

To Be or Not To Be Informed, That Is the Question of O ntology

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Abstract

The relations between ontology and information are many and fundamental, and they help us to understand the present gulf between (formal) *ontology* and (philosophical) *Ontology*: We can speak of respectively ontology-driven information and information-driven ontology as the focus on being informed vs. informed being. The question of whether these two (can) coincide is relevant to both fields, and in this article I elaborate on what needs to be addressed first of all to provide us with an answer: *The form*. This core ontological concept rooting in Aristotelian metaphysics was central to philosophical ontology, in particular in Latin Scholasticism, when it was clearly put into relation with information as that which defines an entity. In this context, Dietrich of Freiberg synthesized this long debate in a way that matters not only to the philosophical effort of producing information-driven ontologies but also to the engineering constructs of ontology-driven information systems.

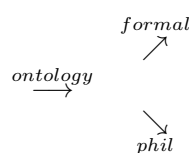
Key words: O ntology; Ontology-driven information; Information-driven ontology; Form; Dietrich of Freiberg

1 Introduction

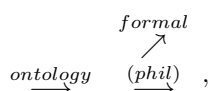
Ontology and information are intimately tied up with each other, explicitly so ever since the medieval philosophers looked upon reality as the source of metaphysical information: The things – *res*, in Latin – that compose reality carry in themselves the information required to our knowing them; they are, in a strict sense, informed beings, and hence existence is first and foremost a matter of being endowed with information. Metaphysics has existed as a clearly separate subject since Aristotle's

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Metaphysics coined the general inquiries into being/existence and what (there) is.¹ The latter of these inquiries was more recently – early 17th century – segregated as a subfield of metaphysics (Freedman, 2022; Øhrstrøm & Uckelman, 2022; Smith, 2022)² and the coinage “ontology” was reserved for the effort of identifying (all and only) the different beings or entities – *ónta*, in Greek – that compose reality and which we capture conveniently with the term “things” or, more unspecified, “stuff.” Almost two centuries later, I. Kant (1781/1998) threw a hand full of sand into what had been a very well oiled engine when he asked what the source – the objects or the subject of knowledge – of the information is that underlies our ontological constructs.³ Even more recently, in the early 1990s, ontology was said to branch into a formal and a philosophical variants, but in fact the former can be said to be a new branch in a long trunk whose growth remained unaltered. Regardless of whether we can speak of a proper or an improper branching, i.e.



or



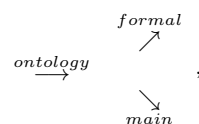
respectively,⁴ this phenomenon was motivated to a large extent by our understanding of information brought about by the rapid progress in classical computation and firstly elaborated on in Shannon (1948). Briefly, the importance of being informed is at the very heart of what is still spoken of as the Information Age.⁵

¹Note the anecdotal origin of this coinage: “*Tá metá tá physiká*,” meaning in ancient Greek “what comes after the physical things,” was the title chosen for the collection of texts by Aristotle that appeared to follow what was collected into a single book entitled *Physics*. See Jaroszyński (2018) for a comprehensive study on this topic.

²These three references are all part of an ongoing discussion in the *Journal of Knowledge Structures & Systems* on the birth of ontology.

³Kant used the term “*Kenntnis*,” also translatable as “knowledge” or “acquaintance.” For the difficulty in distinguishing *information* and *knowledge*, see Augusto (2020).

⁴In the second form of branching, the improper one, the adjective “philosophical” is added as an artifact concocted to allow for distinguishing the new branch (formal ontology) from its trunk; in effect, before this new branch ontology was just ontology simpliciter. The branching



where “main” abbreviates “mainstream,” resolves this ambiguity (see Augusto, 2021b).

⁵Some already speak of the Knowledge Age (e.g., Bereiter, 2002; Ragsdell et al., 2002), but it is not well understood how knowledge replaces information (Augusto, 2020), especially when our computational apparatuses remain essentially the classical ones. (We can today already distinguish computation as classical – the Turing-von Neumann paradigm – or non-classical: e.g., the computational-intelligence and quantum paradigms. See Augusto [2021c] for this distinction.)

Formal ontology and information are naturally tied up: The former, often written “ontology,” has typically been seen as part of the broader field of information science, in which it features as a formal/technical means of sharing information in a given domain (e.g., Borst, 1997; Gruber & Olsen, 1994; Smith, 2003, 2021; Studer et al., 1998). Philosophical, or mainstream, ontology – *Ontology* – and information are currently not so explicitly tied up, but we may safely assume that in some way(s) they are or must be (e.g., Hagengruber & Riss, 2014; Poli & Seibt, 2010). In effect, regardless of the different methods and theoretical assumptions that may separate these two manners of doing ontology (see Augusto, 2021b), information is at the very core of both: Independently of the upper/lower case use of the initial “o”, we can speak both of *ontology-driven information* (e.g., Fonseca & Egenhofer, 1999; Gailly & Poels, 2007; Guarino, 1998; Křemen & Kouba, 2012; McDowell & Cafarella, 2006; Tomassen, 2006; Vcelak et al., 2014) and *information-driven ontology* (Augusto, 2022b). Variations of the former, especially *ontology-based information*, are frequently to be found in the literature (e.g., Müller et al., 2004; Vallet et al., 2005; Wache et al. 2001; Wimalasuriya & Dou, 2010). Although one may quibble over the point that information-driven and -based/-... ontology might not be synonymous I shall capture all the variations under the expression “information-driven ontology.”

As the number of citations shows, ontology-driven information has been extensively researched and written about in the circumscribed contexts of information *systems* (also: *retrieval*, *extraction*, etc.) where metadata or annotations are central constructs, namely with a view to (web-based) applications that range from (governmental and/or corporate) projects to already patented systems (e.g., [1] - [4]). Unsurprisingly, the Semantic Web works as a center of gravity for much of this work (e.g., Fonseca, 2007; Sheth & Ramakrishnan, 2003; Zhuhadar et al., 2009). And interestingly, there is already available an ontology of information artifacts (IAO: [5]), in what appears to be an instance of both meta-information and meta-ontology, a combination whose novelty requires intensive self-corrective work (e.g., Smith & Ceusters, 2015).

Contrasting with this profusion is what I recently called information-driven ontology (Augusto, 2022b). This novel coinage requires a proper elaboration and I address this in the present article. In doing so, I shall focus on a core ontological concept – the *form* – that is essentially neglected in contemporary ontology, formal or otherwise, but which is the very root of the noun “information.” As part of an ongoing project in the *Journal of Knowledge Structures & Systems* that aims at bridging (the gap between) formal and philosophical, or mainstream ontology, I shall root my own work in that of the Latin scholastic philosopher Dietrich of Freiberg, namely on the fourth part of his text written in the 1280s entitled *Treatise on the Origin of the Categories* (Dietrich von Freiberg, sd/1983).⁶ A central idea in this project is that philosophical ontology can – or actually should, or even ought to – work as a conceptual source for formal ontology, for which purpose sufficient knowledge of Classical Greek and Latin are highly desirable, if not indispensable (see the Editorial for this issue: Augusto, 2022c); with this in mind, in my discussion below of Aristotle and Aquinas’ take on the form I give the original passages in Classical Greek and Latin in footnotes. Whenever appropriate, and with all readers in mind, in the main text I give transliterations

⁶See *Journal of Knowledge Structures & Systems* 2(2), 3(1), and 3(2) for published issues in this project.

of core concepts in Classical Greek (e.g., I transliterate “οὐσία” as “*ousía*”).

2 Ontology-Driven Information, or the Quest for Being Informed

2.1 Ontologies and Informational Gaps

2.1.1 Two Questions and a Very Short History

Formal ontologists are in general well aware both that their work diverges substantially from that of the philosophical ontologists and of the central role of information to this distinction, and this in such a way that they are often keen to, and capable of, segregat_{ing}^e different approaches to ontology according to its intended role for, and impact on, information systems. For instance, F. Fonseca (2007) distinguishes not only (philosophical) *Ontology* and (formal) *ontologies*, but also the latter into “ontologies *of* information systems” and “ontologies *for* information systems”. He writes:

The first distinction deals with the creation of ontologies. What are the best methods to create representations of reality? How can we be sure that our ontologies are good? Among all the ontologies that may be created to describe the different aspects of reality, information scientists are particularly interested in ontologies that describe information systems, i.e., they are interested in what we call *ontologies of information systems*. These are ontologies that will support the validation of tools which are used to create conceptual models. The second distinction concerns the use of ontologies. From the set of all ontologies, we select those that have been captured in computational form and that may be used to generate or validate information system components. We call these *ontologies for information systems*. The different uses of the term by information science communities, having different connotations, may lead to confusion in the study and use of ontologies.

For the sake of analysis, let us isolate the two questions posed by Fonseca:

- (Q1) What are the best methods to create representations of reality?
- (Q2) How can we be sure that our ontologies are good?

As we shall see, these questions are tightly interrelated to such an extent that when answering one of them we are also giving an answer to the other, and the link between them is precisely *information*. Fonseca’s answers accordingly point to information, namely how we capture, represent, and transmit it. This awareness of the central role of information for the field of ontology is recent and arose out of the need brought about by the fast-evolving computerization of the processing of information. In the mid 1990s, at the height of the Information Age, ontology branched into the two (main) variants of philosophical ontology and formal ontology – see above – with the realization by some people working in information science that the core of some of their engineering and computational constructs was as old as Western philosophy

itself, to wit, the effort of producing a comprehensive list of the things that compose reality in general and/or exhaustive lists of the constituents of its many domains. They soon called the former constructs *top-level* or *upper ontologies*, and referred to the latter as *domain ontologies*; *task ontologies* and *application ontologies* are also to be found in the literature (e.g., Guarino, 1998). The fact that the plural is used in all these labels shows that the philosophical aim of coming up with *the* unique ontology (the *Ontology*) was replaced by the more pragmatic and perhaps realistic objective of producing several accounts or lists of entities, a plurality that reflected the realization that ontological constructs mirror different *conceptualizations* of reality.

In effect, within this computer science branch it was early on clear that the task of identifying the components of reality and its domains was mostly one of conceptualization, and more specifically of *shared* (vs. private or individual) conceptualizations; this appeared as a *formal* task (Borst, 1997) that was very soon specified as the requirement that these shared conceptualizations – ontologies – should be machine-readable (Studer et al., 1998). Philosophical ontology remained largely unaware or dismissive of this branching and went on with its millennia-old techniques in its task of identifying the same components until in the mid 2000s the alarm bell sounded and the philosophical community was awoken from its dogmatic slumber (to use an expression in the Kantian *Critique of Pure Reason*) by B. Smith’s wake-up call paraphrased as “Wake up, oh ye philosophers, or you will shed ontology (just as you did shed psychology a century ago)” (Smith, 2021).

One might see this alarm bell as perhaps a tad too exaggerated, but philosophical ontologists appeared then to be wholly unaware that, just like many other fields (e.g., biology, physics, mathematics, linguistics), ontology had taken an informational turn in the sense that it was now being done for the sake of information, in particular of information systems. The ontologists working with these systems in view were asking not so much whether their conceptualizations were true mirrors of reality, reason why the term “truth” was either absent or had a purely logic/algebraic meaning in them, but what the optimal means were to computerize – i.e. store and retrieve in appropriate machines with actions in view such as transmission, integration, sharing, etc. – symbolic structures whose interpretation aimed at reflecting as much as possible the “true” structure of reality. After all, an information system hardly deserves to be called that if it neither captures nor processes information from the environment in a reliable way, as the objective of its conception and construction is that of informing the agents with respect to both their environment and the changes in this brought about by both their actions and natural phenomena. In other words, the main concern of the agents is that of *being informed*, and veridically so,⁷ reason why they go to great lengths and readily expect great costs to both design and maintain the artificial information systems that extend our natural information-processing capabilities.

Indeed, this capturing is an exceedingly difficult task that presupposes the ability, firstly, to abstract from our natural language-^{bounded}_{driven} perception of reality in the direction of axiomatic theories (ontologies) with a view to obtaining language-independent constructs (conceptualizations), and back from these into the former via the realization that our ontological models are but approximations of our *intended* models. This entails a new notion of *ontological commitment* that manages not only to keep

⁷Differently put, being knowledgeable. But *not* equivalently put, as information and knowledge are distinct in fundamental ways (Augusto, 2020).

Quine’s (in)famous logical criterion but also to extend it well beyond a strictly logical framework. The reader will find a comprehensive formal account of what is currently the standard meaning of the above expressions in italics in, for instance, Guarino (1998) and Guarino et al. (2009); in the following paragraphs, I elaborate on Quine’s account of ontological commitment, which I see as the – implicit or explicit – source of this concept in formal ontology, and I give my own account of the gap postulated by these authors between models and intended models.

