cases, a natural substance instrumentalizes another, not *for the sake of* realizing an arbitrary fantasy, but in order to actualize its nature. This undermines the strictly internalist view of nature because it means that at least some natural substances cannot actualize their nature 'on their own'.[166] The fact that we find accounts of instrumental relations in Aristotle's biological works suggests that he considered that the externality entailed by such relations can be reconciled with the internality which characterizes natural change. However, it remains for us to clarify the nature of this reconciliation. We have briefly addressed this topic in the introduction,[167] but will now provide a more comprehensive analysis and address some questions raised by our preliminary answer.

First, it will be useful to delineate the scope of our present inquiry. Some of the instrumentalization processes identified by the scholars mentioned above raise questions regarding

[164] Byrne, 2018**;** Gelber, 2016**;** Cooper, 2004, p. 108**;** Nussbaum, 1978, p. 115-118.
[165] Gelber, 2016, p. 258**;** Byrne, 2018, p. 117 –footnote no.37.
[166] Gelber, 2016, p. 286-287.
[167] Namely in discussing the natural motion of elements (*Ph*. VIII, 4, 255 a 25-27) and animal respiration (*Ph*. VIII, 4 259b10-15).

relations at higher levels of organization (*e.g.* within households, cities, animal communities, etc.) While these questions are worthy of consideration, given the purpose of the present chapter, it will be sufficient to restrict our attention to cases of instrumentalization involved in the functioning of middle-sized organisms such as plants and animals.[168] The following investigation will be centered on the relation between natural substances and their constitutive elements. We will argue that part-whole relations within natural substances are not always strictly intrinsic on Aristotle's account, and that consequently, his view of natural change does in fact involve instrumentalization.

The aporia

A distinction is commonly[169] made between compositional and functional parts. Functional parts are quasi-substances such as tissues and organs, whose formal and final principles are completely defined in relation to the whole they constitute, whereas compositional parts are substances in their own right (e.g. the material elements which constitute the tissues and organs), which can be defined (and exist) apart from the whole they constitute. The homonymy principle[170] thus applies to the former, but not the latter. The nature (formal and final cause) of functional parts is completely determined in relation to that of the body, thus once the body loses its formal and final cause (through death), they can no longer perform their biological function and consequently no longer 'have a nature'; while they may still look the same outwardly, in truth they no longer are what it was for them to be a specific body part. Compositional parts, on the other hand, are not defined in

[168] We shall come back to the topic of teleology beyond organisms in our conclusion.

[169] For references to scholarly works which establish this distinction see Byrne (2012, p. 390 –footnote no.11).

[170] The notion that parts are defined by their ability to perform a given biological function *e.g.* the dead hand, because it cannot grab, is a hand only by name. See for instance *PA* I 1, 640b30-a6; *GA* II 1, 734b25-32**;** *Metaph* VII 10, 1035b24 – See also Mirus (2001, p. 357) and Shield (2002) ch.1.

relation to the body they constitute, thus the homonymy principle does not apply to them, and they can survive the death of the organism. The water which constitutes eye tissues, for instance, does not cease to be water at the death of an animal.[171]

Because functional parts are completely defined in relation to the organism, the *telos* of the latter (*e.g.* life, nutrition, reproduction) belongs to them *intrinsically.* Thus given the purpose of the present investigation, our focus will be the relation of organized bodies to their compositional parts, for only they may be said to exhibit a sufficient degree of independence so as to be *instrumentalized* by the body. Some scholars adopt a strictly intrinsic view of this relation and claim that constitutive elements, like tissues and organs, are completely defined by the formal cause of the organism they constitute. As a result, they undermine the distinction between functional and compositional parts. Others emphasize the distinction and defend a strictly extrinsic view which takes compositional matter to be a distinct substance which is 'used' by the body in a similar fashion to how external objects are used. The surprising diversity of approaches to this issue is born from a tension, inherent to the Aristotelian view of substance, between the composite and individual nature of hylomorphic substances.[172] It is generally agreed that the resolution of this difficulty lies in appealing to the notions of actuality and potentiality which are developed in books VIII and IX of the *Metaphysics*. In short, the solution is said to be that the elements which act as the material cause of natural substances exist *potentially*. The controversy lies in how to understand the potentiality ascribed to compositional matter. Are the elements which compose tissues *potential* in the sense that they no longer possess the substantial form which made them a 'this'; or

[171] Byrne, 2012, p. 388.
[172] A difficulty which Aristotle recognized (*Ph.* I 2, 185b12) And discussed exhaustively in the *Metaphysics* namely in books VII, VIII and IX.

should we rather say that, insofar as they are part of a higher level structure, they are being prevented from fully actualizing their nature? For instance, is the water in the eye tissue potentially water in the same way that earth is potentially water, namely in the sense that, while it does not possess the substantial form of water, it remains the kind of thing which *could* acquire it; or does it retain its substantial form (*i.e.* remain water) and is called potential simply because it is being prevented from fully actualizing its nature? While it is beyond the scope of this paper to resolve the difficulty, we shall attempt a preliminary delineation of the main solutions developed by scholars in order to situate our own perspective within the ongoing discussion of the issue. Three main ways to approach the difficulty are; (1) *eliminativism;* denying the status of substance to elements altogether, (2) *neutralism;* claiming that while the elements are substances when they exist in isolation, they lose that status upon becoming part of tissues because they are completely transformed (destroyed) as they gain their 'new identity' within the context of composition, and (3) *dualism;* maintaining that the elements are altered, but not destroyed in the process of composition, and that their potentiality is to be understood only in relation to the form of substances at higher levels of organization.

The first two approaches rest on a strictly intrinsic view of the relation of substances to their compositional matter, whereas the latter presupposes a strictly extrinsic relation. In what follows, we will show the limitations of both extremes and suggest that the relation between natural substances and their compositional parts is best described as quasi-intrinsic.

The limitations of the strictly intrinsic view

Eliminativism

Peterson,[173] in her article *Unity, Plurality, and Hylomorphic Composition in Aristotle's Metaphysics,* argues that being and unity are equivocal terms, meaning that there is no such thing as being or unity *tout court*. Consequently, she argues that the alleged conflict between the unity of hylomorphic substances and the multiplicity of their constitutive elements can be avoided once we recognize that they have being and unity *in different ways.* More precisely, she relies on the opening lines of *Metaphysics* VII 16 in order to argue that matter is not a substance, but *"only potentiality."* Thus Peterson views potentiality as an inherent character of the 'kind of being' that matter is.[174] While her approach is interesting in many respects, it is limited *first* in that it rests on a confusion of matter (a kind of being) and material causes (a role played by determinate beings)[175] and *second*, in that it creates a tension with the way in which Aristotle speaks of the elements in other contexts. Indeed, the opening passage of VII 16 reads *"earth and fire and air; for none of them is a unity, but as it were a mere heap, till they are worked up and some unity is made of them"*,[176] thus if Peterson is right that, in this passage, Aristotle is teaching us about the 'kind of being' that the elements are, then it contradicts the accounts we find in the treatises on *Meteorology* and *Physics* for instance, where the elements are by no means presented as mere heaps. In what follows, we will suggest that potentiality should be understood as a relational property rather than an intrinsic character of material causes. If we adopt this view, Aristotle's characterization of the elements in these different contexts entails no contradiction for the same reason that there is no contradiction involved in

[173] Peterson, 2018.
[174] Peterson, 2018, p. 8.
[175] We will discuss the nature of this distinction more exhaustively below.
[176] Aristotle. (1984). *Metaphysics* (Ross, Trans.).

calling an object big and small, when considered from different perspectives. Simply, *qua* material principle (which is how they are treated in *Metaph.*VII 16), Aristotle considers the elements to be akin to a heap in need to be unified, but *qua* substance, they are unified and goal-directed beings. Thus it appears that the two limitations of Peterson's perspective are intimately related, for the confusion of the relative indeterminacy of the elements *qua* material cause with their inherent nature rests on the failure to distinguish properly between matter and material causes.

Neutralism

Another way to approach the difficulty of hylomorphic unity is to claim that, while the elements are indeed substances, when they are combined and form homogeneous tissues they are *transformed* and no longer retain their substantial form.[177] Gill develops this view in her book *Aristotle on Substance: The Paradox of Unity.*[178] Because she does recognize the relative nature of Aristotle's notion of potentiality[179] there remains a tension in her account of the role played by compositional matter; while she claims the elements do not *actually* persist in tissue formation, she does note that they contribute something to hylomorphic compounds; as she puts it *"their presence*

[177] On this view, the water which makes up the eye tissue is no longer water, although it remains the kind of thing which could acquire the substantial form of water (Johnson, 2005, p. 144**;** Gill, 2021, p. 194).

[178] Gill, 1989. She also developed this view more recently in her articles *Unity of definition in Metaphysics H.6 and Z.12* (2010) and *Hylomorphism Reconceived* (2021). While Johnson (2005) also develops this perspective to some extent, our analysis will focus on Gill's work because she treats this question more exhaustively.

[179] She recognizes that being potentially something entails being actually something else (Gill, 2021, p. 184) – Although, in her book she sometimes seems to equate the loss of a *relational property* of that which acts as a material cause with the ceasing-to-be of that subject, see for instance her discussion of *Ph.*I 9 (Gill, 1989, p. 149).

is felt".[180] Simply, the tension lies in the fact that the elements, while they no longer remain *specifically* what they once were, can still be said to contribute in specific ways to the compound.[181]

Gill relies on Aristotle's discussion of potentiality in *Metaphysics* IX 7 in order to clarify what it means for the elements to exist potentially in higher-level compounds. She insists on Aristotle's approval of a greek way to speak of objects and their material constituents, namely the practice *"not to call the product a 'this' (tode) with reference to the matter out of which it is made, but a that-en' (ekeininon)" i.e.* not to call a box "wood" but "wooden". From this she concludes that Aristotle thinks that wood does not survive the generation of a box;[182] and that, while the production starts with wood, which exists as a definite subject, once the box is crafted *"the original wood, although it survives as a constituent, has become indefinite".*[183] The mystery of her view lies in what it means for the wood to be such an indefinite subject; especially given the fact that its essential properties continue to be exhibited by the box. In short, Gill's view is that the properties survive,[184] while the subject does not, although eventually, it (the material cause *e.g.* the wood) will

[180] Gill, 2021, p. 194**.** See also Gill, 2010, p.118-120 and Gill, 1989, p. 152-3.
[181] Gill, 2021, p. 185, 196**;** Gill, 2010, p.119. We find the same tension in Johnsons' (2005) account (p. 144-5)

[182] She also argues that while we may qualify an object with reference to its proximate material cause; it would be incorrect to characterize it with reference to the matter at lower levels of organization (Gill, 2010, p. 120), but, it is unclear why this would be a mistake. While for practical reasons it is rare that we do so, we could very well refer to an artifact as a mix of certain elements. For instance, a potter who explains the proportions of earth and water which make up his clay bowl would not be 'mistaken' when he describes them as being made out of these remote materials. Gill provides no reason why it would be correct to say that the potter's artifact is made of clay; but false to claim that it is made of water and earth – this is especially surprising since, according to her view, the clay is no more actually present than are the elements.
[183] Gill, 1989, p. 152.
[184] However, these properties are now explained by the formal principle of the compound *"The bronze which can be made into a sphere has its own character as bronze, but once it is worked up into a sphere, the bronze depends for its existence on the object whose matter it is. The material properties of a sphere, which connect it with its simpler origins, are not properties of the constituent bronze as an independent actual subject, but properties of the sphere it constitutes"* (Gill, 2010, p. 119) Thus her view demands that the same properties have different explanations depending on whether the elements exist separately or in a compound.

be *"recreated as a separately existing entity".*[185] According to Gill, maintaining that the elements persist through the generation of a higher-level compound leads to materialism. She presumes that if the wood is present in the wooden box; then the box is nothing more than wood.[186] However, we contend it is not necessary to deny the composite nature of substances in order to escape materialism; one only needs to assert that the material constituents are not a sufficient explanation of the nature of the higher substance.[187] In fact, it is reasonable to suppose that the practice of calling a box 'wooden' rather than 'wood' simply indicates that the box is considered to be something more than *just* wood. To say this, however, is not the same as saying that the wood is not present in the box, and it is unclear why we should take Aristotle to make the latter – much more radical– claim. Gill herself[188] recognizes the fact that the persistence of material causes is evident to perception; and grants that, perhaps in the case of an artifact such as the wooden box, Aristotle would agree that the wood is still present and identifiable even when it has become a box.

The term *neutralism*[189] which we have used to describe Gill's view is borrowed from Michel Loux who, in his article *Composition and Unity: An Examination of Metaphysics H.6,* challenges Gill's account of the role played by material causes in the composition of hylomorphic

[185] Gill, 1989, p. 157.
[186] Gill, 2010, p. 120.
[187] In line with this, let us recall what Aristotle said about the combination of elements into genuine wholes (by contrast with heaps) in *Metaphysics* VII 17 ; *"The syllable, then, is something – not its phonetic elements alone, the sounded (=A) and the unsounded (=B), but also something else, and the flesh is not only fire and earth or the hot and the cold* ***but also something else****."* Aristotle. (1984). *Metaphysics* (Ross, Trans.).
[188] Gill, 1989, p. 161.
[189] We use this term to highlight the inert/passive role of material causes which is presupposed by this perspective *i.e.* the fact that it seems to make no difference what kind of entity acts as the material cause of a given compound, for the material cause is re-informed through the process of composition and thus the specific way in which it contributes to the compounds is completely determined by the formal principle (thus unrelated to its former nature). Let us note that Loux (1994) uses the term in a slightly different, although not unrelated sense (p. 270-1).

compounds.[190] He notes, amongst other things, that her account of Aristotle's solution to the problem of unity raised in *Metaphysics* VIII 6[191] – namely to deny definitional independence to the constituents of hylomorphic substances – is unpersuasive for the examples which Aristotle invokes in that context mostly do not involve functional matter (the central example under discussion in the passage being that of the bronze sphere). Most significant for our present purpose, Loux notes that Gill's own account of the solution to what she calls the problem of 'horizontal unity'[192] is to posit an underlying substratum which persists through change. Thus, if she wants to maintain that the elements are potential in the sense that they will once again exist in actuality after the death of the organism, she must posit a substratum which persists through the destruction and re-generation of these elements.[193] This substratum, Loux rightly notes, is a distinct entity which composes the organic body and *actually* persists throughout its life. Thus she defers rather than overcomes the aporia of hylomorphic unity.[194]

The greatest difficulty

The most serious objection which faces the strictly intrinsic view which underlie the solutions explored above[195] is that it undermines a key premise of hylomorphism. Aristotle insists on many occasions[196] that the nature of a hylomorphic compound is not reducible to its form. Consider for

[190] Loux, 1994, p. 258-272.
[191] *Metaph.* VIII 6, 1045a7-15.
[192] The aporia raised in *Physics* I 7-8 concerning the identity and integrity of a substance as it changes through time.
[193] Loux, 1994, p. 260-1.
[194] Let us note that she seems aware of this difficulty (Gill, 2010, p. 102).
[195] Johnson's perspective is essentially the same as Gill's. Here we have focused on Gill's account due to the limited extent of Johnson's exploration of this issue – which is contained within a single page (Johnson, 2005, p. 144).
[196] *Metaph.* VI 1, 1025b34- 1026a6**;** VII, 11 1037a27-b7**;** VIII 2 1043a30-b15**;** *Ph*. II, 2.

instance his discussion of this issue in *Metaphysics* VII 11; in this passage, he first identifies the definition with the formal principle, which he insists is not the same as the concrete thing.[197] He then explains that it is easier to define artifacts, for the distinction between the material and formal principles is made apparent by the fact that artificial forms can be instantiated in different materials. By contrast, the form of man is always found in flesh and bones and so *"we are unable to effect the severance"* (*Metaph.* VII, 11 1036b5).[198] Aristotle then establishes that, even if it is difficult *for us* to distinguish those principles, nonetheless they are distinct, *i.e.* the material principle does contribute something to the compound, whose nature is not exhausted by stating the formulable essence.[199] Although the contribution of the material cause to the nature of an artifact is more evident *for us,* Aristotle is clear that in truth (*per se*) it is in natural substances that the contribution of the material cause is most crucial:

> And the comparison which Socrates the younger used to make in the case of animal is not good; for it leads away from the truth, and makes one suppose that man can possibly exist without his parts, as the circle can without the bronze. But the case is not similar; for an animal is something perceptible, and it is not possible to define it without reference to movement. (*Metaph*. VII 11, 1036 b25-26)[200]

In other words, while it is easy to see what the bronze contributes to the bronze circle because it is less 'tangled up with the form', in truth, its contribution to the compound is less 'essential' than that of the material principle of natural substances. This is why circles can be instantiated in something other than bronze (although not *any* material will do, there are many options) whereas

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[197] *Metaph.* VII, 11, 1036a27.
[198] Aristotle. (1984). *Metaphysics* (Ross, Trans.).
[199] *Metaph*. VII,11 1036b20.
[200] Aristotle. (1984). *Metaphysics* (Ross, Trans.).

"the form of man is always found in flesh and bones and parts of this kind". This suggests that Aristotle's hylomorphic conception of substances entails that the nature of that which acts as the material cause is *presupposed,*[201] not replaced or destroyed; and although this fact is easier to recognize in the case of artificial compounds, it holds *a fortiori* in the case of natural compounds.[202] While the passage just examined focuses on functional parts (flesh and bone), Aristotle treats the contribution of compositional matter in a similar manner. Chapters 4 to 7 of the fourth book of the treatise on *Meteorology*, for instance, are devoted to the role played by the elements in the composition of natural substances. Consider for instance the following:

> The moist is what makes the dry determinable, and each serves as a sort of glue to the other – as Empedocles says in his poem on Nature, 'glueing meal together by means of water'. Thus the determined body involves them both. (*Mete*. IV 4, 381 b31)[203]

In commenting on this passage, Byrne notes that the respective characters of water and earth are not only preserved, but contribute something necessary to the bodies they constitute, for the very existence (and persistence) of well-defined bodies depends on the right combination of these elements.[204] Such a view of the role played by the elements in the composition of natural bodies is significantly clearer if we suppose that their nature is preserved as they become parts of substances at higher levels of organization.[205]

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[201] Byrne, 2018, p. 38-9. (See footnote no.7 for textual references in support of his argument that the nature, or as he puts it the 'capacities' of the material cause is presupposed by higher level ones).

[202] By contrast, on both the *eliminativist* and the *neutralist* views, there is no reason why a natural form should be instantiated in one material rather than another, for the identity of that which acts as a material cause is completely determined by the formal principle of the higher-level organism.

[203] Aristotle. (1984). *Meteorology* (E.W. Webster, Trans.). In *The complete works of Aristotle : the revised Oxford translation* (J. Barnes, Ed.). Princeton University Press.

[204] Byrne, 2012, p. 394

[205] Gill's view, let us recall, entails that a given property is explained differently depending on whether the elements exist separately or in combination. The tactile properties of water, for instance, are grounded in the formal cause of water when it exists by itself; but when it exhibits those same properties within the context

The independence of material causes

Accordingly, Byrne argues that Aristotle's account of the role played by material causes entails that they preserve their integrity and independence, thus he challenges the traditional view which reduces material causes to 'pure potentiality'.[206] In order to explain and overcome this (mis)understanding of Aristotle's perspective, Byrne first distinguishes between *matter* (physical stuff) and *material causes* (that out of which something is made), and clarifies in what sense the latter can be called 'potential'.[207] He explains that material causes are not 'a kind of thing' with definite properties, *i.e.* being a material cause does not mean 'being material' in the sense of being something physical. Rather, being a material cause means standing in a certain relation to something else; it *"describes a job, rather than the thing that performs that job."*[208] Broadly speaking, something is a material cause if something else can be made from it. Byrne notes that Aristotle does not always resort to physical examples for illustrating the role of material causes. He gives, for instance, the example of the letters of the alphabet *out of which* syllables are made. By contrast, to be something material (to be matter, or made of matter) means to have definite properties *"to be*

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of composition, they are to be explained with reference to the formal principle of the higher-level compound. (2010, p. 119) — For a well developed objection to such a multiplication of explanations for a single phenomena See Byrne's 6th chapter (2018). — Let us also note that Gill recognizes the fact that the elements 'work against' the compound, so to speak, and that they are ultimately are responsible for the disintegration of natural substances (2010, p. 121); a fact which seems odd if (a) the elements are not present in the compound and (b) the properties exhibited by the material cause are completely determined by the formal cause of the composite. Once again, it seems that much clarity and simplicity would be gained by recognizing the persistence of the elements in the process of composition.

[206] Byrne, 2018, p. 5-6.

[207] Others make this point (Balme, 1939, p. 135**;** Irwin, 1988, p. 234**;** Peters, 2019, p. 149**);** Gill, 2021, p. 184).

[208] Byrne, 2018, p. 38.

matter *in the sense of physical stuff is to possess certain intrinsic, non-relational properties, such as being extended, divisible, movable, and so forth."*[209]

Having established this distinction, Byrne clarifies in what *qualified* sense material causes may be called potential. He argues that although matter has a nature, and is in no sense 'pure potentiality',[210] material causes are potential in one respect, namely *in relation to* a compound. He insists, however, that in order to be able to play the role it is assigned, the material cause of a hylomorphic compound must have definite properties in its own right. In other words, although it is potential *in one respect*, considered in itself the material cause must be something actual. For instance, although the bronze considered *qua* material cause is *potentially* a statue, *qua* bronze it is *actually* something determinate. In fact, Byrne argues, it is precisely because it is *actually* bronze, that it can act as the material cause of the statue; to be *potentially* a statue means being *actually* hard, malleable, and a series of other things.