2.1.2 Ontological Commitments: Quine’s Descriptive Account

In a strictly logical framework, a theory is a set of statements believed to be true, or axioms.⁸ These can be logical or proper, the difference being that the former alone – or together with a set of rules – constitute a calculus (they are then called axiom schemata) and the latter constitute a theory of a specific domain. For instance, “ $\forall x(\varphi) \rightarrow \varphi_t^x$ (if t is substitutable for x in φ)” is an axiom schema that governs the elimination of the universal quantifier in a first-order predicate axiomatic calculus: If one has $\forall x(\varphi) \rightarrow \varphi_t^x$ and $\forall x(\varphi)$, then by applying *modus ponens* and the admissible substitution one has $\varphi(t)$. Any proper theory formalized in this logical language can in principle apply this axiom schema, or some equivalent rule, as long as there is a term t that is substitutable for x in a given formula φ . For instance, in the rule-based Natural Calculus the same result can be obtained by applying the rule of universal instantiation, meaning that you go from universally quantified predicates to instantiated predicates. The sentence “Every human is mortal” does constitute a non-trivial theory, albeit a very frugal one; let us denote it by Θ_{HM} and formalize it as $\Theta_{HM} = \{\forall x(Human(x) \rightarrow Mortal(x))\}$. Let us now extend this theory by adding the sentence “Socrates is a human,” so that we have now the extended theory $\Theta_{HM}^* = \{\forall x(Human(x) \rightarrow Mortal(x)), Human(socrates)\}$. It can be shown that “Socrates is mortal” is a sentence of Θ_{HM}^* by applying universal instantiation (via the substitution of the constant *socrates* for the variable x and the elimination of the universal quantifier) and the rule *modus ponens*. Of course, one could obtain the same result by using a fictional character, say, Ulisses, or one of L. M. Alcott’s little women (one of them indeed died; as far as we know, the other sisters are immortal), but these would go against one’s beliefs with respect to human existence and mortality in general. In other words, one’s intended model of human existence aims at capturing *only* the individuals in the domain of humans that can be extensionally a very, very large set constituted by *all* the human individuals. But first and foremost the theory Θ_{HM} assumes that individual humans must exist, in order for it to be a true theory; this is the ontological commitment of Θ_{HM} .⁹ Note that we accept that individual humans exist (and are mortal) because we firstly accept the theory Θ_{HM} , which is ontologically committed to these entities, and not vice-versa. This is the perspective defended by W. Quine (1948):

A theory is committed to those and only those entities to which the bound

⁸See Augusto (2019) for the meaning of the classical logic terms used here. What follows is a short elaboration on ontological commitment from a philosophical perspective; there is much more to this topic than can be reasonably discussed here and I refer the reader to Bricker (2014) for an encyclopedia article.

⁹I henceforth drop the star (*).

variables of the theory must be capable of referring in order that the affirmations made in the theory be true.

Taken from a strictly descriptive viewpoint, it is the theory Θ_{HM} – and not we – that is committed to the existence of humans, in particular of *at least one* human individual, say, Socrates. This allows then for the application of the axiom schema (or rule of existential generalization of the Natural Calculus) “ $\varphi_t^x \rightarrow \exists x(\varphi)$ (if t is substitutable for x in φ).” Indeed, if there is a human called Socrates such that we have $Human(socrates)$, then $\exists x(Human(x))$. And, of course, the other way round must be also possible, i.e. if we have $\exists x(Human(x))$, then we can replace the bound, or quantified, variable x by some individual – say, Socrates – that is denoted by a constant – *socrates*, say – in our domain, in which “ s ocrates” is a *value*. Quine summarizes this discussion in the now (in)famous terms:

To be is to be the value of a bound variable. (Quine, 1948)

2.1.3 The Prescriptive Account and Informational Gaps

I say “infamous,” because Quine’s motto might be interpreted as a definition of existence in purely logical terms. However, Quine ruled out this interpretation when he wrote “I look to variables and quantification for evidence as to what a theory says that there is, not for evidence as to what there is” (Quine, 1960). This entails a second account of ontological commitment, a prescriptive one, in the sense that we ought to choose the best theory from a collection of theories on the same domain. For instance, given the theories $\Theta_{HI} = \{\forall x(Human(x) \rightarrow Immortal(x))\}$ or $\Theta_{H-M} = \{\forall x(Human(x) \rightarrow \neg Mortal(x))\}$, the substitution of values in the domain of human individuals for the variable x will output false theories, whereas the same substitution with respect to Θ_{HM} will result in a true theory; so, we ought to choose Θ_{HM} and reject the other two theories. We are thus committed to Θ_{HM} ; this is *our* ontological commitment.

Why is this important? Because our ontologies reflect our ontological commitments. If one is committed to Θ_{HM} , then one’s ontology will have at least two (*classes* of) entities, humans and mortals, and they will coincide in this ontology via the *relation* – yet another entity – “humans are mortals.” This, in turn, might entail that there are also animals, a class of animated entities (a genus) of which in fact humans are a subclass (the species *homo sapiens*), and immortal entities, such as gods, or geometrical shapes, etc., so that by now one has to decide whether to cut short this proliferation or let it grow, as well as to establish criteria for these choices. This is what ontological commitment in formal ontology is all about and it matters because reality matters. For instance, Ilic et al. (2007) write on the Plant Structure Ontology (PSO), an ontology within the larger Plant Ontology project (PO; [6]):

Angiosperms are one of the most diverse groups of plants that vary greatly in morphology, size, habitat, and longevity. Agriculture is almost entirely dependent on angiosperms. Besides providing food and fiber, angiosperms are important sources for pharmaceuticals, lumber, paper, and biofuel. Understanding the origins, mechanisms, and functions of morphological diversity in flowering plants is one of the fundamental questions in plant biology.

No wonder these authors want to get this ontology right. But this is not going to be an easy task, because not only is reality (often) impressively complex, but also there is linguistic, namely semantic, variability that generates confusion. With respect to the first aspect, the authors write:

Modern approaches to studying plant development integrate classical knowledge in plant anatomy and development with molecular genetics and genomics tools. Among powerful tools, analyses of mutants that affect developmental processes have shed new light on our understanding of the complexity of plant development. More recently, high-throughput, genome-wide phenomic screens in *Arabidopsis* (*Arabidopsis thaliana*; ...), and large-scale gene expression-profiling technologies (...) generated a huge amount of data in plant science. These tools and resources have the potential to contribute to efforts to link genes with developmental morphology (i.e. genotype with phenotype) and make an impact on our understanding of functions of genes involved in plant development. (Ilic et al., 2007)

And concerning the second aspect (*ibid.*):

Accurate and standardized nomenclature for plant anatomy and morphology is also required for comparative purposes (i.e. for comparisons of genes involved in plant development among related or evolutionarily distant taxa). Semantic perplexity presents a major obstacle for conducting such comparative studies in plants; similar plant structures are described by their species-specific terms. For example, in scientific publications, fruit is often referred to as silique in *Arabidopsis*, grain or caryopsis in rice (*Oryza sativa*), and kernel in maize (*Zea mays*). Conversely, the inherent ambiguity of some plant anatomical terms led to the same or similar terms being applied to different structures (e.g. cork cell in the epidermis of grasses and cork cell in the periderm in all other angiosperms).

These verbose passages show how overwhelmingly complex a task the design of an ontology is: Answering Q1 above, it begins by identifying the most general entities, or the genera (in the case at hand: plants), and all their sub-genera (here: angiosperms, i.e. flowering plants) and (sub)species (*Arabidopsis thaliana*, *Oryza sativa*, *Zea mays*, ...) by considering such diverse aspects as morphology and function and their relations at macro- and microlevels (e.g., linking genotypes with phenotypes), and it ends with the aim of engineering a vocabulary that is both precise and unequivocal to name all the many and diverse entities at play in this complex picture of what is in fact a very small portion of reality.¹⁰ Ilic et al. (2007) clearly identify the target users of the PSO, which is said to be “intended for a broad plant research community, including bench scientists, curators in genomic databases, and bioinformaticians,” and this *intended target* helps to define the *intended model* that works as the standard with relation to which the PSO is calibrated in terms of approximation. In the cited article and in Jaiswal et al. (2005) the authors elaborate on their rationale for their selection of plant entities (*terms*) and the relations between them, which are all parent-

¹⁰See APG IV (APG, 2016) for an updated taxonomic classification of the angiosperms.

child relationships in a directed acyclic graph, to wit, `is_a`, `part_of`, and `develops_from`. Jaiswal et al. (2005) write with respect to the choice of terms in the PSO:

The plant structure ontology is a controlled vocabulary of botanical terms describing the morphological and anatomical structures of plants. These structures include organs, tissues and cell types and relationships among them. Examples are “stamen”, “ovule”, “petal”, “parenchyma”, “guard cell”, etc. The structure ontology does not include attributes (or characters) of the structural components, e.g. the term “ovary” is included but whether the ovary is superior and inferior is not described.

And as far as the relationships between terms are concerned, the account, which includes comparison with other hierarchical models and takes annotations into consideration, is as follows (*ibid.*):

Compared to the simple hierarchies ..., where there are no defined relationships among terms, in the PO three types of relationships were introduced to link a child term to a parent term ..., thus creating a network of botanical terms depicting the morphological and developmental complexity of plants. The relationships are: (1) “part of”, indicating a composition or constituency relationship, e.g. “root hair” is a part of “root epidermis”; (2) “is a”, indicating a generalization relationship where a child term is a type of a parent term; e.g. “root hair” is a “cell”; and (3) “develops from”, indicating a derivation relationship where a child is derived from the parent; e.g. “root hair” develops from “trichoblast”.

The quotations above show that great care was taken in the selection of the terms of the PSO so that these are restricted to morphological and anatomical structures of plants and their relationships, and this to a level of detail that is considered appropriate for the target users. For instance, neither subcellular structures nor attributes of the structural components are to be found in the PSO; on the other hand, genetic information can be as detailed as to include the name of the gene, its structure of expression, and its relations with its parent structures in the directed acyclic graph. The question is: Does this ontology capture the intended model in the sense that the target users will be as informed as the authors expect?

This is question Q2 above. The authors indicate that users seeking information on subcellular structures or attributes of the structural components will not be adequately informed by searching the PSO, as this does not have enough information for them; on the other hand, it can easily be imagined that a florist will be confronted with too much and/or irrelevant information on plant structure and morphology. Both a bioinformatician and a florist are admissible, not to say legitimate, users of the PSO, namely in the sense that they are expected to be ontologically committed to the theory it expresses to a lesser or greater degree.¹¹ In both cases, there is an *informational gap* in the sense that the PSO provides too much or too little of plant structure and morphology depending on the *target users*. So, additionally to speaking of approximation of an ontology to an intended model as largely dependent on the language used to express a conceptualization (e.g., Guarino, 1998; Guarino et al., 2009), an

¹¹As far as I know, there is no logic-based formalization of the theory on which the PSO is built, another reason for the extensive quotations above.

aspect that I discuss below, we should see it also as a gap between what the users of an ontology seek – as a reflection of their ontological commitment – and what the ontology actually provides in terms of information. Despite these users’ ontological commitment with respect to the PSO they will have to seek elsewhere to satisfy their informational needs.

2.2 Ontology as Representation: The Kantian Legacy

2.2.1 Information and Representations

Questions Q1-2 above are central in philosophical and formal ontology alike. From a philosophical perspective, they are just contemporary reformulations of the Kantian inquiry (Kant, 1781/1998), and formal ontologists, too, when invoked to go deeper into the foundations of their constructs, are keen to try to answer them (e.g., Guizzardi & Baratella, 2022; Keet & Khan, 2022).

Taken in a sense stricter than the one analyzed above, Q1 respects what we today call knowledge representation and reasoning (KRR), a subfield of the larger subject of knowledge engineering, and despite some ongoing debate the consensual answer points in the direction of formal languages that are capable of supporting axiomatization without the full expressiveness – and associated computational costs and undecidability issues – of first- or higher-order logics. This desideratum is currently believed to be satisfied by description logics and its web-oriented (metadata-based) versions like OWL, the Web Ontology Language (see, e.g., Staab & Studer, 2009, Part I).¹² There is arguably much more to KR – the subfield of KRR restricted to knowledge representation – than language, but this is what binds together the features considered desirable in a KR system. According to Davis et al. (1993), an article that, to judge by the number of citations, was and remains highly influential, the language of a KR system must function as a medium of communication, whereby it is meant that it must provide knowledge agents with a medium of talking or thinking that is *easy*, so that its adequacy must be sought in the kinds of things that can be *easily* said in that language – versus those that are so difficult that they are “pragmatically impossible” and would require “heroic effort” to be formulated. This *easiness criterion*, according to the authors, fosters a broader conception of representation, which in turn enhances our ability to use this broader view to guide both the combination of representations and the dissection of some of the arguments about formal equivalence of representations; in sum, it makes it clearer to knowledge engineers that KR’s central task is that of “capturing the complexity of the real world” by means of a language that “embeds a theory of intelligent reasoning.” How to achieve this while conciliating the epistemological and computational imperatives, or the views that an ontology KR language must allow for both knowledge of reality and tractable computational requirements, is indeed not an easy matter. This difficulty, together with the development of the World Wide Web, prompted the reorientation of research – away from questions to do with the nature of reality or our apprehension of it – in

¹²Do not confuse *knowledge representation language* with other, related but formally different, kinds of ontology languages, like OWL or RDF(S); these aim at knowledge sharing and ontology interoperability, rather than representation proper. “Knowledge engineering” is here to be understood in a broader sense than its 1970s original one, in which it was largely restricted to the creation of expert systems.

the sense of finding the perfect ontology-representation language.

As for Q2, the answer is very pragmatical when posed in the context of applied ontology: Use the ontology, in order to find out how good it is (e.g., Keet & Khan, 2022). Ontologies are largely consensually seen as knowledge constructs, in either a very coarse-grained (foundational ontologies) or a very fine-grained way (domain and application ontologies) with respect to their entities, so one can say that they are good for storing/sharing/extracting/... knowledge at both micro and macro levels. Say, one wants to buy a microwave oven online; the seller is expected to have structured its available products in such a way that the navigation of the customer will be effortless. For instance, the customer, who in fact is more often than not unaware that they are using an ontology, does not in principle expect to find a microwave under “garden,” “garden appliances,” or even “electrical garden appliances,” so the seller’s ontology has to match the structure of the customer’s naïve, or commonsense, ontology. Or, to use a scientific example, an unknown salamander has been found and needs to be accommodated in the adequate phylogenetic tree; this will be a relatively easy matter, given the many biological ontology models available today that can (automatically) process this information at the levels of the genotype, phenotype, even anatomy, etc. (e.g., Carral et al., 2017; Maglia et al., 2007). How can the ontologists responsible for these two ontologies be sure that these are good ontologies? In the case of the online store, tests can be conducted with subjects and complemented with surveys; in the second case, the accommodation of the new subspecies should not require major changes in the ontology. In other words, an ontology is good when it reflects ontological commitments of the theories, whether commonsense or scientific, of its users (see above).

But this *goodness criterion* presupposes, firstly, that the conceptualization is shared by engineers and users alike, and secondly that not only the conceptualization, but also the *representation*, is shared. This takes us back to the subject of the informational gap between the intended models and the engineered ontologies: The problem is now not so much that the ontology provides too much or too little information with respect to its users, but rather that it does or does not meet their representations, and this includes their representation media, namely their language. When paired with the easiness criterion, one could answer Q2 in the following way: We are sure that an ontology is good when it meets the representations of its target users. A microwave buyer does not expect to have to look for this item in, say, bedroom furniture, nor do they expect to have to apply vocabulary from physics when navigating the seller’s ontology; the salamander expert does not expect a pet shop-like ontology, and they will be interested in the Latin name given to the newly discovered amphibian.

2.2.2 Information and the Form of Representations

We thus have it that ontology-driven information systems are to a great extent language-processing systems, or information-processing systems in which language is the main representation medium. But in fact this is not necessarily so: Our perception of reality recruits all our sensory modalities, and some humans are actually a verbal, though we have evidence that their conceptualization of the world is essentially “normal” (e.g., Lecours & Joannette, 1980).¹³

¹³Actually, we often nurture concepts for which we cannot readily provide a lexical item, or word.

As said above, Q1 and Q2 are in fact reformulations of the Kantian inquiry into ontological matters, and it might pay off to go briefly through his answers one more time.¹⁴ Actually, Kant fused the two questions into a single inquiry:

(QK) How do we know that our representations of reality are good?

According to Kant, there are three types of representation, to wit, analytic, synthetic, and synthetic *a priori*:¹⁵ The first, which concern only the content of concepts and the application on them of the principles of identity and contradiction, are wholly *a priori*; the second are *a posteriori* representations, based on experience; as for the third, if they are possible, then they would be universal and necessary, and thus go beyond experience, while also going beyond the first type of representations in the sense that they extend our knowledge of the concepts involved. This differentiation – see Augusto (2005) for an elaboration – impacts on the very principles of ontology as a separate field of inquiry in the following way:

The Transcendental Analytic ... has this important result: That the understanding can never accomplish *a priori* anything more than to anticipate the **form** of a possible experience in general, and, since that which is not appearance cannot be an object of experience in general, it can never overstep the limits of sensibility, within which alone objects are given to us. Its principles are merely principles of the exposition of appearances, and the proud name of an ontology, which presumes to offer synthetic *a priori* cognitions of things in general in a systematic doctrine (e.g., the principle of causality), must give way to the modest one of a mere analytic of the pure understanding. (Kant, 1781/1998, A246/B303; my emphasis¹⁶)

In this passage, Kant states with respect to ontology that (i) only sensory experience can provide us with information on the objects and (ii) the proper task of ontology is thus that of finding out the principles that govern our perception of reality taken in the sense of experience in general (vs. the experience of particular objects). This redirects the ontological question of *what* we know of the objects of experience to *how* we know them, which in turn requires an inquiry into what our understanding is as a pure possibility – the *form* – of knowledge before any object is given to it. The ontological categories are thus categories of the pure understanding, and instead of the existence of the external objects Kant's idealism is concerned with their form, reason why his is a *formal* idealism, as he was keen to clarify in his *Prolegomena to Any Future Metaphysics*, a self-defense meant to address the many critical challenges his *Critique* was confronted with (Kant, 1783/2003).

The whole project of Kant's *Critique of Pure Reason* was to argue for the possibility of the synthetic *a priori* representations in our quest for ontological knowledge, but this project can be formulated more simply by appealing solely to the concepts of *a priori* vs. *a posteriori* in cognition:

Now such universal cognitions [which reason is so desirous of], which at the same time have the character of inner necessity, must be clear and certain

¹⁴See Augusto (2005) for a comprehensive discussion.

¹⁵These are judgments, to be more precise.

¹⁶The English term "form" translates the German term "*Form*."

for themselves, independently of experience;¹⁷ hence one calls them *a priori* cognitions: whereas that which is merely borrowed from experience is, as it is put, cognized only *a posteriori*, or empirically. (Kant, 1781/1998; A2)

Thus, the form of the objects that are given in experience is wholly *a priori*, namely the pure intuitions of space and time, or the universal and necessary forms of intuition, and hence not to be found in the objects themselves. This conciliates our *a priori* knowledge of mathematics and physics with the belief in the existence of external objects. But, alas, belief does not necessarily mean knowledge, though it can equate with information, and we thus remain wholly ignorant of what objects might be in themselves.¹⁸ Kant saw this realization as the equivalent in metaphysics to the Copernican Revolution in celestial physics: Just as Copernicus had moved the center of the solar system from the earth to the sun, so did Kant move the center of ontology from the object to the subject. In the terminology of the present article, Kant moved the ontological quest from *informed being*, or the being with a form, to *being informed*, or the form of our representations, while keeping the former as the guarantee that we are not merely dreaming or just imagining. This shows that informed being was not simply replaced by the concern with being informed, thus doing justice to the impact of Aristotelian metaphysics in Western thought.

3 Information-Driven Ontology, or the Quest for Informed Being: Form from Aristotle to Latin Scholasticism

3.1 Aristotle's Metaphysics of the Form: The Formative Interpretation

The Kantian focus on the form in ontological matters is what I call *information-based ontology*, but it is only a part of it. In effect, the question of what the *form of our understanding*, or the *form of the subject*, is cannot be posed separately from the question of the *form of the objects* that are given to it, as only this provides us with knowledge of reality – so it might be argued. Before Kant, this was in fact the major question of ontology, and the ontological categories were categories of the objects (Augusto, 2022a). This presupposed that every single object had its own form that distinguished it from other objects and allowed for its classification in the order of being. This classification, or identifying the class to which an object belongs, was based on the universals, or that which remains unchanged in, and is shared by, the many particulars. We owe this doctrine to Aristotle.

Aristotle's starting point is substance (*ousía*): Everything that is, is first and foremost substance. Man, say, or horse, are substances; but how are we to distinguish

¹⁷A Cartesian maxim.

¹⁸In the first edition of his *Critique* (Kant, 1781/1998; A380), Kant wrote: "If, therefore, as the present critique obviously requires of us, we remain true to the rule established earlier not to press our questions beyond that with which possible experience and its object can supply us, then it will not occur to us to seek information about what the objects of our senses may be in themselves, i.e., apart from any relation to the senses."

“man” and “horse” from “this man” and “this horse”? Clearly, there must be something in the individual man that allows us to say of him that he is a man, and not a horse, so some distinction has to be made with respect to substance: There are indeed for Aristotle the first and the second substances, the *first substance*¹⁹ being an individual entity (a particular) and the *second substance* being the genus and the species (universals), as shown in Figure 1 in an ontological diagram.

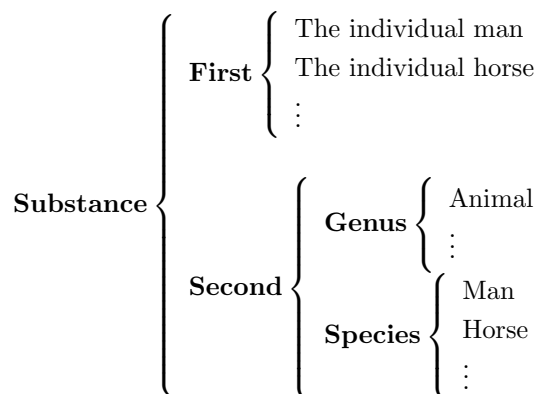


Figure 1: Aristotle’s two substances.

Figure 1 is extracted from *Categories* (Aristotle, sd/1963), the work in which Aristotle established his “formal” approach to ontology, and it is meant to be read as follows: The second substance is to be said, or predicated, of the first substance, in the sense that we say “John is an animal and a man” or “Freddie is an animal and a horse.” Note that we cannot say “John is a this man” or “Freddie is a this horse,” so that we can say that a first substance is that which cannot be said or predicated of anything else. Figure 2 shows this interpretation.

This interpretation originating in the *Categories* would be the source of many debates, in particular because in it it appears that Aristotle reduces the ontological relations between universals and particulars to questions of linguistics (grammar or logic, too), so that our ontological comprehension of the world might be reduced to the ways of speaking about it.²⁰ In effect, in the same way that the second substances are said or predicated of the first substances, so are the remaining nine categories, apparently not existing without the first substances: If there were no individual things, then entities like quantities (e.g., 75 kg), qualities (e.g., white), relations (e.g., is a part of), etc., would not be said or predicated of anything simply because they would have no support for their being.²¹ In Aristotle’s own words:

¹⁹Also to be found as “primary” or even “prime substance.”

²⁰But there are additional issues; for instance, Ross (Aristotle, sd/1924) writes about this binary distinction in the *Categories*: “The main difficulties of the doctrine are concerned with the category of substance. It contains two distinct types of thing: (1) individual substances, (2) the species and genera to which they belong. It may seem surprising that these should be grouped together. Why, it might be asked, should one of the universals under which Socrates may be classed, viz. ‘man’ be picked out as having more affinity with Socrates than other universals under which he may be considered, such as ‘white object’?”

²¹See Augusto (2022a) for a discussion of Aristotle’s categories.

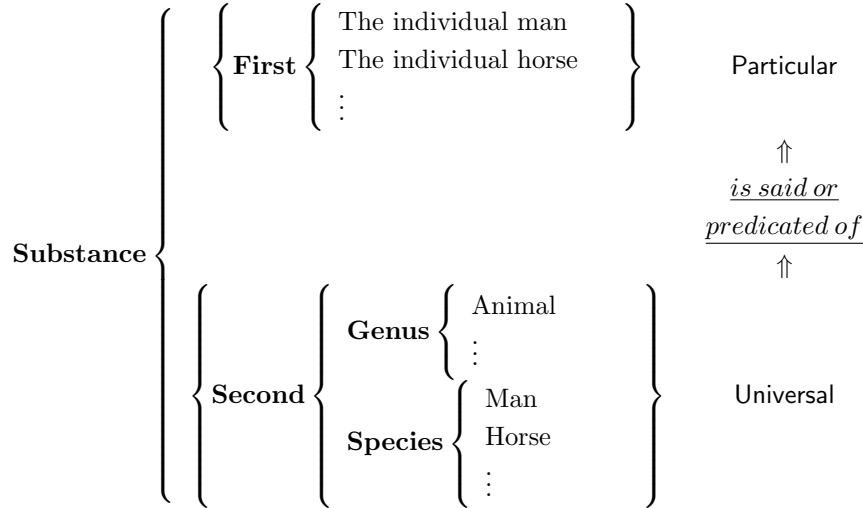


Figure 2: Aristotle's two substances: The linguistic interpretation.

For some things are said to “be” because they are substances; others because they are modifications of substance; others because they are a process towards substance, or destructions or privations or qualities of substance, or productive or generative of substance (...). (met. IV, 2, 1003b6-9)²²

This realization, in Aristotle's *Metaphysics* (Aristotle, sd/1933)²³, moves the focus from a linguistic (grammatical or logical, too) conception of substance to a metaphysical one, i.e. to substance taken as a being qua being. In this perspective, the questions “what is being?” and “what is substance?” are one and the same question. The problem is that before this metaphysical focus Aristotle had focused on the physical things (see footnote 1 above) with respect to which two aspects must be taken into consideration: Every corporeal thing is a compound of both matter (*hylê*) and form (*morphê*), it being the case that this hylemorphic compound is more complex than what first meets the eye when we put it into relation with the concept of substance:

We have now stated in outline the nature of substance – that it is not that which is predicated of a subject, but that of which the other things are predicated. But we must not merely define it so, for it is not enough. Not only is the statement itself obscure, but also it makes matter substance; for if matter is not substance, it is beyond our power to say what else is. For when everything else is removed, clearly nothing but matter remains; because all the other things are affections, products and potencies

²²τὰ μὲν γὰρ ὅτι οὐσίαι, ὄντα λέγεται, τὰ δ' ὅτι πάθη οὐσίας, τὰ δ' ὅτι ὁδὸς εἰς οὐσίαν ἢ φθορὰ ἢ στέρησις ἢ ποιότητες ἢ ποιητικὰ ἢ γεννητικὰ οὐσίας ἢ τῶν πρὸς τὴν οὐσίαν λεγομένων (...).

²³This reference is for H. Tredennick's translation; for the original Greek text, I use here W. D. Ross' edition (Aristotle, sd/1924), which is available online at [7].

of bodies, and length, breadth and depth are kinds of quantity, and not substances. (*Met.* VII, 3, 1029a7-15)²⁴

Moreover, every corporeal thing comes to be and ceases to be, which (in between) implies change, so that substance cannot be identical to this changing combination of matter and form. At a purely metaphysical level, at play is the constant tension between act and potency that makes it so that a being is continuously in a state of privation with respect to both what it will be next (what I call *privation*₁; Augusto, 2022b) and what it was before (*privation*₂). So, how can we say of an animal embryo, say, a horse's, that it is a horse, or of a carcass that it is a horse('s)? Aristotle's reply is that there is something – substance – that subsists per se under those changes, so that substance proper is that which remains unchanged, or the essence of a thing taken separately and as “this something.” If we see this “saying of” from an epistemological perspective – one says of an animal that it is a horse because one knows that this is an animal and this animal is a horse –, then the essence is the same as the definition (*lógos*; also: *horismós*), that which in a thing allows for knowledge of it as such.²⁵ Essence cannot be matter, because this is neither separable nor individual, two properties that belong especially to substance²⁶; for instance, a piece of wood is neither an individual plant (a tree) nor separable from a plant (a tree), though it may be now taken from the viewpoint of another substance, for example, a table. What allows us to say that it still is somehow a tree is the *unity of the form* that remains the same in change or in privation, but *form* now translates the Platonic *eidós*, or *idéa*, idea.