In line with this, we contend that in fact, Aristotle's understanding of potentiality does not allow for the notion of 'pure' or 'unqualified' potentiality. There can be no potentiality *tout court* for Aristotle, because actuality is primary in multiple ways, two of which interest us presently. First, actuality is prior to potentiality 'in formula', for the nature of a given potentiality is determined by a corresponding state of actuality. To be 'capable' (to be *potential*) is always to be capable of something specific.[211] Secondly, actuality is first in time; *"For from the potentially existing the actually*

[209] Ibid. p. 38.
[210] Ibid.
[211] *Metaph*. IX 7, 10498a1-5**;** *Metaph*. IX 8, 1049b12-17.

existing is always produced by an actually existing thing, e.g. man from man"(*Metaph*. IX 8, 1049b25).[212]

This holds not only in the case of the agent which produces the change, but also for the patient:

> Is earth potentially a man? No– but rather when it has already become seed, and perhaps not even then. It is just as it is with being healed; not everything can be healed by the medical art or by luck, but there is a certain kind of thing which is capable of it, and only this is potentially healthy. (*Metaph*. IX 7, 1049 a1-5)[213]

Earth is not potentially a man because it lacks certain determinations in order to be 'the kind of thing' which is capable of receiving the form of man "...*just as earth is not yet potentially a statue (for it must first change in order to become brass)."* (*Metaph*. IX 7, 1049 a15)[214] Thus, in order to talk about a man existing *potentially,* both the formal and material principles must be *actual*. The formal cause must exist *actually* in another substance of the same kind, and the material cause must *actually* have the properties required to be *potentially* a man. Potentiality then, is limited and determined by actuality 'on both ends' on Aristotle's account, for to be *potentially* x means a) being *actually* something capable of embodying the form of x and b) being informed by a substance which is *actually* x.

On the whole, Byrne's account of the relation of the elements (and material causes generally) to the organized body seems more plausible than the strictly intrinsic view which undermines the dual nature of hylomorphic compounds. Indeed, if Gill and Johnson are correct in asserting that the material cause is *essentially* informed/transformed by the form of the body, then it contributes nothing in its own right to the compound. If, for instance, water may no longer be

[212] Aristotle. (1984). *Metaphysics* (Ross, Trans.).
[213] Ibid.
[214] Ibid.

called water once it constitutes the body; if from that point on, 'what it is' is grounded in the formal principle of the body, water cannot be said to be 'the nature of the body'. By contrast, Byrne's account is easily reconciled with the view that nature can be said in three irreducible ways, namely matter, form, and compound. However, if we are to adopt Byrne's view, we must answer the legitimate concern that the elements, if they retain their nature, may be considered to have an extrinsic and incidental relation to the living body and that, as a result, an account of their contribution to the actualization of the latter's *telos* would be both artificial and scientifically irrelevant.[215] In what follows, we will attempt to establish some nuances in order to preserve the truth of Byrne's position while avoiding commitment to a view of natural instrumentalization which requires (1) artificial and (2) incidental (non-explanatory) accounts. To achieve this, we will argue that, while Byrne is right to differentiate between functional and compositional parts and to insist that the latter have a certain degree of independence, it is a mistake to conceive of their relation to the organized whole as strictly extrinsic.

The limitations of the strictly extrinsic view

Unity

Byrne denies that the potential existence of elements in homogeneous mixtures entails their destruction. In his view, it is precisely because the elements persist through the generation of the tissue that the latter exhibits the intermediary properties that it does.[216] The properties of clay, for instance, are derived from the basic properties of the earth and water which constitutes it, and the

[215] Let us note that this is the underlying concern which drives the efforts of Gill, Johnson and like-minded scholars and which explains their emphasis on the potentiality of material causes.
[216] Byrne, 2018, p. 82.

potentiality ascribed to both constituents follows from the fact that they are not existing separately, but in combination.[217] Byrne insists that Aristotle conceives of combination as a middle ground between simple aggregation (a process in which elements are simply superposed, not changed in a significant way) and transmutation (a process in which the elements lose their substantial form).[218] The benefit of his view is that it offers clarity on how the elements can contribute in specific ways to the nature of the compound. The difficulty lies in grounding the unity of composite substances. On Byrne's account, there is no fundamental difference between the relation of formal and material principles in natural substances and artifacts.[219] In his view, the material cause of a natural body is just as independent as that of an artifact; with the only difference that *"the formal causes of natural substances impose greater demands on their material causes."* [220] The unity of natural substances only differs from that of artifacts in that the formal principle makes *"greater demands"* on the material principle, because unlike artificial forms, natural forms have to be instantiated in very precise materials, and the specific requirements apply at many levels of composition.[221] The issue is that it is unclear why the mere fact that natural forms make 'greater demands' on their material cause can, in and of itself, ground the claim that natural substances are more unified than artifacts. For one thing, it is conceivable that a special kind of artifact could only be instantiated in materials with very precise composition; nevertheless, we would want to say that such an object does not

[217] By contrast, Gill's reading of Aristotle's discussion of combination in *GC* I 10 assumes the destruction of the elements (Gill, 2021, p. 194; 2010, p. 118 – footnote no. 6).

[218]Consider for instance the following passage which explicitly denies that the constituents of homogeneous tissues are destroyed in the process of composition; *"they neither persist actually, as body and white persist;* ***nor are they destroyed*** *(either one of them or both), for their potentiality is preserved*" (*GC* I 10, 327b30). Aristotle. (1984). *On Generation and Corruption* (H.H. Joachim, Trans.). In *The complete works of Aristotle : the revised Oxford translation* (J. Barnes, Ed.). Princeton University Press.

[219] He claims the difference rather lies in the efficient and formal principles (Byrne, 2018, p. 94).

[220]Byrne, 2018, p. 96.

[221] Ibid.

exhibit the same kind of unity as does a natural substance. Simply, Byrne's criteria for distinguishing natural and artificial unity does not capture the difference between using something *as a tool* and using it *as material.*[222]

Individuality

Another difficulty which faces Byrne's perspective is the tension it creates with Aristotle's explicit assertion (in chapters 13 and 16 of *Metaphysics* VII)[223] that no substance is composed of substances. This second difficulty is more delicate and an adequate answer would demand an exhaustive discussion of the middle books of the *Metaphysics*. While it is beyond the scope of this paper to provide such an answer, we may say this much in order to overcome the apparent tension; *first*, we may note that both passages concern a specific view of composition; and do not necessarily apply to all conceivable ways for substances to enter into a compositional relation. The argument in VII 16 is directed at the Platonists, and concerns the possibility for substances to be composed of substances that are actual *in the same respect* (e.g. for the *horse itself* to be the substance of particular horses). Consequently, we suggest that the conclusion of the passage should be understood in the restricted sense that two substances existing at the same level of organization cannot be in a compositional relation. In line with this, let us recall Peterson's insight concerning the polysemy of the notions of being and unity. Peterson suggested that unity and multiplicity are only in tension if attributed to the same thing *in the same respect*.[224] Thus she notes, echoing Aristotle's discussion of this issue in VII 16, that if a horse were composed of horses, it would undermine its unity.[225] This,

[222] *Resp.* 485a30-b5. More on this below.
[223] *Metaph.* VII 16, 1041a4; VII 13, 1039a15.
[224] See also Loux (1994) p.264 and 268.
[225] Peterson, 2018, p. 7.

we suggest, does not mean that horses, if they are one, are incomposite entities.[226] In short, Aristotle's rejection of the Platonic view of composition does not *a priori* contradict the view that the instrumentalization of material elements by higher level organisms presuppose rather than destroy the nature of these lower-level substances.

Natural use

Another question raised by the extrinsic view is whether the contribution of compositional matter to the self-actualization of organized bodies can be called natural. We have established in our introduction that the distinction between natural and artificial processes is that in nature, agent and patient are *one*; whereas in art, they are *distinct*. Consequently, it is legitimate to ask how the instrumentalization of the elements by the body can be natural if they are distinct entities. In other words, the question is how to avoid saying that the body is 'practicing a craft' when, for instance, it uses water *for the sake of* sight in tissue formation. Simply, if we are to adopt the view that the elements preserve their nature upon entering the constitution of the body, we must come up with a way to differentiate between natural and artificial instrumental relations. It is indeed, at first sight, unclear why for instance the appropriation of matter through nutrition is a natural process, while the use of materials in tool fabrication is artificial. In both cases, the patient is moved by a distinct entity, and made to serve an end which does not, strictly speaking, belong to it in virtue of what it is. The common sense answer to our question is that natural and artificial *use* may be distinguished

[226] Composition undermines unity only if part and whole are individual things (*to deti*) in the same respect. As Gill points out (2010, p. 98); at the heart of Aristotle's challenge to the Platonist view of composition (towards the end of *Metaphysics* VII) is the notion that forms are concrete, definite things (*to deti*). See *Metaph.* VII 14 1039 a30.

with respect to the need for deliberation. Let us start our examination with this preliminary answer, for Aristotle's view rarely (if ever) violates common sense.

Distinguishing between artificial and natural instrumentalization processes with regards to the need for deliberation is not a complete answer, for we must then face a further question; what grounds the need for deliberation in the case of artificial processes? If water is no more intrinsically directed towards the formation of an eye than is the wood towards the formation of a boat, why is it that eyes come into existence without craftsmen deliberating, but boats do not? In book II of the *Physics,* Aristotle says that *"If the ship-building art were in the wood, it would produce the same result by nature."* (*Ph*. II 8, 199 b27).[227] If the craft was 'in the wood', the generation of boats would not require the deliberation of an artist. But what would it mean for the craft to be in the wood? We have said that Aristotle, when he describes nature as an *inner* principle of motion, does not only mean a physical kind of internality, thus we should not understand him to mean 'if the craft was physically in the wood'. In fact, let us notice that he does not say 'if the craftsman was in the wood'. We can easily imagine what it would mean for the craftsman (the efficient cause) to be physically in the wood, but what does it mean for the craft to be in the wood? It is plausible to think that it means something like this: 'if the nature of the craft and that of the wood were more intimately related', *i.e.* if the boat and its formal principle were *one*, as a living body and its soul are *one.* This is the answer suggested by an analogous thought experiment found in book II of *De Anima:*

> The soul is a substance in accord with the account. And this is the essence of this sort of body. It is just like this: if an instrument – for example, an axe – were a natural body, its substance would be the being for the axe, and this would be its soul. (*De An*. II 1, 412 b12-14)[228]

[227] Aristotle. (1984). *Physics* (Hardie & Gaye, Trans.).
[228] Aristotle. (1984). *On The Soul* (Smith, Trans.).

It follows that, in natural instrumentalization processes, there is a sense in which agent and patient, although differentiated in some respect, are nonetheless *one*. Let us invoke once again the passage of the treatise on *Respiration* where Aristotle contrasts the way in which craft and nature *use* fire: "*while the crafts use the fire merely as an instrument, nature uses it as a material as well"* (*Resp.* 485 a30-b5).[229] Although he does not elaborate on what this distinction entails, what he says afterwards suggests that he means to say that the natural use of fire involves a certain 'fusion' (combination) with the natural body ;

> for this is no longer a function either of fire or of breath, so it is remarkable that we should find such a faculty combined with these two bodies. Again with regard to soul we find the same cause of wonder, for it must be assumed in the functions of these two, and therefore there is some sense in referring to the same agent – either generally or to some particular creative part – the fact that its motion always operates in the same way; for nature, from which they are generated, is always constant. (*Resp*. 485 b11-16)[230]

This suggests that the distinction between use 'as instrument' and use 'as material' is that in the first case, agent and patient remain distinct whereas in the second, the agent 'assimilates'[231] the patient, and as a result *"there is some sense in referring to the same agent"*. Thus, when a natural substance uses fire *as material*, although agent and patient can be differentiated in some respects, there is also a sense in which they are the same. This, we suggest, means that the formal, final and efficient causes of the natural substance (its soul) should not be called the extrinsic, nor even the quasi-extrinsic cause of the changes it imparts in fire. We suggest that in such a case, the relation of

[229] Aristotle. (1984). *On Breath* (Dobson, Trans.).
[230] Ibid.
[231] *GC* I 7, 324 a10.

agent and patient is best described as *quasi-intrinsic.* To clarify what this means, it may be useful to consider the way in which individual humans are said to be parts of a family; there is a sense in which the individual members *are* the family – the family is not a distinct substance existing besides its members – and for this reason, the relation of the individual members to the family cannot be strictly extrinsic; yet they remain individuals with an integrity, a nature, a purpose of their own, thus their relation to the whole cannot be strictly intrinsic either.

Simply, we suggest that, although compositional parts have a certain level of independence, within the context of composition they do not exist as an entirely distinct entity. This is because the fusion and integration of materials in natural instrumentalization makes them an integral part of the natural substance. As a result, we can effectively distinguish between the way in which an artisant *uses* materials and how a natural body *uses* compositional matter; in art, the relationship between the materials and the artisant is quasi-extrinsic, as they remain separate entities, while in nature, the relation is quasi-intrinsic, because the agent and patient are somewhat interwoven, in a sense becoming one and the same.

Extrinsic ends

The most significant difficulty for the extrinsic view arises from the fact that the *telos* of natural substances does not belong to the elements in virtue of what they are, and thus may be said to constitute for them an incidental end. Because Aristotelian science is not concerned with incidental causes,[232] it becomes a question whether there can be a genuine teleological account of the contribution of constitutive parts to the self-actualization of natural substances. The issue is that,

[232] Johnson, 2005, p. 99-104.

for instance, if the water which constitutes the eye tissues remains a distinct substance with its own formal and final principle, its contribution to sight is incidental to it, and a teleological account of its contribution to such an extrinsic and incidental end would be as scientifically irrelevant as an account of the motion of a horse which is being moved by a truck *for the sake of* a human end.[233]

This difficulty – namely how the *telos* of the whole can explain something about the changes which occur in its compositional parts – echoes an ongoing discussion within the scholarship concerning the explanatory value of hypothetical necessity. While Johnson and like-minded scholars avoid the difficulty by denying the independence of compositional parts *i.e.* treating them as functional parts; others emphasize the contrast between functional and compositional parts and treat the latter as completely distinct substances whose relation to the whole is strictly extrinsic. As a result, they must diminish or even deny the explanatory value of hypothetical necessity. Byrne, for instance, insists that it would be a mistake to explain the essential characters of the elements by appealing to the nature of the whole they constitute.[234] He notes that while it is hypothetically necessary for eyes to be made out of something transparent, it is problematic to explain the transparency of water with respect to the nature of the eye; for one thing, water can constitute many other hylomorphic compounds or even exist on its own; and in all these cases, it is transparent. In order to avoid the mistake of explaining *everything* about compositional matter with reference to the nature of the composite, he emphasizes the former's independence and deprives hypothetical necessity of explanatory power. On his account, hypothetical necessity does not express a real causal dependance of the matter on the formal and final causes that are being embodied; it is rather a description of the kind of material and efficient

[233] Johnson, 2005, p. 202-3
[234] Byrne, 2012, p. 397.

causes which are required to produce a good result non-accidentally. In this view, *"final causes are effects, not causes"*.[235] Although we share the concern regarding excessively broad teleological accounts which rob compositional matter of its integrity, we consider this reduction of the scope of teleological accounts to be excessive and problematic.

Hypothetical and conditional necessity

Nathanael Stein's presentation of hypothetical necessity in his article *Explanation and Hypothetical Necessity in Aristotle*[236] provides a restricted account of the explanatory role of hypothetical necessity which can allow us to address Byrne's concern while avoiding the equally problematic confusion of functional and compositional parts. He distinguishes between necessary conditions and hypothetical necessity *i.e.* between acting *for the sake of*, and merely *contributing to* something. Simply while a number of conditions contribute to the actualization of a given form, only those which actively contribute to the process *qua* 'auxiliary cause' (*συναίτιον*)[237] are hypothetically necessary. This distinction allows him to maintain the explanatory power of hypothetical necessity without making the nature of the composite whole responsible for explaining too much about the substances it instrumentalizes. According to Stein, the tendency to undermine the explanatory value of hypothetical necessity arises from a failure to establish this distinction. If one takes all the necessary conditions of realization of a given *telos* to be hypothetically necessary, then the scope of a single teleological explanation becomes outrageously broad. Indeed, the necessary conditions for the realization of any natural form can ultimately be traced back all the way to the very structure of

[235] Byrne, 2018, p. 108. Woodfield (1976) develops a similar view (p. 205-209)
[236] Stein, 2016.
[237] Ibid. see footnote no.18 on p.360 for Stein's discussion of Aristotle's use of the notion of auxiliary cause (*συναίτιον*).

the cosmos.[238] Stein suggests that the relation of hypothetical necessity in fact expresses an explanatory relationship between the final and material principles of natural substances, and thus does not extend to all necessary conditions.[239]

Part of his challenge to the common view (the reduction of hypothetical necessity to conditional necessity[240]) is to deny that hypothetical necessity expresses a *temporal* relation of priority. In his view, the temporal separation of the explanans and explanandum, although it is frequent, is not a requirement for the relation of hypothetical necessity to hold. He rightly notes that the teleological relation holds not only in the generation process, but also as the organism maintains its form and actively exercises its natural functions.[241] In other words, he argues the relationship between the *telos* and the material properties is a synchronic one. Accordingly, he suggests that the contrast with the kind of necessity which belongs to mathematics should not be understood temporally, *i.e.* it is not a contrast between a hypothetical relation that starts with 'what is', and one that starts with 'what will be'. The real contrast, he argues, has to be understood in terms of the nature of part-whole relations, for in mathematics, the inference is from the definition of simpler components, such as the nature of a straight line, to a necessary conclusion regarding a more complex object constructed from them, such as a triangle. By contrast, hypothetical necessity starts with the definition of the complete and mature being, and infers something about its constitutive elements.[242] Stein insists that what is being hypothesized is not the temporal realization of a given nature, but rather the essence. In the case of eye formation; it is not the generation of an

[238] Stein, 2016, p. 355.
[239] Ibid. p. 358.
[240] Ibid p. 355 – footnote no.6.
[241] Ibid. p. 368-69.
[242] Ibid. p. 370.

eye at a given moment in time, but the nature of eyes which is hypothesized. Therefore, it is misleading to emphasize the temporal dimension and describe the relation, as we often do, by saying that *if an eye is to come into existence*, then it must be made out of water. Instead, we should say that *if this is the nature of the eye*, then it must be made out of water. The second formulation makes it clear that the material composition of the eye is explained by its nature, whereas the first formulation makes it seem as if a future event in some way dictates the use of materials.[243] It is clear, on Stein's account, that the nature of the good result which is hypothesized, although temporally last, can have explanatory power.[244] By contrast, the usual way of viewing the 'hypothesis', makes it hard to see in what sense it could be explanatory, for the temporal realization of a given nature is indeed an effect rather than a cause.

Let us take note of the fact that those who deem it necessary to minimize the explanatory power of hypothetical necessity share the mistake of artificial teleologists discussed in the first chapter. The reason why they think of the relation of priority between explanans and explanandum *temporally* - and consequently, consider it problematic to grant explanatory power to an *end* - is that they cannot conceive that the good might 'cause' anything except through efficient causality.[245] In this view, a teleological explanation is simply a special kind of efficient account; one where the efficient cause either is good, or intends to realize some good. We have argued above that a 'good' efficient cause is not a final cause according to Aristotle; in his view, the good is a cause in its own

[243] The problem of attributing such a view to Aristotle is one commonly recognized by scholars (Johnson, 2005, p. 2**;** Stein, 2016, p. 354**;** Gonzalez, 2020, p. 161).
[244] Stein (2016) refers us to *PA* I 1 640a 13-b5 in support of his perspective.
[245] *i.e.* The good is not considered a cause in its own right. See Byrne (2018, p. 108, 112). We have noted above that according to Byrne, final causes are effects, not causes. While Byrne's intention in saying this is to highlight the distinction between final and efficient causes, we contend that in fact it reveals a commitment to the paradigm of efficient causality *i.e.* a failure to consider ends as causes in their own right.

right, and teleological explanations are not rooted in a character or disposition of the efficient cause but in the nature of the good result.

Stein's account is easily reconciled with Aristotle's conception of final causes, and has the added benefit of allowing us to grant explanatory power to hypothetical necessity while avoiding to make a natural kind responsible for too much; for rooting hypothetical relations in the *essence* of the substances that are being actualized naturally limits the scope of what a given *telos* can explain. His view provides us with a clear way to distinguish hypothetical necessities (auxiliary causes) from mere conditions of possibility. In short, something is hypothetically necessary when it is constitutive of a given capacity *e.g*. being hard is more than a 'necessary condition' of cutting, it is an integral part of the cutting capacity.[246] This distinction in turn provides us with the means to distinguish between a 'result' and an end.[247] A set of necessary conditions may lead to a given result, for instance if a bird steps in water, *then* his feet will be wet. Stepping in something watery is a necessary condition of wet feet, yet the bird's wet feet are simply the *result* of a given set of conditions, this state of affairs is not an 'end'. Although it is true that *if* the bird is to have wet feet, *then* he must step in water, it is incorrect to say that the bird's wet feet have explanatory power, and that it 'hypothetically necessitates' stepping in water. By contrast, an end such as walking in a marsh – in the case of a marsh dweller bird – is more than the result of a set of necessary conditions. In the Aristotelian perspective, it is incorrect to say that the bird developed webbed feet, and *then* he could walk in the marsh.[248] Rather we should say that *since* the bird is a marsh dweller, *then* the developmental process of his feet is such. The *end* ('marsh dwelling', or living a marsh dweller's life)

[246] Stein, 2016, p. 377.
[247] For a similar account of this distinction, see Gonzalez, 2020, p. 156-7.
[248] Gelber makes a similar point (2016, p. 290).

is not a mere *result*. The development of webbed feet in marsh-dwellers is not just a 'necessary condition', nor is walking in the marsh a mere *result* of this developmental process, but rather the end (*telos*) which renders the bird's developmental process *hypothetically necessary*.

With these clarifications in mind, let us now return to our main inquiry. We have said that, while Byrne convincingly argues for the independence of compositional matter, his view raises questions regarding the status of the explanatory relation which holds between a natural substance and its constitutive elements. Because Byrne views their relation as extrinsic, he must describe the latter's contribution to the self-actualization of the former in terms of necessary conditions. In this view, the essence of a natural substance *presupposes* but does not explain anything about the elements which constitute it.[249] We have relied on Stein's account of hypothetical necessity in order to outline a more nuanced approach that does justice both to the relative independence of compositional parts and to the explanatory relation between them and the natural substances they constitute. Although he does not use this language, Stein's account presupposes a quasi-intrinsic view of the relation which holds between a whole and its compositional parts. His account does justice to the distinction between use *as tool* and use *as material* (between natural and artificial instrumentalization) and consequently provides the means for distinguishing instrumentalization processes that are scientifically relevant from those that are not. We can say for instance, that the water present in the eye is more than a tool which can be 'used' by the eye *for the sake of* seeing in a comparable manner to the way eyeglasses are *used*; for water (its ability to transmit light) is constitutive of the *being* of eyes. Thus we can differentiate between the contribution of eyeglasses, and that of the water to the realization of sight; the latter being hypothetically necessary, thus

[249] Gonzalez rightly notes that this view entails an impoverished conception of teleological causation. (Gonzalez, 2020, p. 144 - footnote no.17).

teleologically explicable, the former being a mere condition of possibility, and not relevant to a scientific account of the functioning of eyes. This can help us to clarify the place of instrumentalization processes within a view of teleology which is primarily intrinsic. By excluding conditions of possibility from the scope of teleological explanations, we ensure that accounts of instrumentalization processes are rooted in the self-actualization of specific natural substances. The upshot is that teleological accounts of the natural development or functioning of substances can indeed include some instrumental relations *in the restricted cases* where user and used, although differentiated in some respect, are nonetheless *one, i.e.* in cases where the contribution to the self-actualization of a natural substance is hypothetically (not merely conditionally) necessary. In such cases, we contend, the *use* is neither artificial nor incidental.