It is as *eidós*, and as *eidós* alone, that Aristotle identifies form and essence:

By “form” (*eidós*) I mean the essence of each thing and its primary substance. (*Met.* VII, 7, 1032b1-2)²⁷

By form (*eidós*) I mean essence (*tó tí hên einai*; that which was to be). (*Met.* VII, 10, 1035b34)²⁸

When form and essence are identified and used interchangeably, then each is regarded as first substance (see Hartman, 1976; Yu, 2001). This means that there are substances that are simple in the sense that they are not a hylemorphic combination, so *morphê* plays no role in their definition. Aristotle himself is quite aware of this deep conceptual change, writing in *Metaphysics* VII, 3, 1029a30-3:

²⁴ οὐκ ἔστιν οὖν οὐρανὸς οὐδὲ γῆ, οὐδὲ ἀέρας οὐδὲ ὕδωρ, οὐδὲ οὐσία, ὅτι τὸ μὴ καθ' ὑποκειμένου ἀλλὰ καθ' οὐ τὰ ἄλλα: δεῖ δὲ μὴ μόνον οὕτως: οὐ γὰρ ἰκανόν: αὐτὸ γὰρ τοῦτο ἄδηλον, καὶ ἔτι ἡ ὕλη οὐσία γίγνεται. εἰ γὰρ μὴ αὕτη οὐσία, τίς ἐστὶν ἄλλη διαφεύγει: περιαιρουμένων γὰρ τῶν ἄλλων οὐ φαίνεται οὐδὲν ὑπομένον: τὰ μὲν γὰρ ἄλλα τῶν σωμάτων πάθη καὶ ποιήματα καὶ δυνάμεις, τὸ δὲ μῆκος καὶ πλάτος καὶ βάθος ποσότητές τινες ἀλλ' οὐκ οὐσία (...).

²⁵ *Met.* VII, 1, 1028a31-7: “Now ‘primary’ has several meanings; but nevertheless substance is primary in all senses, both in definition and in knowledge and in time. For none of the other categories can exist separately, but substance alone; and it is primary also in definition, because in the formula of each thing the formula of substance must be inherent; and we assume that we know each particular thing most truly when we know what ‘man’ or ‘fire’ is (...).” (πολλαχῶς μὲν οὖν λέγεται τὸ πρῶτον: ὅμως δὲ πάντως ἡ οὐσία πρῶτον, καὶ λόγῳ καὶ γνώσει καὶ χρόνῳ. τῶν μὲν γὰρ ἄλλων κατηγορημάτων οὐθὲν χωριστόν, αὕτη δὲ μόνη; καὶ τῷ λόγῳ δὲ τοῦτο πρῶτον (ἀνάγκη γὰρ ἐν τῷ ἐκάστου λόγῳ τὸν τῆς οὐσίας ἐνυπάρχειν): καὶ εἰδέναι δὲ τότε ἰοίμεθα ἕκαστον μάλιστα, ὅταν τί ἐστὶν ὁ ἄνθρωπος γινώσκων ἢ τὸ πῦρ (...)).

²⁶ *Met.* VII, 3, 1029a27-8: καὶ γὰρ τὸ χωριστόν καὶ τὸ τόδε τι ὑπάρχειν δοκεῖ μάλιστα τῇ οὐσίᾳ (...).

²⁷ εἶδος δὲ λέγω τὸ τί ἦν εἶναι ἐκάστου καὶ τὴν πρώτην οὐσίαν (...).

²⁸ εἶδος δὲ λέγω τὸ τί ἦν εἶναι (...).

The substance, then, which consists of both – I mean of matter and form (*morphê*) – may be dismissed, since it is posterior and obvious. Matter too is in a sense evident. We must consider the third type [of substance: *eidos*], for this is the most perplexing.²⁹

Aristotle actually distinguished *eidos* and *morphê* by saying that the latter is the arrangement or schema of the form (*schêma tês idéas*), so that the form must be prior to both the matter and the hylemorphic combination:

Now in one sense we call the matter the substrate; in another, the shape (*morphê*); and in a third, the combination of the two. By matter I mean, for instance, bronze; by shape (*morphê*), the arrangement of the form (*idéa*); and by the combination of the two, the concrete thing: the statue. Thus if the form (*eidos*) is prior to the matter and more truly existent, by the same argument it will also be prior to the combination. (*Met.* VII, 3, 1029a2-7)³⁰

In the passage above, it is obvious that Aristotle does not confuse *morphê* and *eidos/idéa*, and the translation of the former as “shape,” as above, contrasted with the translation “form” for the latter helps to distinguish both conceptions in English. However, because of the difficulty to distinguish both senses and also because these two terms – *morphê* and *eidos/idéa* – occur together by means of the conjunctive connector as “*hê morphê kaí tó eidós*” in passages of the *Metaphysics*³¹ and of other books of his, translators typically do not distinguish both terms, translating both *morphê* and *eidos* as *form* (see Long, 2007). In fact – and a fact of significance for the study at hand – this “fusion” (rather than “confusion”) was already the case in Latin scholasticism (see Section 3.1.2).

Nonetheless, if we consider the natural beings from the viewpoints of universality and individuality, then *morphê* can mean the *material form* of the individual compound of form and matter that makes “this man” or “this horse,” whereas *eidos* is the *substantial form* by means of which we classify “this man” and “this horse” as “man” and “horse,” i.e. as members of a *species*. This is indeed Aristotle’s suggestion in *Metaphysics* VII, 5, 1030a11-13: “essence will belong to nothing except species of a genus, but to these only.”³² This conciliates the approach in the *Categories* and that of the *Metaphysics* (as well as of other texts) into a single substance in which the *eidos* as universal – the **species** (of a **genus**) – is that which *forms* the compound of matter and form (*morphê*) in the case of the material beings. In effect, although Aristotle emphasizes the ontological status of the individual, of (being) “this something,” it seems unlikely that he speaks of individual forms in the sense that every individual thing would have its own idiosyncratic form; knowledge of reality, which

²⁹ τὴν μὲν τοίνυν ἐξ ἀμφοῖν οὐσίαν, λέγω δὲ τὴν ἕκ τε τῆς ὕλης καὶ τῆς μορφῆς, ἀφετέον, ὑστέρα γὰρ καὶ δῆλη: φανερὰ δὲ πως καὶ ἡ ὕλη: περὶ δὲ τῆς τρίτης σκεπτέον, αὕτη γὰρ ἀπορωτάτη.

³⁰ τοιοῦτον δὲ τρόπον μὲν τινα ἡ ὕλη λέγεται, ἄλλον δὲ τρόπον ἡ μορφή, τρίτον δὲ τὸ ἐκ τούτων λέγω δὲ τὴν μὲν ὕλην οἷον τὸν χαλκόν, τὴν δὲ μορφήν τὸ σχῆμα τῆς ιδέας, τὸ δὲ ἐκ τούτων τὸν ἀνδριάντα τὸ σύνολον, ὥστε εἰ τὸ εἶδος τῆς ὕλης πρότερον καὶ μᾶλλον ὄν, καὶ τοῦ ἐξ ἀμφοῖν πρότερον ἔσται διὰ τὸν αὐτὸν λόγον.

³¹ E.g., *Met.* III, 10, 999b16.

³² οὐκ ἔσται ἄρα οὐδενὶ τῶν μὴ γένους εἰδῶν ὑπάρχον τὸ τί ἦν εἶναι, ἀλλὰ τούτοις μόνον (.)

is composed of individual things, would be impossible.³³ On the other hand, species (of a genus) would not exist were it not for the individual things they *form*, i.e. provide with a form, so that the form (*eidōs*) is not to be taken in the Platonic sense as existing wholly outside the things.³⁴ For Aristotle, the form (*eidōs*), now taken as species, is that which allows for knowledge of the particular as being that which every particular shares – or does not share – with other particulars, so that we can actually speak of *universality*. The next passage summarizes Aristotle’s identification of essence/substance and form in this – largely epistemic – perspective:

Now since we must know that the fact actually exists, it is surely clear that the question is “why is the matter (*hylē*) so-and-so?” e.g. “why are these materials a house?” Because the essence of house [that which it is to be a house] is present in them. And this matter, or the body containing this particular form, is man. Thus what we are seeking is the cause (i.e. the form [*eidōs*]) in virtue of which the matter is a definite thing; and this is the substance of the thing. (*Met.* VII, 17, 1041b4-9)³⁵

Figure 3 shows this *formative interpretation* of Aristotle’s meaning of form as essence/substance, which is at the root of the *informative interpretation* to be found many centuries later in Latin Scholasticism.

3.2 Thomas Aquinas and the Form: The Informative Interpretation

The interesting fact in this study is that this formative interpretation of Aristotle’s two substances reaches Latin scholasticism (13th-14th century A.D.) as an *informative interpretation*, it being the case that the Latin noun “*informatio*” is indeed to be found in the writings of these philosophers who saw themselves as carrying out the task of synthesizing Aristotle and his Arab commentators, a huge corpus that spanned approximately sixteen centuries and included Plato and the Neoplatonists.³⁶ Among these synthesizers Thomas Aquinas can undoubtedly be elected as one of the

³³In *Met.* VII, 15, 1040a6-7, Aristotle writes: “in cases relating to definition, when we are trying to define any individual, we must not fail to realize that our definition may always be upset; because it is impossible to define these things.” (τῶν πρὸς ὅρον ὅταν τις ὀρίζηται τι τῶν καθ’ ἕκαστον, μὴ ἀγνοεῖν ὅτι αἰεὶ ἀνααιρεῖν ἔστιν: οὐ γὰρ ἐνδέχεται ὀρίσασθαι.)

³⁴*Met.* VII, 16, 1040b26-34: “it is clear that no universal exists in separation apart from its particulars. The exponents of the Forms are partly right in their account when they make the Forms separate; that is, if the Forms are substances, but they are also partly wrong, since by ‘Form’ (*eidōs*) they mean the ‘one-over-many’. The reason for this is that they cannot explain what are the imperishable substances of this kind which exist besides particular sensible substances; so they make them the same in kind as perishable things (for these we know); i.e., they make ‘Ideal Man’ and ‘Ideal Horse’, adding the word ‘Ideal’ (*autó*) to the names of sensible things.” (δῆλον ὅτι οὐδὲν τῶν καθόλου ὑπάρχει παρὰ τὰ καθ’ ἕκαστα χωρὶς. ἀλλ’ οἱ τὰ εἶδη λέγοντες τῇ μὲν ὀρθῶς λέγουσι χωρίζοντες αὐτά, ἔπειρ οὐσία εἰσί, τῇ δ’ οὐκ ὀρθῶς, ὅτι τὸ ἐν ἐπὶ πολλῶν εἶδος λέγουσιν. αἴτιον δ’ ὅτι οὐκ ἔχουσιν ἀποδοῦναι τίνες αἰ τοιαῦται οὐσίαι αἰ ἀφθαρτοὶ παρὰ τὰς καθ’ ἕκαστα καὶ αἰσθητάς: ποιοῦσιν οὖν τὰς αὐτὰς τῷ εἶδει τοῖς φθαρτοῖς (ταύτας γὰρ ἴσμεν), αὐτοάνθρωπον καὶ αὐτόϊππον, προστιθέντες τοῖς αἰσθητοῖς τὸ ῥῆμα τὸ “αὐτό.”)

³⁵ἔπει δὲ δεῖ ἔχειν τε καὶ ὑπάρχειν τὸ εἶναι, δῆλον δὲ ὅτι τὴν ὕλην ζητεῖ διὰ τί τί ἐστίν: οἷον οἰκία τοδὶ διὰ τί; ὅτι ὑπάρχει ὁ ἦν οἰκία εἶναι. καὶ ἄνθρωπος τοδὶ, ἢ τὸ σῶμα τοῦτο τοδὶ ἔχον. ὥστε τὸ αἴτιον ζητεῖται τῆς ὕλης (τοῦτο δ’ ἐστὶ τὸ εἶδος) ᾧ τί ἐστίν: τοῦτο δ’ ἡ οὐσία.

³⁶See Capurro (2019) for details of this transmission, as well as for the concept of information in modernity.

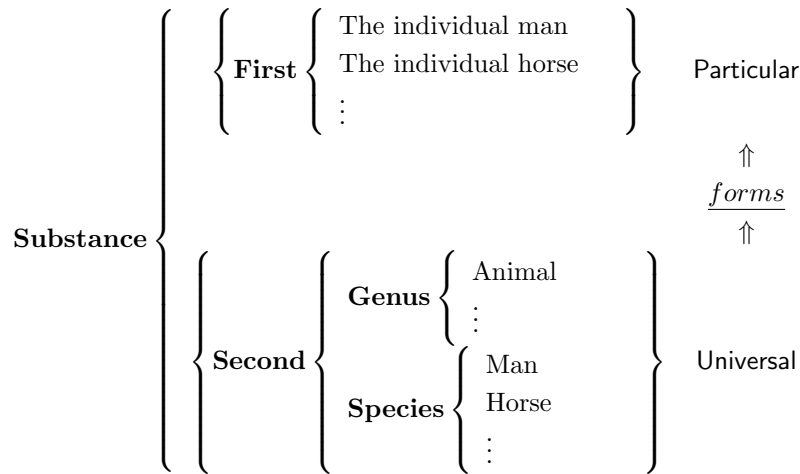


Figure 3: Aristotle’s two substances: The formative interpretation.

most representative and the fact that there is a comprehensive lexicon extracted from his writings available online (*Thomas Lexikon*, [8]) allows for a study of the concept “*forma*” and its derivatives, in particular “*informatio*,” namely as these are found in his *Summa Theologica* (abbreviated *Theol.*).³⁷ To bear in mind is the fact that the Latin “*forma*” translates both Greek terms “*morphê*” and “*eidós*”/“*idéa*,” so that the problem of the “fusion” of these two concepts becomes more acute in Latin scholasticism. The following aspects summarize the results of this analysis:

- True to the Aristotelian doctrine, the *form* is first and foremost synonymous with *essence*, *quiddity*, and *nature*. In this conception, it is considered a principle or cause of being, namely the formal cause. Aquinas writes that “each and every thing is that which it is by its form” (*Theol.* I. q. 5, a. 5 co.).³⁸
- Its relation to the substance is defined as “the whole consistency of things” (*In De caelo* II, l. 20, n. 7).³⁹
- It is related to the *act* in the sense that “by itself the form makes a thing be in act, so that by its essence it be in act; and it does not give being via any medium” (*Theol.* I, q. 76, a. 7 co.).⁴⁰ In effect, “the form, inasmuch as form, is the act” (*Theol.* I, q. 75, a. 5 co.)⁴¹, and its relation to *matter* is settled as “the form is none other than the act of matter” (*Theol.* I, q. 105, a. 1 co.)⁴² and “the unity of a thing composed of matter and form is thanks to the very form, which by itself is united with matter as its act” (*Theol.* I, q. 76, a. 7 co.).⁴³

³⁷I refer the reader to [8] for the texts by Aquinas quoted from in this Section.