Summary

Throughout this chapter we have attempted to show that the contribution of compositional parts to the self-actualization of natural substances can be described as an instrumentalization process because there is a sense in which part and whole are distinct. We have insisted that this distinction must be understood in a restricted sense, for conceiving of part-whole relations in extrinsic terms undermines the relation of hypothetical necessity as Aristotle understands it. Through showing the limitations of both the intrinsic and extrinsic views, we have attempted to highlight the need to adopt a balanced perspective which does justice to the integrity of compositional matter while also recognizing its (relative) identity with the hylomorphic compound. Concretely, our view entails that the water which makes up the eye tissue is not destroyed, and that insofar as it is *ensouled* (used

as material) it *is* the eye tissue, it is not merely 'contained' by the eye, as is the water in wet wool.[250] We have tried to show that this view – which we call quasi-intrinsic – best aligns with Aristotle's balanced perspective on the unity of hylomorphic compounds; for the strictly intrinsic view overlooks the plurality of substance, whereas the extrinsic view overemphasizes it. [251]

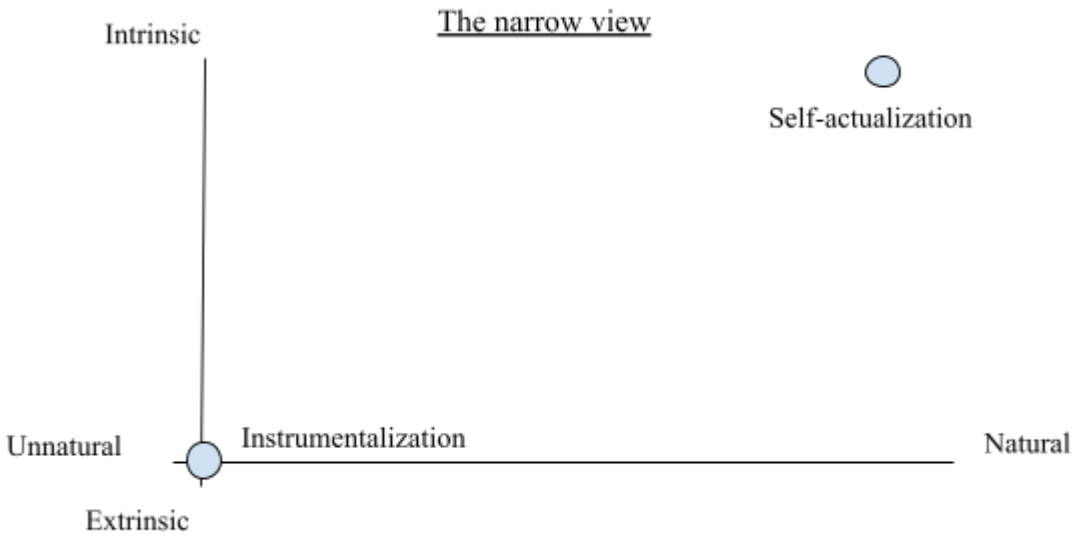
Conclusion

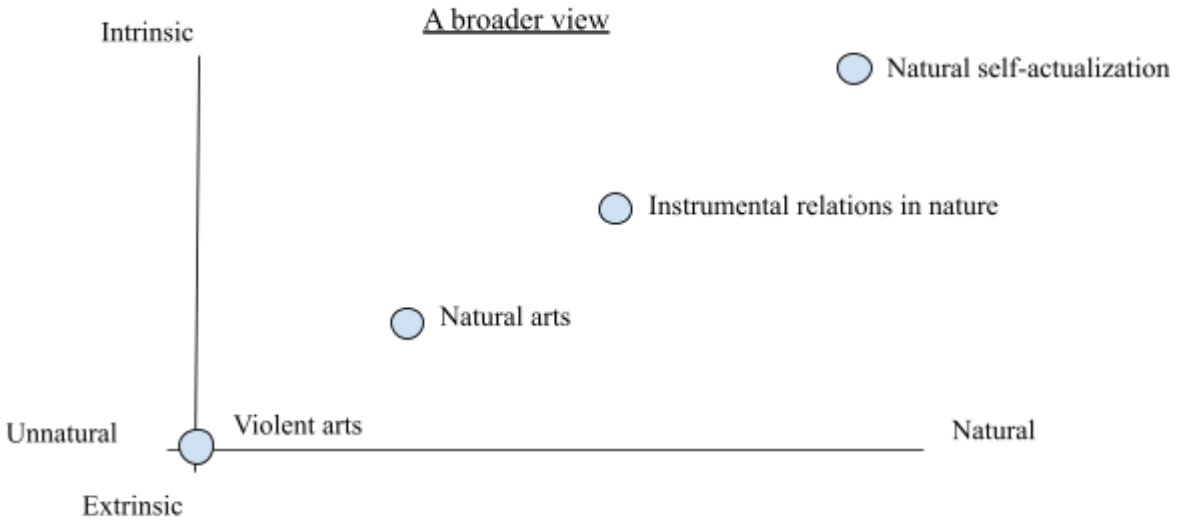
As our inquiry draws to a close, it is fitting to reflect on the progress we have made and to consider the implications of our work. Our contribution represents an initial step in the development of an interpretation of Aristotle's teleology which, although it differs fundamentally from artificial and extrinsic views, also avoids confining its scope to strictly intrinsic and natural self-actualization processes. In short, we have argued that Aristotle considers the self-actualization of natural substances to be the focal point rather than the exclusive subject of teleological accounts. Our first chapter has argued that artificial goal-directedness should not be viewed in opposition to, but rather understood in light of natural teleology; and our second chapter has established that natural instrumentalization processes have their place within the scope of Aristotelian teleology because they are constitutive of the being/becoming of specific substances. Through this, we have challenged the assumption that there exists no middle ground between self-actualization and arbitrary instrumentalization. By developing a perspective which overcomes this dichotomy, we have been able to avoid the excessive narrowing of scope which we find problematic in Johnson's

[250] *Mete* IV 5, 382 b10-10 *"The subjects of drying are water and the various watery fluids and those bodies which contain water either foreign or connatural. By foreign I mean like the water in wool, connatural, like that in milk."*. Aristotle. (1984). *Meteorology* (E.W. Webster, Trans.).

[251] Let us note that all the approaches investigated above aspire to achieve such a balance, and that our brief encounter with these different scholar's work – some of whom spent decades writing about this particular question – can only serve as a preliminary discussion of this issue.

and like-minded scholars' perspective. We have been careful to show that the twofold expansion of the teleological horizon that we advocate does not entail an appeal to unnatural and extrinsic schemes of explanation. In other words, our perspective does not entail an open-ended extension of the scope of teleology, for the inclusion of instrumentalization processes is grounded in their relation to a specific self-actualization process. The following schemes may help to illustrate the contrast between the narrowly intrinsic view and our own.





The narrow view

	Cause	Agent- patient relation	Teleologically explicable?
Instrumentalization	Artificial / incidental	Extrinsic	No
Self-actualisation	Natural	Intrinsic	Yes

A broader view

	Cause	Agent- patient relation	Teleologically explicable?
Violent use	Accidental(non-explanatory)	Extrinsic	No
Artificial use	Artificial	Quasi-extrinsic	Yes
Natural use	Natural	Quasi-intrinsic	Yes
Natural self-actualisation	Natural	Intrinsic	Yes

In the narrow view, only the self-actualization of natural substances can be explained teleologically. This is because 'natural' and 'intrinsic' are thought to have a single meaning. In this view, a motion or change is either natural in the strict sense that it results from an intrinsic principle of motion, or it is unnatural and scientifically irrelevant – the result of an extrinsic and incidental cause. By contrast, the broader view which we defend entails that different kinds of motions and changes can be classified according to the sense in which they are natural and intrinsic, for both these notions are polysemous. For instance, while the growth of an organism is natural in the fullest sense,

natural arts are 'more natural' than their violent counterparts because of their subordination to natural goal-directedness. The instrumentalization of compositional matter by a living organism is even more natural than 'natural' artificial processes, for in addition to being subordinated to natural goal-directedness, there is a sense in which it is caused by an inner principle of motion (*e.g.* in the case of tissue formation, the motion of water *qua* part of the body, is self-caused - for there is a sense in which the water *is* the body which moves it). Thus in our view, there is no such thing as the notion of 'intrinsic' or 'natural' *tout court*, although we can speak of a change being 'intrinsic' or 'natural' *most of all*. In short, these notions apply primarily to the self-actualization of substances, but can be said in different (derived) ways in other cases.[252]

Simply, viewing the self-actualization of natural substances as the focal point of Aristotelian teleology provides an ontological basis which allows us to discriminate and classify other types of motions and changes. We may gain clarity on what this means by invoking the semantic analogy which Plato develops in his discussion of composition in the *Sophist.*[253] In short, the analogy establishes a relation between structure and meaning on the one hand, and structure and being on the other. The way in which structure (syntax) produces meaning (semantics) is compared to the way in which formal principles cause being. This is contrasted with mere addition or superposition which results in meaningless strings of words, and heaps with no genuine being. Expanding on the analogy, we may compare the way in which different subordinate entities derive meaning/being from their relation to sentences and substances respectively (*i.e.* their relation to that which has meaning/being in the primary sense):

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[252] As is the case with the notion of *being* (see *Metaph.* IV 2, 1003 a32-b17).
[253] *Sophist*, 261d-262e. For an interesting discussion of the analogy, see Harte, 2002, p. 168.

Meaning	**Being**
Sentence	Substance
Parts of speech (verbs, nouns, etc.)	Functional parts (e.g. organs)
Sentence complement	Crafts (e.g. housebuilding)
Modifiers	Artifacts (e.g. eyeglasses)
Syllables/ words	Tissues
Letters	Compositional parts (e.g. elements)
String of words	Heaps
Made up words	Objects of unnatural craft (e.g. a *vistemboir*)

The comparison can help to illustrate the fact that recognizing a certain multiplicity of derivative notions does not entail arbitrary inclusions. It is clear, for instance, that granting meaning to sentence complements because of their contribution to sentences does not commit one to the view that made up words have meaning. Similarly, granting being to objects of natural crafts does not commit one to the view that *vistemboirs* are beings. In short the analogy helps envision the kind of limited extension of scope which we put forward, one that avoids binary classifications while remaining focused on the *being* of natural substances.

The task ahead

In our introduction, we outlined four stages essential to the development of a comprehensive view of Aristotle's intrinsic teleology, and set out to undertake the first. We shall now conclude by reflecting on the incidence of our work in shaping our approach to the forthcoming phase. The next step, let us recall, should be to determine whether the scope of Aristotelian teleology is

restricted to the internal functioning of organisms.[254] The issue is often formulated in a way which suggests an alternative between strictly local and strong global teleological perspectives, *i.e.* the question is whether natural substances are directed towards a species-specific intrinsic end, or exist and act primarily *for the sake of* some uniform and extrinsic purpose (*e.g*. pleasing God or serving humanity). An important limitation of Johnson's approach to this difficulty is that he accepts the question as formulated by those who hold extrinsic and artificial views of the teleological organization of nature. More precisely, he accepts the premise that the interdependence of natural substances can be explained teleologically only if we posit an extrinsic organizer whose intentions explain the functional arrangement of nature beyond the level of middle-sized organisms.[255] This is because he thinks instrumentalization belongs to the domain of (arbitrary) intentions and is divorced from natural goal-directedness. By contrast, the perspective we have developed, because it emphasizes the ontological basis of goal-directed instrumentalization processes, can help to frame the question in a more fruitful way. Having established that all teleological accounts, even instrumental ones, must be understood in relation to the development of a specific nature or form, the question becomes an ontological one, namely whether there are beings at higher levels of organization *i.e.* whether nature is organized functionally into wholes which have a nature (genuine being and unity[256]) beyond the level of middle-sized substances. If we take for instance the notorious question of the instrumental role of rain in plant growth, instead of asking whether the

[254] The very next step, we had said, should be to inquire into the possibility of explaining the functional organization of nature at different levels of organization, and then, depending on our answer, we should be in a better position to investigate Aristotle's view on the unity of the good as a cause.

[255] Johnson, 2005, p. 280-286.

[256] Because being and unity are said in many ways, the answer to this question will demand a detailed analysis of the sense in which higher-level entities *are* and *are one*. Recognizing the functional organization of nature at the level of plant communities or whole ecosystems for instance, does not commit one to the view that they are organisms or substances; but only to the view that they are something more than a heap *i.e.* more than a *result* of the individual activity of individual substances.

rain cycle exists directly and exclusively for the sake of plants, the question becomes whether rain and plants are parts of a functional whole whose nature accounts for their mutually beneficial relations.[257] This way of formulating the question in no way suggests that rain, if it plays an instrumental role in the development of some other nature or form, is devoid of intrinsic value or inclination to realize its own nature, any more than the functional organization of elements into organic tissues entails that the former exist exclusively for the latter's sake.[258]

We contend that this formulation of the question is itself a significant step because it allows us to move past the confines of a strict dichotomy which compels one to choose between a "strong" view of global teleology[259] and a narrowly individualistic perspective, as it opens the door to a so-called 'weak', or as we prefer to call it an 'organic' global teleological perspective. Simply, the organic perspective takes the specifically distinct ends of natural substances to be unified by a directedness towards an overarching order (which is the specific form or nature of a higher level entity), comparable[260] to how the specifically distinct function and form of organs are united through their common directedness towards achieving and maintaining the form of the organism they constitute. Thus it constitutes a middle ground between the strong global perspective which

[257] Let us note that Aristotle is in fact concerned with neither of these questions in the passage from *Ph.* II8 (more on this below).

[258] In line with this, see Byrne's argument for the extension of the scope of teleology (2018, p. 115-119). He insists (p.118) on the importance of identifying the subject of a given teleological account – namely to specify the right level of composition. He notes, for instance, that a teleological account of the role played by water in eye formation has the eye, *not* the water as its subject. Thus, he points out, describing water's contribution to sight is part of the explanation of eyes, not water. Similarly, we suggest an account of the functional organization of individual substances into higher-level functional wholes has the latter as its subject, *not* the individual substances.

[259] The view, often attributed to Plato and Socrates, which affirms a more direct and apparent unity of the purposiveness found in nature, one which presupposes *uniformity*, for it take all substances to have the *exact same purpose* (*e.g.* to serve/please God or Humans), and thus undermines the specific differentiation of natural ends.

[260] Comparable, not identical.

affirms the uniformity of natural purposes, and the individualistic view which emphasizes their diversity. If this is Aristotle's perspective as we hope to demonstrate, it presents an exciting opportunity for a meaningful engagement with the different branches of ecology, as it entails that individual organisms can be studied not only in isolation, but also as parts of a goal-directed wholes which exists at higher levels of organization.

Nature beyond organisms

Because Aristotle has not left us a treatise on ecology, the discussion requires some level of speculation.[261] Aristotle's silence on this question has led many to the conclusion that he was not interested in ecological studies, or even that his views on nature are, by principle, incompatible with the presuppositions of ecology.[262] A first thing worth noting – something which even advocates of the global interpretation often fail to acknowledge – is that given the subject matter of Aristotle's biological treatises,[263] we should not expect him to discuss the functions of animals and plants in the higher-level organization of the natural world, even if he did consider nature to be organized higher up, for the same reason that an anatomy textbook written by a biologist today would not include discussions of the ecological niche of the organisms under analysis. In both cases, it is the nature of the inquiry which explains the omission rather than a principled opposition to ecology

[261] Let us note that those who wish to restrict teleological accounts to the realm of middle-sized substances (*i.e.* defend the view that Aristotelian teleology cannot, by principle, explain the relation between organisms) too must 'break Aristotle's silence'.

[262] For a discussion of the difficulties entailed by Aristotle's silence, see Leroi (2014, p. 310-325) and Nussbaum (1978). For the more radical view that Aristotle's teleology is in fact by principle opposed to the presuppositions of ecology, see Johnson, 2005, p. 209.

[263] The *History of Animals* is a work of zoology, *Parts of Animals* a work of comparative anatomy, *Generation of Animals* a study of reproductive physiology, and *Motion of Animals* is concerned with biomechanics.

on the part of the author.[264] Thus we suggest it is a mistake to attempt to ground an argument for the extension of teleology beyond living organisms in the – very few – "ecological remarks" found in the works on nature such as those which mention the location of the mouths of dolphins,[265] or the relation of rain and crop growth.[266] We contend that this is not the best avenue *first* because these passages are not meant to address this question[267] and *second* because there are much more relevant texts in the *Metaphysics*, *Nicomachean Ethics,* and most importantly in the *Politics,* where Aristotle does provide teleological accounts of the functional organization of nature at higher levels of organization.

[264] Some (*e.g.* Gonzalez, 2020, p. 149) suggest that the rarity of ecological speculation in these treatises should puzzle us if we suppose that Aristotle did consider nature to be organized beyond individuals. We contend that given the topic of these works, it is nothing surprising. What is puzzling is Aristotle's choice not to write an ecological treatise. As Leroi notes *"Aristotle has the ingredients of community ecology in his hands but does not use them".* (2014, p. 319) Let us note, however, that it is much more surprising that a so-called local teleologist would write the *Politics*, than it is that a global teleologist would fail to produce an ecological treatise.

[265] *HA* VIII 2, 591 b23-30**;** *PA* IV 13, 696 b24-34.

[266] *Ph.* II 8, 198 b16- 199 a9.

[267] The passage from *Physics* II 8 concerns the relation of mechanical and teleological accounts. Aristotle argues against those who claim that the possibility to explain rain in terms of material necessity entails that it is not *for the sake of* an end. He suggests that the opposition of material and teleological accounts is a mistake and that in truth, to determine whether something is a *result* of chance or the *end* of a goal-directed process, we must consider the regularity of the event. Whether the event is a result (*e.g.*rain in winter) or an end (rain in summer), Aristotle argues, the mechanical account still holds. Given the purpose of his argument in that context, he does not provide a detailed account of the instrumental role of rain in crop growth, but simply mentions it in passing. The passages from *PA* and *HA* appear within the context of an investigation of the way of life of a specific animal. While it is true that Aristotle's comments in these (and other similar) passages may serve as circumstantial evidence of his general sympathy towards the idea that nature is well ordered beyond the level of individuals, this is not the question at hand in those contexts, thus they constitute a weak and inadequate foundation for establishing Aristotle's view on the application of teleology beyond the level of organisms.

The family exists by nature

The *Politics* opens with the remark that "*Every state is a community of some kind, and every community is established with a view to some good"* (*Pol.* I 1, 1252a1).[268] The good, let us recall, is primarily *ontological* for Aristotle, and can be an object of intentions only secondarily; thus the notion that a community exists *for the sake of* some good means something more than the fact that some people have come together because they *desire* to achieve a good result. To call the community goal-directed entails that it has a nature.[269] In the first chapter of book I of the *Politics*, it is already apparent that Aristotle considers the family and the state to have genuine *being* and *unity*, *i.e.* to be something more than an aggregate of beings.[270] The next few chapters, which examine the relation of individuals to these higher level entities, reinforce and clarify this. Aristotle's discussion of the functional role played by individual members of the family closely mirrors his views on part whole relations within the context of the composition of living organisms. He explicitly establishes the priority of the state over both the family *and the individual*, and makes the radical suggestion that the latter, if it exists outside the state, is a man only by name:

> The state is by nature clearly prior to the family and to the individual, since the whole is of necessity prior to the part; for example, if the whole body be destroyed, there will be no foot or hand, except homonymously, as we might speak of a stone hand; for when destroyed the hand will be no better than that. (...) the proof that the state is a creation of nature and

[268] Aristotle. (1984). *Politics* (Jowett, Trans.).

[269] In line with this, he insists on the specific differentiation of *kinds* of communities based on their respective formal and final cause (*Pol.* I 1, 1252a10). See also book VII chapter 4; where the city is clearly considered to be an entity with a definite nature or form. See also book V chapter 3 (1302b35) which compares the growth of cities to organic development.

[270] *"And therefore, if earlier forms of society are natural, so is the state, for it is the end of them and the nature of a thing is its end. For what each thing is when fully developed, we call its nature, whether we are speaking of a man, a horse,* ***or a family.****"* (*Pol.* I 1, 1252 b30-35). Aristotle. (1984). *Politics* (Jowett, Trans.).

> prior to the individual is that the individual, when isolated, is not self sufficing; and therefore he is like a part in relation to the whole. But he who is unable to live in society, or who has no need because he is sufficient for himself, must be either a beast or a god; he is no part of a state. (*Pol*. I 2, 1253 a20-35)[271]

This is indeed quite radical, as it seems to suggest that man, like a hand, is defined functionally with reference to a whole whose end precedes and determines the purpose of its parts.[272] The sense in which the function of individuals is determined by the end of the communities they constitute is specified throughout the rest of the first book[273] where the nature, function, and relation of the individual members of the family are examined. The main elements to take away from this investigation are (1) that the parts of the family are specifically differentiated in a way that reflects the differentiation of organs within a body. There is no opposition between the respective ends of master and slave, or husband and wife on Aristotle's account because of a shared directedness towards the end of the family which is primary, much like the end of an organism precedes and determines that of its organs, thus grounding the harmony of their respective forms and functions.[274] (2) It is also worth noting that the differentiation of family members is qualitative, not merely quantitative *i.e.* the woman is not simply an imperfect man, thus her function is distinct from that of her husband, again mirroring the specific differentiation of organs within a body.[275]

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[271] Aristotle. (1984). *Politics* (Jowett, Trans.).