³⁸*unumquodque sit id, quod est, per suam formam* (.)

³⁹*[forma] est substantia totius consistentiae rerum.*

⁴⁰*forma autem per seipsam facit rem esse in actu, cum per essentiam suam sit actus; nec dat esse per aliquod medium.*

⁴¹*forma, inquantum forma, est actus* (.)

⁴²*forma nihil aliud est quam actus materiae.*

⁴³*unitas rei compositae ex materia et forma est per ipsam formam, quae secundum seipsam unitur*

- With respect to the universals, the form is indeed associated with the *genus*, but it is with the *species* that this association is emphasized: “Each and everything is constituted in a species by the form” (*Theol.* I, q. 5, a. 5 co).⁴⁴ In fact, Aquinas writes simply “the species or the forms” with respect to the individual forms of the particulars (*Summa contra gentiles* II, c. 75, n. 2).⁴⁵
- Commenting on the distinction between *first* and *second act* according to Aristotle’s *De anima*, Aquinas equates the former with the form and the latter with the operation: “The form is the first act, but the operation is the second act inasmuch as the perfection and the end of the operating. And this is as true in the corporeal things as in the spiritual ones, for example the habit of the soul, and as true in the natural things as in the artificial ones” (*In De Caelo* II, l. 4, n. 5)⁴⁶, even if the forms of the artificial things are accidents (*In Physic.* VII, l. 5, n. 3).⁴⁷

Capturing all the above and retaking the also core ontological concept of subject, already elaborated upon by Aristotle, Thomas Aquinas concludes that “everything that becomes, is and becomes out of a subject and a form” (*In Physic.* I, l. 13, n. 2).⁴⁸ One can thus speak of “formed matter” (*materia formata*) or “formed subject” (*subiectum formatum*) as the matter/subject that has been given a form. This entails for some philosophers that there is an intermediary – a giver – between the subject/matter and the form; in effect, there is for them an entity – one of the intelligences postulated by Avicenna – that gives each thing its own form, reason why it is referred to as the *giver of forms* (*dator formarum*), but Aquinas rejects this on the grounds that it reduces, or even altogether eliminates, the operation of the natural principles – or of the divine principles, according to convenience (cf. *Super Sent.* III, d. 33, q. 1, a. 2 qc., 2 co.; *De Potentia*, q. 5). This Avicennian giver of forms – but also the Platonic *idéa* – contrasts with the perspective according to which there is no intermediary, and this is when we reach the idiosyncratic conception of *information* to be found in Latin scholasticism: The verb “to inform” (*informare*) and the noun “information” (*informatio*) are used in the sense of providing matter and the subject with a form (*formare*) *immediately*: “between the form and matter there is no intermediary whatsoever, because the form by itself informs matter or the subject. But the agent informs the subject not thanks to its substance, but by the form that it causes in matter.” (*Theol.* I-II, q. 110, a. 1, ad. 2).⁴⁹ In a theory of cognition that is more and more anthropocentric, this act of information conflicts with Augustine’s theory of divine illumination, which was also based on the form, albeit Platonically so (cf. *Theol.* I, q. 12). Figure 4 shows this informative interpretation.

materiae ut actus eius.

⁴⁴ *per formam unumquodque in specie constituitur.*

⁴⁵ *species autem aut formae.*

⁴⁶ *forma est actus primus, operatio autem est actus secundus, tamquam perfectio et finis operantis. Et hoc est verum tam in corporalibus, quam in spiritualibus, puta in habitibus animae, et tam in naturalibus, quam in artificialibus.*

⁴⁷ *forma vero dicitur, quae dat esse specificum artificiatio; formae enim artificiatorum sunt accidentia.*

⁴⁸ *omne, quod fit, est et fit ex subiecto et forma.*

⁴⁹ *inter formam autem et materiam non cadit aliquod medium, quia forma per seipsam informat materiam vel subiectum. Sed agens informat subiectum non per suam substantiam, sed per formam quam in materia causat.*

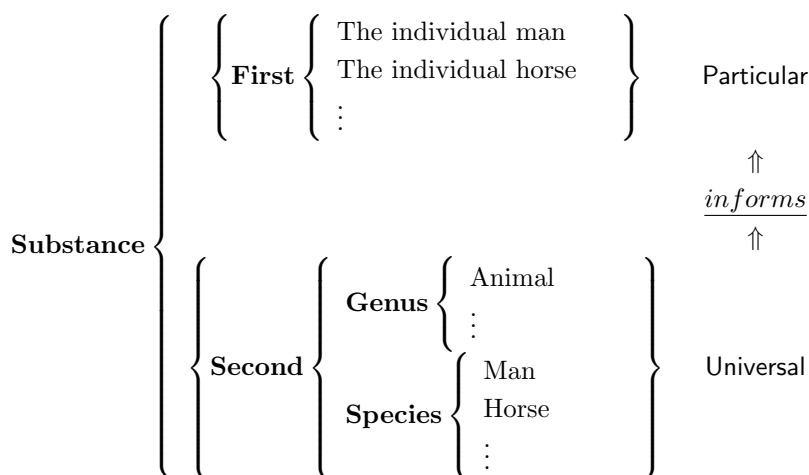


Figure 4: Aristotle's two substances: The informative interpretation.

This informative interpretation is not complete without the addition of a core contribution by the Arab commentators of Aristotle, to wit, the first and second intentions.⁵⁰ Briefly, before this Arab contribution the concept of *intentio* contained already an implicit distinction in Western philosophy, being either the mental act of representation or the representation itself, and in both cases it was associated to the intelligible species. Thomas Aquinas discusses this subject at length in his *De veritate* (q. 10, a.8), but he is not the best source for the issue at hand, even though his views on the topic evolved in important ways (see, e.g., Pini, 2002, Ch. 2). The central aspect to bear in mind is that the theory of the two intentions is a fusion of the concept of intention rooting in Aristotle's *De anima* as developed in Western philosophy by, for instance and authoritatively, Augustine and as elaborated on by the Arab commentators of Aristotle, in particular Averroes. This fusion, fully achieved in the late 13th century, fueled – though it did not initiate – in Western thought what is now called *the intentionality debate*, namely because of its significant impact on the Christian doctrines (e.g., de Rijk, 2005). Considerably abbreviating an elaboration that cannot be carried out here, the two intentions as conceived by the Arab commentators of Aristotle evolved in late medieval philosophy into a distinction between concepts in the mind (the first intentions) and concepts of concepts (the second intentions; the universals), a stance defended by William of Ockham (sd/1980; *Quodlibeta septem* IV, 35) that is tightly connected to his theory of signification:

the first and the second intentions are really distinct, because the first intention is the act of understanding (*actus intelligendi*) signifying the things that are not signs; the second intention is the act [of signifying; *actus significandi*] signifying the first intentions; they are thus indeed distinct.⁵¹

⁵⁰See Gyekye (1971) for the complex transmission of this distinction to Latin scholasticism.

⁵¹*intentio prima et secunda realiter distinguuntur, quia intentio prima est actus intelligendi significans res quae non sunt signa; intentio secunda est actus significans intentiones primas; igitur*

With the due caveats, it might be concluded that in Latin Scholasticism the doctrine of the two intentions has a largely significative interpretation, which can be coupled with the informative interpretation as shown in Figure 5. This informative-significative interpretation, in turn, evolved into an *ontological* distinction between two things, the *real thing*, or the thing of first intention (*res primae intentionis*), and the *thing of reason*, or thing of second intention (*res secundae intentionis*).⁵² For instance, Francis of Marchia wrote in the 1320s in his *Quodlibet* (q. V; Francis of Marchia, sd/1997) that *man* and *animal* were first intentions (or intentions of things that are actually posited) and thus real things, whereas *species* and *genus* are things of second intention and solely things of reason. But a thing of reason was authoritatively conceived as a “diminished thing,” namely because it did not have the perfection of the real thing in itself (e.g., John Duns Scotus, (sd/1967; *Quaestiones quolibetales*, q. I).

4 Towards an Informational Synthesis in Dietrich of Freiberg

4.1 *Treatise on the Origin of the Categories* (Translation of Part IV from the Latin into English)⁵³

In which it is shown in which way a being firstly differs formally from nothingness or non-being, as well as a few things on the unity and order of forms

(1) However, there are those who doubt what was said above, to wit, that a being by virtue of its complete act firstly differs from nothingness or from non-being simpliciter. This does not seem to be true, given that between the being in complete act and nothingness or non-being simpliciter there is the being in potency, which, finding itself in an intermediary state, seems to be closer to non-being simpliciter than to that which is a being in act.⁵⁴

(2) But one must know, according to the Philosopher in Book IX of *Metaphysics*⁵⁵, that a being in potency has neither existence nor definition except in terms of the act to which it is determined. Hence by virtue of the act of which something already participates, and according to its proper notion this being in potency has both the notion of being and that thanks to which it differs from non-being simpliciter; and therefore first and foremost the notion of both being and the difference from nothingness are in the act.

distinguuntur.

⁵²But note that despite the distinction above William of Ockham (*Quodlibeta septem* IV, 35) saw both intentions as real beings.

⁵³The references for explicit/implicit sources are those provided by L. Sturlese in Dietrich von Freiberg (sd/1983). I refer the reader to this text for the complete bibliographical data of these sources.

⁵⁴In my translation of *De origine* I-III (Augusto, 2021b; 2022a-b), I consistently translate “*ens*” as “entity.” Now, the main topic is *to be* (*esse*) and I accordingly translate “*ens*” (the present participle of *esse*) as “being” (the present participle of *to be*); in both cases, Latin and English, the present participle is used as a noun.

⁵⁵Aristotle, *Met.* IX, 8, 1049b10-11.

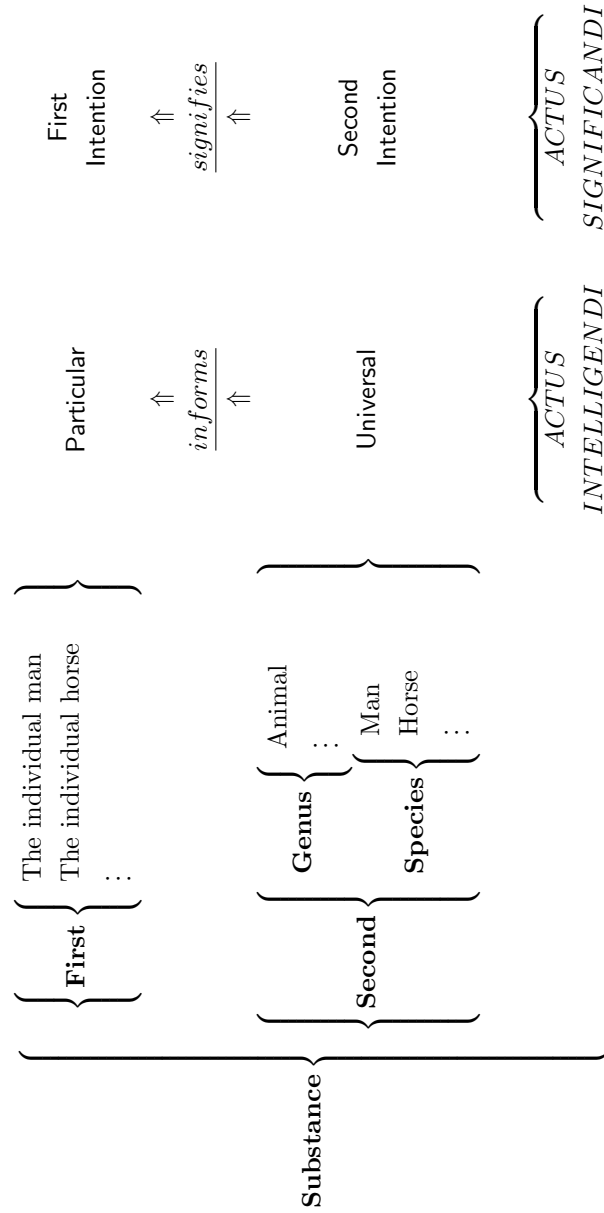


Figure 5: Aristotle's two substances: The informative-significative interpretation in Latin Scholasticism.

(3) That it was objected that a being in potency is closer to non-being, one must say that that is true by virtue of the notion of the privation that a being in potency entails, according or thanks to which it neither has the notion of being nor differs from non-being. Once the privation has been removed from a being in potency, that which is a being in potency and a being in act have a single notion; according to the notion of being neither do they increase in number, given that a being in act is not the result of an addition to a being in potency, nor is there between them any composition, but according to the course of generation the potency becomes act. But I speak of the potency and the act,⁵⁶ since a being in itself is firstly wholly in potency and afterwards in act.

(4) Moreover, the same, the opposite, and the different, all presuppose being; therefore, that which is but a being in potency is neither the same as something else, nor does it differ from anything else but in potency. Therefore, a being does not differ actually from nothingness except thanks to something by virtue of which it is a being in act: Hence the Philosopher says in Book VII of the *Metaphysics*⁵⁷ that solely the act distinguishes.⁵⁸ Hence, just as a thing tends to its complement⁵⁹ according to the notion of being, so does it tend to the notion of differing from nothingness.⁶⁰

(5) In order to make this clear one must consider that it is in a twofold way that a being tends to the complement that befits it according to the act and the form.

(6) In one way in which it is considered in relation to its causes, and this with respect to the first way mentioned in the beginning.⁶¹ In another way in which a thing is considered with respect to the notion of its quiddity and absolute essence, to wit, in that that it is a being, and this with respect to the second aforementioned way.⁶²

(7) In the first of these ways, a thing tends to its complement by way of generation. And then, as the Commentator says in *On Physics I*⁶³, between primary matter and the final form there are some intermediaries that are some sort of composites of matter and form, according to which intermediaries by virtue of an agent primary matter participates more and more of the act of the final form, which is the end of generation.⁶⁴ Which

⁵⁶Less literally: I distinguish between the potency and the act.