[272] *Pol*. I 2, 1253a35 also suggests that the isolated individual is somehow dehumanized: "*If he has not excellence, he is the most unholy and the worst savage of animals, and the most full of lust and gluttony. But justice is the bond of men in state; for the administration of justice, which is the determination of what is just, is the principle of order in political society.".*

[273] See especially chapters 2-7.

[274] In *Pol*. III 4, 1277 a5-7 he explicitly compares the diversity of the parts of a city to that of the internal parts of an organism; and again at 1277 b20-25.

[275] *"So it must necessarily be supposed to be with the excellences of character also; all should partake of them, but only in such a* ***manner*** *and degree as is required by each for the fulfillment of his function."* (*Pol.* I 13, 1260 a15-20) Aristotle. (1984). *Politics* (Jowett, Trans.). Along the same line see *Pol.*III 4, 1277a5-12. See also *Pol*

(3) Lastly, let us note that the roles are not attributed arbitrarily according to Aristotle. This is attested, for instance, by the distinction he establishes between legitimate (natural) and violent acts of enslavement in the 6th chapter. On Aristotle's account, there exists a proportionality between the intrinsic character of individual members and their role within the household. Again, there is a clear correspondence with the constitution of organisms, more precisely it reflects the intimate relation of the anatomy and physiology of living things, for the specific function parts is determined by its intrinsic character *e.g.* eye and liver tissues are not interchangeable; they are, in virtue of their intrinsic characters (transparency, permeability, etc.), specifically adapted to their respective function.

Thus it is clear that in the *Politics,* Aristotle develops an organic view of the teleological organization of nature beyond living organisms.[276] This is something that Johnson himself has recognized, and while his discussion of these and other related passages[277] is quite helpful in some respects, we contend it is problematic because his purpose seems to shift from presenting Aristotle's perspective to dictating what it ought to have been. When confronted with Aristotle's teleological accounts of the relationship between organisms; rather than reevaluate his strictly individualistic view of Aristotelian teleology, Johnson accuses Aristotle of systematically mis-using his own teleological principles *"Because these relationships do not genuinely have the kind of organic unity that real organisms do, the extrapolation of teleological explanations from organisms to relations*

IV 4, 1290b21-35 for an explicit comparison between the functions of organs and the role of individual members of a community.

[276] Leroi calls the *Politics* a work of sociobiology (2014, p. 311), and Johnson likewise recognizes that *"Aristotle treats political science to some extent like a natural science"* (2005, p. 238).

[277] In fact, Johnson (2005) covers a lot more ground than we are able to here, the whole section (**8.5**) contains precious references (primary and secondary) and constitutes a very helpful starting point for investigating Aristotle's views on the teleological organization beyond individual substances.

between organisms must be judged a failure." [278] Johnson's argument is circular; the question at hand is whether higher-level entities are an appropriate subject of teleological explanations, and he answers by the negative on the basis that these higher-level teleological accounts are a failure, because they have an inadequate subject. He does not say why higher level entities may not be said to have organic unity,[279] yet the whole treatise on *Politics* is grounded in the premise that they do. Johnson simply dismisses passages which contradict his individualistic perspective by calling them mistakes, *"or worse—positively evil"*![280]

Apart from the 'acceptability' of the view defended by Aristotle in the *Politics*, Johnson's concern is exactly what we would expect, namely that ascribing a function to the members of a community undermines their integrity as individuals.[281] He claims that Aristotle shares his concern and that we can get a glimpse of this in his discussion of the Platonic view of the unity of the city.[282] He suggests that Aristotle's comments in this passage indicate that he, like Johnson, doubts that communities are truly *one thing*, *i.e.* that he is aware that it is problematic to extend the logic of part-whole relations beyond the realm of middle sized substances;[283] but Aristotle's objective in this passage is in fact to clarify in what sense the city is *one*. Aristotle's main point is that the kind of unity that belongs to the city allows for (in fact presupposes) the heterogeneity of its parts. In other words, by criticizing Plato's emphasis on homogeneity, Aristotle clarifies his own organic view of the part-whole structure of higher level entities; and emphasizes the integrity and diversity of their

[278] Johnson, 2005, p. 238.
[279] It seems that perhaps Johnson has in mind that granting organic unity to a whole community entails that it is a living organism.
[280] Johnson, 2005, p. 246.
[281] On p.243 Johnson (2005) includes yet another comparative table which opposes strictly intrinsic ends and arbitrary instrumental uses.

[282] *Pol*. II 2. For a helpful discussion of this passage, see Narbonne (2020).
[283] Johnson, 2005, p.245.

constitutive elements. While we contend he goes too far in dismissing the teleological accounts found in the *Politics*, we recognize that some of Johnson's concerns are legitimate[284] and demand a more exhaustive discussion than we can provide here. For now, let it be sufficient to note that individuals are considered by Aristotle to be parts of a community which exists by nature and has a specific end which is distinct – although intimately related – to that of its parts. The upshot is that, while man has a certain integrity *qua* individual substance, he is not complete in an absolute sense. In short, the part-whole analysis which we find in the *Politics* suggests the same kind of quasi-intrinsic relations which we described in considering part-whole relations within organisms in our second chapter. Thus for reasons examined in that context, the organic view of the unity of natural communities defended by Aristotle need not be understood in a way that undermines the integrity of its parts. Simply, we should say that being part of a community and contributing to the actualization of its *telos* presupposes rather than undermines the integrity of individuals just as the teleological organization of the living body presupposes rather than undermines the nature of its constitutive elements. To take up the semantic analogy, the first book of the *Politics* seems to suggest that a sentence (which we compared to a substance), while it is meaningful and may be understood to some degree when read on its own, is not completely self-contained and should ultimately be understood in the context of a paragraph (family), which in turn exists within a chapter (city state).[285]

[284] For instance, he is right to note that presenting individual humans as functional rather than compositional parts of the family seems to undermine their status as a substance. (Johnson, 2005, p.241). Wardy expresses the same, and other related concerns (1993, p. 25-26).

[285] In other words, we suggest that in Aristotle's view, we can find being in different – but reconcilable – ways at different levels of organization. By contrast, Johnson's perspective entails a 'horizontal' ontology, in the sense that everything exists at the same level of composition, *i.e.* according to him, natural substances are 'besides' one another, so to speak, and may never be in part-whole relations, which means that everything above (and below) the level of natural substances is a useful but arbitrary abstraction at best.

Non-human nature

It is important to bear in mind what has been established in our first chapter concerning Aristotle's understanding of the relation of nature and the arts if we are to appreciate the importance of the passages examined above. More precisely, we must overcome our view of political communities as the arbitrary creation of the mind if we are to grasp the significance of these passages for thinking about the teleological organization of non-human nature. If human communities are the result of arbitrary desires, then their teleological organization is of no interest to the natural philosopher,[286] but we have shown in our first chapter that man's goal-directed deliberative efforts are never arbitrary according to Aristotle (for if they are, they are not genuinely goal-directed); thus the formation of the state, even if it involves a component of deliberation, must be understood primarily as the expression of the specific nature or form of the community. Thus, we suggest that the kind of part-whole analysis which we find in the *Politics* could be applied to non-human nature. This is attested by Aristotle's reliance on the household analogy for illustrating the way in which *"the nature of the universe contains the good"* in *Metaphysics* XII 10:

> And all things are ordered together somehow, but not all alike, —both fishes and fowls and plants; and the world is not such that one thing has nothing to do with another, but they are connected. For all are ordered together to one end. (But it is as in a house, where the freemen are least at liberty to act as they will, but all things or most things are already ordained for them, while the slaves and the beasts do little for the common good, and for the most part live at random; for this is the sort of principle that constitutes the nature of

[286] This is the view implied by Johnson's reading of the passage from *Pol*. I 8 (2005, p. 231). In order to reconcile Aristotle's comments about the instrumental role played by plants in animal development with his narrowly intrinsic view, Johnson has to create a gap between practical and theoretical knowledge and say that Aristotle's discussion of instrumental relations in the *Politics* is true from the perspective of prudence, but false from the perspective of science. Along the same line, see Wardy, 1993, p. 23.

each.)[287] I mean, for instance, that all must at least come to be dissolved into their elements, and there are other functions similarly in which all share for the good of the whole. (*Metaph*. XII 10, 1075 a10-25)[288]

The analogy re-emphasizes Aristotle's organic view of human communities,[289] but most importantly, attests to his view of the organization of the cosmos as a whole; namely, it makes it clear that it is indeed a *whole,*[290] and not just a collection of beings. In fact, let us note that the household analogy, *i.e.* the view that natural substances are more than "roommates" (completely self-sufficient entities which happen to share a living space), is the basic premise of the science of ecology which is in fact named after the household analogy.[291]

We have spoken of the limited importance of Aristotle's "ecological remarks" for grounding an argument for the extension of teleology beyond the level of organisms. However, it may be appropriate to invoke them now, as they align nicely with the perspective developed in the passages examined up to this point.[292] We have in mind especially: (1) the notorious passages from the *Parts of Animals*[293] and the *History of Animals*[294] which mention the role played by the awkward location of the mouths of sharks and dolphins in regulating their rates of predation (2) as well as the passage

[287] Along the same line, see *Mete.* IV 12, 390a3-15.
[288] Aristotle. (1984). *Metaphysics* (Ross, Trans.).
[289] For as we have said, if the teleological organization of the family was the result of arbitrary intentions, it would be irrelevant to natural science. See also *MA* 703a29 where living organisms are compared to a well ordered city.
[290] *Metaph.* VIII 1, 1042a10. See also Leroi, 2014, p. 325.
[291] *"When, in 1866, Ernst Haeckel coined oekologie to describe the new science of the economics of nature, it was from oikos – Greek for household – that he did so."* (Leroi, 2014, p. 321).
[292] This, we contend, is the appropriate use of these passages. They may legitimately be used as indirect evidence which *complement* an interpretation which is itself grounded in passages that deal more directly with the issue of teleology beyond middle-sized substances.
[293] *PA* IV 13, 696 b24-34.
[294] *HA* VIII 2, 591 b23-30.

from the *Politics*[295] which suggest a certain organization of feeding relations within the natural world[296]; (3) and the (less discussed) passage from the *History of Animals*[297] which presents the rapid multiplication of mice and their disastrous effects on their surroundings as a deviation from the otherwise harmonious equilibrium between prey reproduction and predator pressure. These remarks suggest an organization of nature beyond the level of living organisms, for as Leroi rightly notes, Aristotle surely *"grasps that such a balance does not emerge automatically from any self-interested assemblage of organisms, but must be designed by nature".* [298] Beyond the general suggestion that nature is more than an aggregate of self-interested beings, these comments also attest to an *avant-garde* intuition of predator-prey dynamics. (4) Also visionary are his remarks concerning the symbiosis of biotic and abiotic cycles;[299] (5) his discussion of antagonistic and mutualistic relations in the first chapter of book IX of the *History of Animals*; (6) as well as his remarks concerning the importance of decomposition in natural cycles, in the *Metaphysics* and in the treatise on *Meteorology.*[300] We find in these passages the seeds of important ecological

[295] *Pol.* I 8, 1256b10-25**;** see also *De Plantis* I 2, 817b25.