⁵⁷Aristotle, *Met.* VII, 13, 1039a7.

⁵⁸I.e. only the act makes it that something can be distinguished, or is different, from nothingness (or something else, too).

⁵⁹That which completes it.

⁶⁰Paraphrasing: The notion of being (*ratio entis*) is that by virtue of which a thing both tends to its actualization and differs from nothingness or non-being.

⁶¹*De or.* I, 2; cf. Augusto (2021b). This is the way in which a being is considered from the viewpoint of its *OUT-causes*, which Dietrich refers to as *causes*. These *extrinsic* causes are by and large the Aristotelian final and efficient causes.

⁶²*De or.* I, 3; Cf. Augusto (2021b). Here the focus falls on the *IN-causes*, or *principles*, as Dietrich calls them. These *intrinsic* causes are by and large the Aristotelian material and formal causes.

⁶³Averroes, *In Aristotelis Phys. I*, comm. 1; Venetiis, 1562, 6rE.

⁶⁴Consider, say, a horse; between unformed primary matter and the horse there is an intermediary being, an embryo, which somehow already participates of the horse's final form. The end of generation

participation of the act, whether it is called determination⁶⁵ of matter or the incomplete essence of the form existing in potency in matter, at present does not interest me at all: In the meanwhile, one thing is certain, that primary matter attains the final act by going through different degrees. And these degrees are in themselves and proper according to the proper and determinate manner of generation of each and every thing; otherwise those intermediaries that are created by nature in the course of generation from the first origin of a thing existing in potency right up to the final act at which generation ends would be in vain or by chance. Therefore, because according to each and every one of the intermediaries that precede the final act a thing is a being in potency, hence it is that according to none of them is it a being simpliciter, and consequently such a thing is not determined to any genus of being so that it would be in a genus simpliciter and in act, but only according to the final act of the form by means of which a thing has its specific and complete being, because according to this alone is a thing a being in act.

(8) It is not correct what some⁶⁶ claim, to wit, that according to the course of generation and nature some forms precede the final form remaining simultaneously with it in the generated thing in such a way that according to the first of them a thing is firstly in some act while nonetheless existing in potency to a posterior act, and so on right up to the final form, and that according to these forms a thing is classified in different genera subordinate with respect to the most general one.

(9) This, I say, cannot stand, given that the potency and the act are two extremes and are like simple ends of the whole nature or essence that proceeds from the potency to the act in such a way that just as below the being in potency there is nothing by means of which a thing would remain in a genus and nature of being, therefore there remaining a pure nothingness, so above being in act there is nothing by means of which a thing standing under that same act could become formally under a posterior act.⁶⁷ I speak here of the potency that has nothing of the act mixed to it; I mean here the act according to which it befits a thing to be, the final act of a being in that it is a being. Thus, just as the act of the race does not suppose yet another act of racing above itself, so that the former might become in a posterior act of racing, since it is the final of this genus, so neither does the act of being that either is the same as the form of a thing or befits a thing in terms of the form suppose another act by means of which a thing remaining in act the same as before might be created under a posterior act of being. Such an order and coexistence of forms should not be postulated, contrarily to what some say.

(*finis generationis*) can be taken here in two senses, to wit, the termination of the generation process and the (Aristotelian) final cause. The agent is here the (Aristotelian) efficient cause. See Augusto (2022b) for the complex trio matter-form-agent in Dietrich's ontology.

⁶⁵Translating "*dispositio*."

⁶⁶E.g.: Guillelmus de Falegar, *De gradibus form.*; ed. Glorieux, 297-317; Mathew of Aquasparta, *Quaest. disp. de fide* VI ad 10; ed. Quaracchi 1957, 159-60.

⁶⁷Note the hierarchical structure with the being in potency at the bottom and the being in act at the top.

(10) We see moreover in all genera that the nature of the most general befits a thing according to the final form, by virtue of which it has a specific being⁶⁸, rather than according to some other of those forms that are supposed to precede and co-exist simultaneously in one and the same generated thing. Indeed, a man, as well as a horse, subsists rather by virtue of the soul, by means of which he or it has a specific being, than by some other form that might be in him or in it; therefore, thanks to it, rather than to some of the other forms, is he or it a substance.⁶⁹ It is evident that by virtue of that same final form a man is a man, and a horse is a horse; thus, thanks to the same specific final form a man is a man and a substance, and a horse is a horse and a substance, and similarly in all the genera other than the substance. But the intermediate genera according to this notion do not fall outside the order of these extremes, namely of the most general and of the most special, for the fact that the nature of the most general does not go down to the most special one except through subordinate intermediate natures; therefore, by virtue of the same form thanks to which it has a specific being a thing is included in a most special species, as well in a most general genus and in all the subordinate genera.

(11) But what some argue about the flesh that remains from the animal after the separation or the corruption of the soul, to wit, that it would be necessary by means of this form of the flesh that the body be the subject of the soul, is not valid.

(12) Firstly, indeed, because if the flesh is flesh in the living animal by virtue of the same substantial form thanks to which it is flesh after the death of the animal it follows that the flesh of the living and of the dead animal is not flesh in an equivocal sense; which goes against the Philosopher in, and the Commentator on, Book VII of the *Metaphysics*⁷⁰.

(13) It is equally evident that the matter and the form in a being in itself, which is a substance, are united to each other not by means of some accidental determination that would be formally a means of unity. If thus, thanks to the same substantial form of the flesh by virtue of which flesh is flesh after death, in the generation of the animal the body were in an essential potency not by means of an accidental determination that would be formally intermediary between the body and the soul, but thanks to its essence in that relation to the form of the soul to be induced by an agent, given that the same form would remain that which it was before it follows that the body would stand in the same relation to the form in which it stood before; and thus by means of an approximating agent⁷¹ it would be possible for dead animals to resuscitate, or still better, it is actually necessary according to that that they should resuscitate at some

⁶⁸Or existence, i.e. is/exists as a member of a given species.

⁶⁹The soul (*anima*, in Latin) is that which distinguishes the animated – hence the noun “*animal*” – and the inanimate substances.

⁷⁰Aristotle, *Met.* VII, 10, 1035b24-5; Averroes, *In Aristotelis Met. VII*, comm. 35, Venetiis, 1562, 187rD-F.

⁷¹*Appropinquans agens*, in the original, in the sense of an agent that establishes a *propinquititas*, i.e. an affinity, a kinship, or a belonging to the same genus.

time; otherwise, the potency that in some way befits a thing according to its species would be wholly superfluous; but nature does not allow this.

(14) Nor is the argument valid that although the substantial form might remain in the flesh after death the same that it was in the living flesh there remains not the same temperament and harmony of the flesh according to which it was possible or, still better, necessary for the soul to be in the body when in generation.

(15) That, I say, does not solve the argument. In fact, this harmony by virtue of which a thing either has being or loses substantial being neither is some accident, nor is it formally as an accident in it, but is a certain balance⁷² of a thing that is considered among the essential aspects⁷³: Otherwise, an accident would be an intrinsic principle of a substance and it would be within its essence, which is absurd. Thus, once the harmony of a thing is changed, according to which harmony it is considered to be or not to be as a substance, it is necessary that that thing be changed in its essential aspects; the change of the essential aspects of a thing entails the change of the essence; but given that the essence does not remain the same that it was before, it is impossible that a thing be under the act of the same substantial form. Therefore, once the harmony of the flesh has been changed by death, it is necessary that the same substantial form of the flesh not remain after death.⁷⁴

(16) Moreover, it is evident that the harmony they refer to is not considered in the substantial form of the flesh, which is simple. Harmony seems to be a proportion reserved to a reciprocal relation of multiple aspects. According to them, this harmony that exists between the form of the flesh and its proper matter is not changed after death: There is indeed no longer the same form of flesh in matter that there was before, once the same proportion between the form and the matter that there was before no longer exists; thus it is necessary, according to them, that this change of the harmony occur in some things that are forms of flesh in the subject. Whether they thus want that this harmony be considered in these things among the accidental or the substantial aspects, as long as the change is not such that these things would still keep that proportion by virtue of which they can be the subject of a form of flesh, in such a way that the flesh in terms of its substantial form be in itself in potency and in relation to the form of the soul, it follows up to now that, the same form remaining, the flesh is in the same relation to the form of the soul, just as because that which befits a thing in itself in terms of its quiddity cannot, the thing remaining the same, not be in it, so because in every essential relation of the causes the second is not found without the first, as it is obvious when one talks about the individual things: In the genus of the material things the element is not found without the primary matter, in the efficient the seed does not move without a celestial faculty, in the

⁷²Translating “*moderatio*.”

⁷³“Essential aspects” translates here “*essentialia*.”

⁷⁴In this paragraph “(to) change” translates the forms of the verb “*transmutare*.”

forms the living is not found without the being, and so forth. Hence, in the question at issue, the form of the flesh, by virtue of which the flesh is in itself in relation to the form of the soul, is not found without the soul or without a relation to it, given that the soul, though it be the final form in the course of generation, is nevertheless the first by nature and by the definition. Therefore, the change of the harmony in the said way does not at all change the relation of the form of the flesh to that same soul, as long as it remains the same form of flesh as it was before; and thus it is possible for dead animals to resuscitate, as was concluded above.

(17) Moreover, that the form of the flesh in the dead animal is not the same that it was before in the living animal the Philosopher clearly shows in Book VIII of the *Metaphysics*⁷⁵, and the Commentator in the same place⁷⁶, where he says that when receiving different forms matter behaves in two ways in relation to them. In one way, it behaves in relation to different forms “in terms of privation”; which indeed occurs when matter is in the same relation to both forms and these can succeed each other in the same matter, as when from air fire is generated and vice-versa.⁷⁷ This way of the reception and of the habit of matter with respect to these forms is said to be in terms of privation, because in matter nothing else is required besides the privation of the form to be received, and not that one of them be in it necessarily before so that the other may be received. In another way, matter is in a relation to the different forms in receiving them “in terms of the habit”; which indeed happens when matter receives the forms according to a certain order that is considered in itself between the forms, so that it does not accept one of them unless the other be found in matter before according to the course and order of generation or corruption; it is thus evident that matter does not receive the form of flesh, unless the form of blood precede in matter, and similarly for the like.

(18) And according to this, with respect to this second way in the course of corruption matter does not receive the substantial form under which the deprived being is, unless in matter precede the habit or the form whose privation remains by means of some substantial form in matter after the corruption of the being, just as the form of the dead animal and the form of vinegar, which are deprived beings in a non-regressive order, are not in matter unless the form of the animal and the form of the wine precede in matter. The cause of this is, in terms of subject, in fact the nature of the very being, which thus has to be determined in an essential order that is in itself. I speak of essential order with respect to the form and its opposite privation inasmuch as this privation is the end of the corruption of the form and includes that corruption in its notion, and not with respect to the substantial form of the dead animal that is found in

⁷⁵Aristotle, *Met.* VIII, 5, 1044b29-34.

⁷⁶Averroes, *In Aristotelis Met. VIII*, comm. 14, Venetiis, 1562, 222rD-vH.

⁷⁷I translate “*diversae formae*” as “different forms” when two forms are meant or compared, but the adjective “*diversus*” may convey here (also) the idea of “opposite” (see next paragraph). When more than two forms are meant, “diverse forms” is perhaps the most correct translation.

nature by accident, as was said above. Whence the Philosopher says in Book VIII of the *Metaphysics*⁷⁸ that from the living the dead originates not as from matter, but as the night originates from the day, indicating by this the accidental character of this order. Prior to and effective cause of this essential order is the determined, proper, and natural duration of a thing, which according to its natural succession causes this succession in a non-regressive order; and on account of this, as the Philosopher says in the same place⁷⁹, a regress from the dead into the living or from vinegar into wine does not take place, unless the primary matter of each of them is recovered. It is thus evident according to this that the form of the flesh of the dead animal was never in matter before the corruption of the animal.

(19) From what was said it follows that if thanks to some supernatural faculty it were the case that in a corrupted animal the form of the body or of the flesh remained the same that they say was in it before, that animal would not be really dead, but would be said dead equivocally: It would not be a deprived being according to what was said. Therefore, it would not be a dead being, given that a deprived being is superior to a dead being.⁸⁰ It does not suffice to the notion of the dead that it has no life in any way, unless it be deprived of life in a non-regressive order. In which way a deprived being belongs to the same class of genus or species together with the being whose privation it entails, that was discussed above in the previous chapter.⁸¹

(20) Thus the way in which a thing considered in relation to its causes in the course of generation tends to its complete act, by virtue of which it formally differs from nothingness, and the falsity of the opinion on this concerning the order and coexistence of forms are evident.

(21) If, however, a thing is considered in terms of its quiddity and absolute essence, to wit, in that that it is a being, according to this the order and the progress towards the completion according to the course of generation and of the eduction from the potency to the act by a natural agent is not considered, but only in terms of the final form, according to which it has the complete act in a specific existence, namely inasmuch as in that very and same form the order is found of the different degrees of perfection and actuality that befit the form according to the different so to say formal intentions found in the form.

(22) The notion of which intentions may be taken as follows: As it was said above, in every genus that truly and properly – and not only in a logical perspective – is a genus, it is necessary to find something having the notion of matter that might be the fundamental principle of the whole genus, which according to the different existence might be distinguished in the different beings that belong to the same class according to that genus.

(23) As this distinction is made according to different forms in act, while

⁷⁸Aristotle, *Met.* VIII, 5, 1045a2-3.

⁷⁹Aristotle, *Met.* VIII, 5, 1045a3-6.

⁸⁰Note the *modus tollens*: $A \rightarrow B, \neg B/\neg A$.

⁸¹*De origine* III. Cf. Augusto (2022b).

that very material principle in itself and in its proper nature has a single notion, it is necessary to find in all forms that distinguish it a formally real intention that might have a single notion corresponding to the unity of that material principle; otherwise, the proportion between matter and form in terms of the potency and of the act that is considered in them according to their own natures and according to which they belong to a single class according to nature would not be found in them. And the notion of the first and supreme genus of these beings originates from this.

(24) Then, because the one and the same is in reality and by reason in nothing essentially distinguished and separated in different beings, unless first its nature falls in that division that is considered according to the primary opposition by virtue of which beings are firstly distinguished from each other – this is affirmation and negation in a subject, which is none other than the form and the privation, which is the primary opposition in any genus, as the Philosopher says⁸² –, and because this opposition is founded essentially in beings it belongs to its⁸³ notion to have only two extremes of which each is of a single notion, hence it is that in the beings that are classed under one or the other of these extremes it is necessary similarly to find a formal intention according to which they may be of a single notion, some according to one of the extremes, some according to the other. Thanks to which it happens that they belong to a single class in terms of a subordinate genus; and one goes on like this, in order⁸⁴, until the final perfection of the specific act by means of which the notion of the most special species is considered.

(25) According to this, the intentions of all the superior genera and of the most special species are rooted in one and the same act or specific form in the aforementioned way. These genera and species are indeed not really different forms, nor are they really attained by different forms, but successively⁸⁵ from that same form according to the different intentions of the same form and the order they are in according to the different degrees of perfection and actuality. Not in such a way that a thing might be in itself in some act of being according to any of these degrees up to the final one without that which is the last degree of that order: It would then be possible to find something existing in nature according to the form of a genus and not having a specific act, which is impossible. These degrees of different perfections are considered according to the progress towards the final complement of the specific act by means of which the specific difference and consequently the notion of the most special species is attained; that is why the acts and the perfections that the superior genera designate are but some sorts of participation of the final perfection and of the complete actuality of a specific form. Hence it is that, because a thing does not have an act of being except according to that which by essence is its last, nothing is found in any genus that is not in some most

⁸²Aristotle, *Met.* X, 4, 1055a33.

⁸³Of the opposition.

⁸⁴*Consequenter.*

⁸⁵*Consequenter.*

special species of its.

(26) What was said, to wit, that these genera thus hierarchically⁸⁶ coordinated neither are actually different forms nor are they set up by actually different forms, is, besides what was said above, similarly evident from what will be said next.

(27) It is indeed evident that these forms – which some say because they are simple – are completely different and each one of them is completely outside any of them; therefore from them a single being is not formed except by means of addition⁸⁷. It follows that a species or a thing having a specific act of being would not be a single being except by addition and that the definition, which unites these forms in itself, would not be one except by addition; which goes against the Philosopher⁸⁸ and the Commentator of Book VII of the *Metaphysics*⁸⁹, where it is shown that if a genus were divided among some beings outside the nature of the genus the definition would not be one, just as that which is a white surface is not in itself one by that unity that is the unity of the definition, as is the rational animal. Indeed, the white is outside the nature and the quiddity of the surface, while the rational is not outside the nature of the animal; hence the Philosopher says in Book VII of the *Metaphysics*⁹⁰: “The essence of the surface is not the essence of the whiteness”; the Commentator says in the same place⁹¹: “When we say ‘a white surface,’ the whiteness is not the quiddity of the surface in the same way that the rationality is the quiddity of the animal when we say ‘a rational animal.’”

(28) Nor is it appropriate what some answer to these considerations, to wit, that those beings that are different simpliciter, of which each is a being according to the complete act, do not make a single being except by addition, but that these forms of genera are not like this, having a relation to each other in terms of the potency and of the act, from which a being in itself is formed.

(29) This, I say, is not a valid argumentation. Indeed, firstly because this opinion goes against their own stance. In fact, they say that before not only in nature, but also in time according to the process of generation a thing firstly stands under a more general form, thereafter it stands under another less general form remaining simultaneously with the first one, and so on up to the last one, which is the specific form; and thus those more general forms do not have the notion of potency, being rather a certain act.

(30) Concerning which absurdities follow. Given that each of them⁹² gives the act of being, which in the essences is simply the last act in nature, each

⁸⁶More literally: in a subalternating way.

⁸⁷*Aggregatio*.

⁸⁸Aristotle, *Met.* VII, 4, 1029b13-22.

⁸⁹Averroes, *In Aristotelis Met. VII*, comm. 11, Venetiis 1562, 161vI-162rA.

⁹⁰Aristotle, *Met.* VII, 4, 1029b17-18.

⁹¹Averroes, *In Aristotelis Met. VII*, comm. 11, Venetiis 1562, 161vI-K.

⁹²The intermediary forms.

one of them will be the last act in nature simpliciter and thus the complete act, not having therefore a relation in terms of the potency to a posterior act. Therefore it follows that either there will be many acts of being in the same thing, and thus that same thing will be multiple in number, given that things are enumerable according to the act of being, or from all the acts a single act will be produced, and thus from multiple beings in act there will be a single one besides that which would be some formal principle containing them all, which is impossible, as the Philosopher shows at the end of Book VII of the *Metaphysics*⁹³, given that each one of them is the last and the most formal in nature, to which an addition cannot be formally made; or all the preceding acts except the last one will be destroyed, and then the forms, according to which these acts have to be proper, will similarly be destroyed – and then we have the statement at hand, to wit, that there is but one and final form in a generated thing –, or if forms remain without these acts of being, it follows that something will remain without that which is in it essentially: Which is impossible, as if there could be a quaternary without parity⁹⁴ and a senary without perfection.⁹⁵

(31) Moreover, to say that these forms have that reciprocal relation they say they have does not get around Aristotle's stance. In whatever manner they may be related to each other, any of them is nevertheless outside the nature of any of them; which the nature and the unity of the definition do not allow, as was said. And it is evident from this that the unity of the definition according to the Philosopher is not considered in the unity of the relation that is that of the potency and of the act, which is considered between the matter and the form or between no matter what things that have a mutual composition; rather, the unity of the definition roots in the unity of the form or of the specific act. Which is thus evident. In fact, according to the Philosopher in Book IV of the *Metaphysics*⁹⁶ the notion that the noun signifies is the definition. The name of the species is given by virtue of the specific form; therefore, the parts of the form that are explained in the definition are but parts of a single specific form. As these parts are but forms and natures of the superior genera and of the differences, it is evident that all these are actually but a single specific form. And this is what the Philosopher says,⁹⁷ that the whole notion of the unity of the definition comes from the unity of the final difference: Indeed, all forms of the superior genera and of the differences are but a certain shared formality of the final difference from which the whole entity and unity of a species as such comes, just as from the substantial form the whole entity and unity of a being comes according to nature.

(32) It is thus evident that the forms of the genera hierarchically⁹⁸ posited

⁹³Aristotle, *Met.* VII, 17, 1041b11-33.

⁹⁴Boethius, *Inst. arithm.* I, 9; ed. Friedlein, 17-18.

⁹⁵*Ibid.*, 19; ed. Friedlein, 41.

⁹⁶Aristotle, *Met.* IV, 7, 1012a23-24.

⁹⁷Aristotle, *Met.* VII, 12, 1038a19-20.

⁹⁸*Subalternatim.*

are not actually different forms nor are they set up by actually different forms, but, as was said, by the same form according to the diverse intentions of the same form; which, however, are not in a reciprocal relation with respect to that which they are, so that one would be outside the nature of the other, and that in this way out of them a unity would be made by addition, as was said concerning the forms. Thus neither would the unity of a thing according to nature be safe-guarded if that unity that is according to the form were missing, nor indeed would be one the definition, in which it is necessary that all be one by the unity of the last formal, which is the final difference.

(33) Therefore, these formal intentions are not related to each other according to the relation of the potency and of the act, unless we speak of the potency and of the act less properly and in a broad sense. In this way, that is, according to the relation of the potency and of the act, there are with respect to the substantial aspects of a thing different degrees of the same essence according to the progress towards the complete act in the course of generation. Each of those intentions entails the act of a thing; hence, the forms of the genera, of the differences, and of the species, which in the previous way originate from these intentions, are predicated of a thing existing in act: In fact, often are the said intentions not found in a thing except at the end of generation, which ends in the specific act of a thing in nature. Hence, they are like certain formal principles of a single complete form each of which entails the whole act of the form, though in different ways, so that some of them in a less determinate way, while some others in a more determinate way, just as it is to be seen in the class of the genera that were originally obtained from these, of which each entails the whole specific act, though less determinately, and in this same act a difference is found among the genera. Alone the species thus determinately entails the specific act, so that the posterior is not determinable by something formal, as the being simpliciter⁹⁹. Therefore, these intentions are related to each other according to the order of the indeterminate or less determinate toward the determinate or more determinate in one single and same form. More precisely, concerning that which they are, they are none other than one same form, different only by reason, by reason, I say, not in the way of that which is a thing of second intention, but just as in nature the reason is taken to be the intention of a thing.¹⁰⁰

(34) Therefore, according to what was said, that which with respect to the manner of becoming¹⁰¹ is considered in a thing as regards the course of generation is in a certain way similar regarding the manner of being in the question at hand. Just as in a thing progressing towards the complete act

⁹⁹Or the simple being, or essence

¹⁰⁰The Latin word “*ratio*” can be translated both as *human reason* and *the reason of a thing* (or its *notion*), whence also the *understanding of what a thing is*. See Augusto (2022b) for a discussion of this subject, to wit, Dietrich’s postulation that the universals are not things of second intention, or mere things of reason.

¹⁰¹Or of being made; *modus fiendi*, in Latin.

in generation its matter participates by degrees¹⁰² more and more of the perfection of the final and complete act, as was said above, though in such a way that from the act and from the potency a composition is not made, but that the act becomes from the potency, so, I say, proportionally it happens in a thing according to the final act of being, namely that in a same thing, according to the final form, diverse degrees of perfection and of actuality are found according to which diverse genera are attained one at a time hierarchically coordinated, but in a way that neither from these degrees of distinct perfections among themselves, nor similarly in such a way that from the same genera among themselves a real composition be made, but rather a being becomes another, namely out of the indeterminate becomes the determinate, and out of the less determinate the more determinate, according to the progress towards the final and complete perfection of the specific act.

(35) But the question is posed: If indeed in these beings that were discussed it so happens that, to wit, according to the way of generation a being becomes from another, or a being becomes another, not, however, in a way such that there would be a change in the essence, nor an addition to the essence, as the Philosopher says in Book VIII¹⁰³, but in such a way that the same essence is of that which is a being in potency and of that which is a being in act, though according to different degrees, namely of potency and act; given that thus different beings in act, like the flesh of the horse and the flesh of the ox, may become from a single and same thing that is in potency any of them, as for example from bread, one of the three situations follows, firstly, to wit, if the potency from which these several beings are produced is one and the same, then they will not be different, because two things that are the same in relation to one and the same thing are the same between themselves.¹⁰⁴ But each one of these beings is essentially the same in potency according to what was said: Thus they will be the same among themselves. Or else another situation follows, namely that in one and the same thing, for example in the bread, these are different potencies. But this goes against the Philosopher in Book VII of the *Metaphysics*¹⁰⁵, where he says that only the act separates.¹⁰⁶

(36) Moreover, it does not seem possible to conceive how it is that different beings formally distinct can exist in one and the same being according to the same being and, yet, without there being a mixture: Such a potency will thus not be distinct and different in itself. But if these situations are absurdities, a third situation follows, to wit, that the essence of the existent in potency and of the existent in act that is brought out from the potency is not the same, which is contrary to what was said.

(37) It may likewise be objected concerning the genus and the species

¹⁰²More literally: according to the different degrees.

¹⁰³Aristotle, *Met.* VIII, 6, 1045a23-33.

¹⁰⁴Cf. Euclides, *Elem.* I, comm. a. conc. 1; ed. Heiberg-Stamatis, 5.

¹⁰⁵Aristotle, *Met.* VII, 13, 1039a7.

¹⁰⁶Translating directly the Greek “ἡ γὰρ ἐντελέχεια χωρίζει” instead of the Latin “*distare facit*” for syntactic reasons.

placed under it.

(38) But one must realize that those beings that belong to a being according to the notion of being are made proportionate to that being and follow its manner according to the notion of existing or of not-existing. Similarly with respect to the notion of the potency and of the act: Indeed, those beings that befit a being according to its own notion cannot exist or be in act if that very being does not exist, or if it is only in potency. Therefore, in these beings, though they might be simpliciter or that according to them some comparison of beings to each other might be considered, that same being is presupposed. As the same and the different belong to the genus of those beings that belong to a being as a being, some beings are wrongly compared to each other as being the same or different simpliciter, unless these beings be beings simpliciter, which is the existence in act. Hence, where there has been such a comparison, such expressions must be replaced by others of absolute terms.

(39) Therefore, when someone asks if a being in potency and a being in act are the same in these beings that proceed from the potency to the act, in this question the being is not presupposed, nor is a comparison made of a being simpliciter with a being simpliciter, but a comparison is made between the essence so to say of the same being with itself according to its different degrees in terms of the potency and of the act, whence it must be explained. It is the same as if someone asked if from a being in potency a being in act would become in such a way that from them some composition would be made, or in such a way that the potency becomes the act. The Philosopher postulates each of these ways in Book IX of the *Metaphysics*¹⁰⁷, where he says that the potency and the act are related to each other in a twofold way. In one way, as in this¹⁰⁸, to wit, so that form be in matter, and this with respect to the first manner; in another way, as to this¹⁰⁹, as motion is to the potency and the form in act is to the form in potency, and this with respect to the second manner. According to which manner it was said that it would not be a composition of matter and form; and according to this manner it must be said that the same essence is of the being in potency and of the being in act, either according to the transition of a thing from the potency to the act in generation, or according to a class of genera hierarchically placed in relation to each other. And this potency taken in itself and absolutely is one on account of the privation or absence of distinct acts, as Averroes says about the unity of primary matter,¹¹⁰ as the previous reasonings concluded, but it nonetheless captures the notion of diversity in relation to the diverse acts. And then the absurdity that was inferred from this principle – whichever is to one and the same alike etc.¹¹¹ – does not follow. Indeed, the potency

¹⁰⁷Aristotle, *Met.* IX, 6, 1048b6-9.