[296] He says for instance that *"livelihood seems to be given by nature herself to all, both when they are first born, and when they are grown up."* (*Pol.* I 8, 1256 b12) Aristotle. (1984). *Politics* (Jowett, Trans.). The reference to 'nature herself' suggests an organization of feeding relations which is more than the accidental result of the respective activities of living things (for in the latter case, it would have been more appropriate to speak of specific organisms providing food for themselves and their young).

[297] *HA* VI 37, 580b15

[298] In other words, Aristotle's principle of causal adequacy (by virtue of which he rejects Empedocles' explanation of living things) should also prevent him from considering something as orderly as the food chain for instance, to be the result of chance. By contrast Johnson (2005) attributes to Aristotle a perspective which entails that order and harmony at higher levels of organization can be nothing more than a happy coincidence.

[299] See for instance the notorious passage from *Ph.* II 8 (198 b16 - 199 a9); as well as in *HA* VIII 19, 601b25 which discuss the relation of plants and animals to rain cycles. For further references to Aristotle's discussion of the intimate relation of the lives of animals to their environment see Gelber, 2016.

[300] *Metaph*. XII 10, 1075 a20-25. See also *Meteo.* IV 12, 390 a1-3 where the same idea is suggested; although the decomposition function is not named explicitly as it is in the *Metaphysics.*

concepts[301] which, although they are not developed and consequently fall short of forming the basis of a comprehensive ecological perspective, still suggest a compatibility between the Aristotelian view of nature and the science of ecology. These insights, let us insist, align perfectly with the organic view of the unity of nature at higher levels of organization which Aristotle develops in other contexts. Let this be a sufficient overview of the difficulty and of the significance of our work for approaching it fruitfully. The more detailed analysis of the passages mentioned above and the questions they raise must be reserved for another occasion.

[301] For further references and discussion of the foreshadowing of ecological concepts in Aristotle, including the notion of commensalism and parasitic relations, see *Roots of ecology antiquity to Haeckel* (Egerton, 2012, p. 5-7).

Bibliography

Primary sources

Aristotle. (1984). *The complete works of Aristotle : the revised Oxford translation* (J. Barnes, Ed.). Princeton University Press.

Secondary sources

Balme, D. M. (1939). Greek Science and Mechanism: I. Aristotle on Nature and Chance. *The Classical Quarterly, 33*(3/4), 129–138. Retrieved from http://www.jstor.org/stable/637273.

—.(1965). Aristotle's Use of Teleological Explanation. Paper presented at the Inaugural Lecture, Queen Mary College, University of London.

Baghdassarian, F. (2016). *La question du divin chez Aristote: Discours sur les dieux et science du principe.* Louvain-la-Neuve: Peeters.

Byrne, C. (2012).Compositional & Functional Matter: Aristotle on the Material Cause of Biological Organisms. Apeiron, 48(4), 387-406.

—.(2018). Aristotle's Science of Matter and Motion. Toronto, Canada: University of Toronto Press.

Broadie, S. (1990). Nature and Craft in Aristotelian Teleology. In D. Devereux & P. Pellegrin (Eds.), *Biologie, Logique et Métaphysique chez Aristote: Actes du Séminaire CNRS-NRS* (pp. 389-403). Paris: Édition du Centre National de la Recherche Scientifique.

Cameron, R. (2010). Aristotle's Teleology. *Philosophy Compass, 5*, 1096-1106. https://doi.org/10.1111/j.1747-9991.2010.00354.x

Charles, D. (1991). Teleological Causation in the Physics. In L. Judson (Ed.), *Aristotle's Physics: A Collection of Essays* (pp. 101-128). Oxford.

—.(2002). Aristotle on Meaning and Essence. Oxford University Press.

Cooper, J. M. (1982). Aristotle on Natural Teleology. In M. Schofield & M. C. Nussbaum (Eds.), *Language and Logos* (pp. 197-222). Cambridge: Cambridge University Press.

—. (1985). Hypothetical Necessity. In A. Gotthelf (Ed.), *Aristotle on Nature and Living Things: Philosophical and historical studies* (pp. 151-167). Pittsburgh: Mathesis.

—. (2004). *Knowledge, Nature, and the Good: Essays on Ancient Philosophy*. Princeton University Press. Retrieved from http://www.jstor.org/stable/j.ctt7srtx.

Depew, D. (1997). Etiological Approaches to Biological Aptness in Aristotle and Darwin. In Editor's Name (Ed.), *AB* (pp. 209–230).

Egerton, F. N. (2012). *Roots of ecology antiquity to Haeckel*. University of California Press.

Furth, M. (1988). *Substance, Form, and Psyche: An Aristotelean Metaphysics*. New York: Cambridge University Press.

Gelber, J. (2015). Aristotle on Essence and Habitat. In B. Inwood (Ed.), *Oxford Studies in Ancient Philosophy, Volume 48* (pp. 1-25). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198735540.003.0007

Gill, M. L. (1989). *Aristotle on Substance: The Paradox of Unity*. Princeton University Press.

—.(1991). Aristotle on self-motion. In L. Judson (Ed.), *Aristotle's Physics: A Collection of Essays* (pp. 241-276). Clarendon Press.

—.(2010). Unity of definition in Metaphysics H.6 and Z.12. In Being, Nature, and Life in Aristotle (pp. 97–121). Cambridge University Press. https://doi.org/10.1017/CBO9780511919275.008.

—.(2021). VII—Aristotle's Hylomorphism Reconceived. *Proceedings of the Aristotelian Society, 121*(2), 183–201.

Gonzalez, F. J. (2020). Colloquium 5 Final Causality Without Teleology in Aristotle's Ontology of Life. *Proceedings of the Boston Area Colloquium in Ancient Philosophy, 35*(1), 133-172. doi: 10.1163/22134417-00351P14.

Gomperz, T. (1909). *The Greek Thinkers: A History of Ancient Philosophy, Vol. 4: Aristotle and His Successors*. (C. G. Berry, Trans.). London.

Gotthelf, A. (1976). Aristotle's Conception of Final Causality. *The Review of Metaphysics, 30*(2), 226–254.

—.(1987). *Philosophical Issues in Aristotle's Biology*. Oxford University Press.

—.(2012). *Teleology, First Principles, and Scientific Method in Aristotle's Biology*. Oxford University Press.

Grene, M. (1972). Aristotle and modern biology. *Journal of the History of Ideas, 33*, 395-424.

Harte, V. (2002). *Plato on Parts and Wholes: The Metaphysics of Structure*. Clarendon Press.

Irwin, T. (1990). *Aristotle's First Principles*. Oxford University Press.

Johansen, T. K. (2004). Teleology and Craftsmanship. In Plato's Natural Philosophy: A Study of the Timaeus-Critias (pp. 69-91). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511518478.00

Johnson, M. R. (2005). *Aristotle on Teleology*. Oxford University Press.

Kahn, C. (1985). The Place of the Prime Mover in Aristotle's Teleology. In A. Gotthelf (Ed.), *Aristotle on Nature and Living Things: Philosophical and Historical Studies* (pp. 183-205). Pittsburgh: Mathesis.

Kosman, A. (2013). *The Activity of Being: An Essay on Aristotle's Ontology*. Cambridge, MA: Harvard University Press.

Lennox, J. G. (1992). Teleology. In E. F. Keller & E. A. Lloyd (Eds.), *Keywords in Evolutionary Biology* (pp. 324-333). Cambridge, MA and London.

—.(2010). *Being, Nature, and Life in Aristotle: Essays in Honor of Allan Gotthelf*. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511919275.

Leroi, A. M. (2014). *The Lagoon: How Aristotle Invented Science*. New York: Viking.

Leunissen, M. (2010). *Explanation and Teleology in Aristotle's Science of Nature*. Cambridge, UK: Cambridge University Press.

—.(2020). Chapter 2: Teleology in Aristotle. In J. K. McDonough (Ed.), *Teleology*. Oxford University Press. https://doi.org/10.1093/oso/9780190845711.003.0003.

Loux, M. (1994). Composition and Unity: An Examination of Metaphysics H.6. In M. Sim (Ed.), *The Crossroads of Norm and Nature: Essays on Aristotle's Ethics and Metaphysics* (pp. 247-279). Rowman & Littlefield.

Mirus C.V. (2001). “Homonymy and the Matter of a Living Body,” Ancient Philosophy 21: 357-73.

Morel, M-P. (2016). ‘La nature ne fait rien en vain’: Sur la causalité finale dans la Locomotion des animaux d’Aristote. *Philosophie antique*, 16, 9-30.

Narbonne, J.-M. (2020). L’unité de la cité. In *Sagesse Cumulative et Idéal démocratique Chez Aristote*. Les Presses de l’Université Laval.

Nussbaum, M. C. (1978). *Aristotle’s De Motu Animalium: Text with Translation, Commentary and Interpretive Essays*. Princeton.

Peters, C. (2019). Hylomorphic Teleology in Aristotle’s Physics II. *Studia Gilsoniana*, 8(1), 147-168. https://doi.org/10.26385/SG.080105.

Peterson, A. S. (2018). Unity, Plurality, and Hylomorphic Composition in Aristotle’s Metaphysics. *Australasian Journal of Philosophy*, 96(1), 1-13. Accessed May 21, 2023. https://doi.org/10.1080/00048402.2017.1324501.

Ravilochan, A. (2023). Unseating the Craftsman: Natural Efficient Cause in Aristotle's Craft Analogy. *Apeiron*, 56(1), 1-14. Accessed May 21, 2023. https://doi.org/10.1515/apeiron-2020-0075.

Ross, D. (1923). *Aristotle*. 5th edition. London and New York, 1949.

Scharle, M. (2008). Elemental Teleology in Aristotle's Physics 2.8. *Oxford Studies in Ancient Philosophy*, 34, 147-183.

Sedley, D. (1991). "Is Aristotle's Teleology Anthropocentric?" *Phronesis (Leiden, Netherlands)*, 36(2), 179-196.

—.(2000). Metaphysics Λ 10. In *AML*, 327-350.

—.(2008). *Creationism and Its Critics in Antiquity*. University of California Press.

—.(2010).Teleology, Aristotelian and Platonic. In J-G. Lennox and R. Bolton (Eds.), *Being, Nature and Life in Aristotle* (pp. 5-29). Cambridge, UK: Cambridge University Press.

Shields, C. (2002). *Order in Multiplicity: Homonymy in the Philosophy of Aristotle*. Oxford University Press.

Stein, N. (2016). Explanation and Hypothetical Necessity in Aristotle. *Ancient Philosophy*, 36(2), 353-382. https://doi.org/10.5840/ancientphil201636224

Waterlow, S. (1982). Nature, Change, and Agency in Aristotle's Physics: A Philosophical Study. Oxford University Press.

Wardy, R. (1993). Aristotelian rainfall or the lore of averages. *Phronesis*, 38: 18-30.

Witt, C. (2015). In Defense of the Craft Analogy: Artifacts and Natural Teleology. In M. Leunissen (Ed.), Aristotle's Physics: A Critical Guide (pp. 107-120). Cambridge University Press.

Woodfield, A. (1976). *Teleology*. Cambridge University Press.

Zeller, E. (1883). Outlines of the History of Greek Philosophy. 13th edition, revised by W. Nestle, translated by L.R. Palmer. New York, 1955.