¹⁰⁸*In hoc.* Cf. Greek ἐν τῷδε.

¹⁰⁹*Ad hoc.* Cf. Greek πρὸς τὸδε.

¹¹⁰Averroes, *In Aristotelis Met. XII*, comm. 11; Venetiis, 1562, 297rD-E; *In Aristotelis Phys. I*, comm. 63; Venetiis 1562, 38rB-D.

¹¹¹Euclides, *Elem.* I, comm. a. conc. 1; ed. Heiberg-Stamatis, 5.

in relation to different acts is no longer one and the same, as was said.

(40) Moreover, this proposition is self-evident, and is proper in these cases in which in all three terms among which the comparison is made there is a being simpliciter and a being of a single notion; which is not in the question at issue, as is evident if we consider this – carefully.

(41) Thus two ways are shown in which beings are found to tend to their complement that befits them, according to which they have existence in terms of the specific act, and consequently that which was the principal question at issue is evident, to wit, that a being in itself simpliciter and firstly differs from nothingness for the reason that it has a complete act.

4.2 Some Remarks on the *De origine* IV

The reader might have noticed that in the above translation of the *De origine* IV the word “information” does not occur, nor does any other word of this family occur in it. As a matter of fact, the occurrences of words of this family in the whole text of the *De origine* are limited to seven:

- In *De origine* II, 9 (see Augusto, 2022a), Dietrich writes that “an entity cannot by virtue of its essence be in an absolute way to itself the cause of some positive information.”
- Speaking in the same locus, now paragraph (14), of the (quasi-)properties, Dietrich writes: “one ought to accept their principle and cause in the intellect as effective, in the substance or the essence of a thing as subjective, and in the notion of a thing as originating and informative.”
- In *De origine* V, 14 (two occurrences), Dietrich distinguishes three ways of the formal cause, to wit, as (a) the intrinsic information of a thing, (b) an exemplar formal cause, and (c) what Dietrich calls an extrinsic principle and I call an OUT-IN cause (Augusto, 2021b). Dietrich then uses (c) to specify the distinction between the formal cause and the efficient and final causes: “all the causes, efficient as well as final, having been removed from a being, if it is considered only according to the notion of being, one still finds a certain formal dependence of the one on the other, not indeed in the way of the efficient, nor through intention or by supposition, which is proper of the end, but by means of information.”
- In the paragraph immediately following this one (15), Dietrich establishes an analogy between the material and the efficient causes: “just as matter in terms of subject stands essentially under a relation to the form, so does the form in terms of information stand essentially under a relation to the efficient.”
- In *De origine* V, 44, Dietrich again mentions the way of the formal cause mentioned above as (a).
- The last occurrence is to be found in paragraph (58), where Dietrich distinguishes the intellect and imagination with respect to what he calls “the informative act that is the apprehension of simple intentions, i.e. of non-composite beings.”

In all these occurrences of “information” and other members of this word family, Dietrich consistently associates *information* and *form*, namely in the sense that the latter provides a thing with formal existence, being thus both an intrinsic cause of a being and that which allows for its cognition, or intellectual apprehension by a human cognitive agent. We can say that *being* just is thus an abbreviation for *informed being*, as the absence of form equates with non-being. This salience of the form taken as the source of both being and its cognition justifies a comprehensive exposition on the form, and that is precisely what Dietrich had in mind when writing the fourth part of the *De origine*. In effect, Dietrich announces that in this fourth part “it is shown in which way a being firstly differs formally from nothingness or non-being,” with the unity and order of forms being also important topics to be discussed.

Dietrich begins (*De or.* IV, 1-2) by eliminating any intermediary between *being* and *non-being*, namely by dismissing the opinion that between these there is the being in potency; for him, and supporting his view on the authority of Aristotle, a being in potency can only be said to have existence or definition with respect to the act to which it is determined. But one cannot speak of act without speaking of privation, too, as every being that is in potency is in privation with respect to its act – what I call privation₁ in Augusto (2022b) –, so that there must be something that persists despite this privation; in paragraph (3), Dietrich tells us that this is the *notion* (*ratio*, or more completely, *ratio entis*), and this is none the other than Aristotle’s *lógos* or *horismós* (see above). Paragraph (4) wraps up all these aspects by invoking the authority of the Philosopher.

So far, no mention of form, but because this is tightly related to the notion or definition we know it is not far from Dietrich’s mind, and in fact in paragraph (5) he introduces it by putting it in relation with the act and the complement of a being, i.e. that which completes it, or takes it to its act. Dietrich proposes to discuss this subject from two perspectives, to wit, by considering a thing (i) from the natural process of generation and (ii) in terms of its quiddity and absolute essence.

If one considers generation, then there appears to be certain intermediary compositions of matter and form between unformed primary matter and the being in act, and these intermediaries are not to be dismissed unless one is willing to accept that nature operates in vain or by chance; but these intermediaries are but beings in potency, neither classable in a proper genus nor in act: Only the final act of the form gives a being its specific and complete being (cf. *De or.* IV, 7). Dietrich rejects that these intermediary compositions might be granted intermediary acts (*ibid.*, 8) by seeing potency and the complete act as clearly opposite poles of a being in its natural duration bounded both below and above by nothingness or non-being (*ibid.*, 9; see Fig. 6). In other words, a being is uniquely determined to a single complete act by its final form, according to which it is a substance classable in a most special species (e.g., horse) and in a most general genus (e.g., and respectively, animal) (*ibid.*, 10).

This elaboration focuses on privation₁, but the same reasoning applies when we consider privation₂: In the dead horse, the relation between matter (the flesh) and the form ceases to be a substantial one, i.e. one can no longer speak of *substantial form*, or the form that determines a substance as such in the natural state of harmony (cf. *De or.* IV, 11-16). To be sure, one can speak of the (substantial) form of the flesh of the dead animal if this is taken as a substance, but this is not the substantial form that corresponds to the flesh of the living animal, being rather its non-regressive

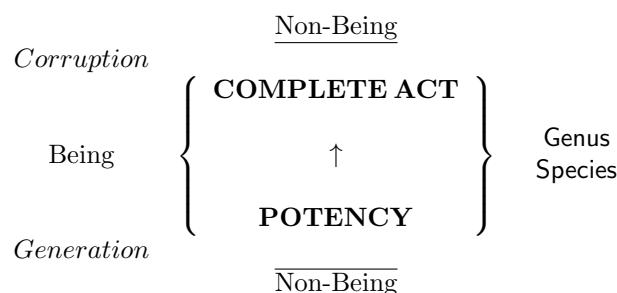


Figure 6: Being and non-being from a natural perspective.

corruption; indeed, neither can the dead horse resuscitate, nor can vinegar turn back into wine (*ibid.*, 17-19).

In sum, when considering the form from the viewpoint of the natural duration of a being Dietrich argues for a notion of form that is *final* already in its firstly being combined with a chunk of matter that is but in potency to some complete act (in privation₁) and is but a privation (privation₂) when the natural duration of a thing ceases; intermediary forms of intermediary acts between this substantial form of the complete act, as in the case of an embryo, which is, say, a horse in potency while at the same time an embryo in act, and forms and acts that emerge when the complete act ceases, like the form of the dead animal, are but accidental forms, by means of which it is only equivocally that we speak of a species and a genus. Figure 7 shows this order and coexistence of the forms that is seen as causing what I in Augusto (2022b) called the *informational problem*.

<u>ACT</u>	<u>BEING</u>	<u>FORM</u>	<u>INFORMATION</u>
Privation ₂	: CARCASS	: Accidental Form	No longer a horse?
	↑		
Specific Act	: HORSE	: Final Form	A horse
	↑		
Privation ₁	: EMBRYO	: Accidental Form	Not yet a horse?

Figure 7: The order and coexistence of forms in the natural duration of a being according to Dietrich of Freiberg in *De origine* IV: The informational problem.

Let us consider now a thing in terms of its quiddity and absolute essence, an elaboration that Dietrich starts in paragraph (21) of the *De origine* IV. From this viewpoint, a being is considered only in terms of its final form, it being the different intentions in this form – the *formal intentions* – that are to account for the different degrees of perfection and of actuality that can be found in a single being. Dietrich thus manages to keep the unicity of the final form, according to which a thing is assigned to a genus and a species, in the face of change: It is not the form that changes, nor is there thus more than one form in the entire duration of a thing; there are not multiple forms successively following each other in the process of attainment of the complete

act of a thing, but it is the intentions of the single final form that change according to different existential degrees of a single thing (*De or.* IV, 21-6). If someone invokes the relation between the potency and the act to account for the different forms that (appear to) succeed each other in the natural duration of a thing, then they contradict themselves, because each one of these intermediary forms would not have the notion of potency, being rather a certain act; it would then follow that either there would be many acts of being in a single thing, which – given that things are enumerable or identifiable according to the act of being – would entail that a single thing would be multiple in number (an absurdity), or a single act would be produced from multiple acts of being, which would entail also an absurdity and would go against Aristotle, according to whom to every and single substance corresponds a single principle or formal cause; or – yet another impossibility – all the acts preceding the final one would be destroyed, which would entail either the destruction of the respective forms (what would corroborate the existence of a single final form), or they would remain without their acts of being, entailing the existence of a thing without that which is in (*inest*) it essentially (cf. *ibid.*, 29-30).

Dietrich supports much of his argumentation on Aristotle, namely on the *Metaphysics*, and in the question at hand his authoritative opinion is not to be disregarded: For each and every substance there is a single definition, it being the case that this unity of the definition roots in the unity of the form or of the specific act; even if the definition appears to explain diverse parts of a form, these parts, which are actually only forms and natures of the superior genera and of the differences, are but parts of a single specific form. Just as the whole entity and unity of a being comes from the substantial form, so does the whole entity and unity of a species come from (the shared formality of) the final difference. In the light of this Aristotelian argumentation, it should be obvious that the unity of the relation between the potency and the act is not to account for the unity of the definition (cf. *De or.* IV, 31).

But what about the formal intentions first mentioned in paragraph (21)? Dietrich retakes them in paragraph (31), and the problem is now to explain their diversity and/or mutual relations in face of the unity of the form and of the final difference. To begin with (*De or.* IV, 33), they give origin to the forms of the genera, of the differences, and of the species; hence, according to the argumentation above they are not related to each other according to the relation between the potency and the act, being rather predicated of a thing in its final or specific act. However, it is a matter of observation that corporeal things change, namely they become more determinate in the course of generation; the formal intentions are thus related to each other according to the progress from the indeterminate or less determinate to the determinate or more determinate in one single and same form. In fact, they are but one and the same form, being different only by reason. Are they then mere things of reason, as discussed above in Section 3.2? Not according to Dietrich, who sees them “not in the way of that which is a thing of second intention, but just as in nature the reason (*ratio*) is taken to be the intention of a thing” (*ibid.*), where he plays cleverly with the polysemous character of the word “*ratio*,” which means both *definition* or *notion* (translating the Greek *lógos*) and the intellectual ability – the difference – that segregates the genus “animal” into the two sub-genera of rational and irrational animals.

In paragraph (34), Dietrich reiterates his view that in the course of generation we can say that a being (say, an embryo, to use an example from *De origine* III) becomes

<u>ACT</u>	<u>BEING</u>	<u>FORM</u>	<u>DETERMINATION</u>
Specific Act :	HORSE	: Final Form	: Determinate
	↑		
Privation _{1,3} :	COLT	: Accidental Form	: More determinate
	↑		
Privation _{1,2} :	FETUS	: Accidental Form	: Less indeterminate
	↑		
Privation _{1,1} :	EMBRYO	: Accidental Form	: Indeterminate

Figure 8: Forms, acts, and determination in generated beings for Dietrich of Freiberg.

another being (say, a horse) solely in the sense that out of the indeterminate the determinate becomes and out of the less determinate becomes the more determinate, a hierarchically coordinated progress that aims at the final and complete perfection of the specific act (see Fig. 8). This view, according to which corporeal change is accounted for by the fact that matter participates by degrees of the perfection of the final and complete act of a thing, dismisses the opinions that a real composition is made from the degrees of distinct perfections or from the same genera.

This theory of the degrees of determination, however, poses a problem. Take a horse and an ox; these two animals are specifically distinct, yet their flesh becomes out of the same bread, in the sense that the bread is in potency their flesh in act. Hence, (1) if the potency is one and the same with respect to these animals, then by a logical axiom (“two things that are the same in relation to one and the same thing are the same between themselves”) they will be one and the same animal in act (*De or.* IV, 35). (2) If one argues that in the bread the potency to become a horse and the potency to become an ox are different potencies, then one goes against the authority of Aristotle, according to whom only the act can differentiate (*ibid.*, 35). Moreover, the absurdity (another) would follow that two different beings formally distinct could exist in one and the same being according to the same being without there being a mixture of both beings. Finally, (3) it would be the case that the essence of that which exists in potency and of that which, brought out from that potency, exists in act would be different, which goes against what was argued for previously (*ibid.*, 36). A similar reasoning can be applied to the distinction between genus and species (*ibid.*, 37).

In paragraph (38), Dietrich retakes the discussion on the potency and the act with the aim of making it clear that the relation between them concerns one and the same being, namely in terms of its essence, even if the different degrees it may take might induce us in wrongful comparisons. This clarification is made by invoking an Aristotelian distinction: If a being is taken *in hoc* (in this), then there is a composition of matter and form; but if taken *ad hoc* (towards this), then there is no composition of matter and form, it being considered only the essence, a perspective by which a being is one and the same regardless of whether we focus on the potency or on the act. This latter perspective considers a being either in terms of the transition from potency to act in the course of generation, or according to a hierarchical organization of genera

(*De or.* IV, 39). Dietrich concludes his elaboration by reiterating the view that there is a single complete act, the specific act, towards which every being progresses as its complement and thanks to which it firstly and simpliciter differs from nothingness (*ibid.*, 41). As seen above, this complete act is tightly associated with the final form.

5 The Informational Problem in \mathcal{O} ntology: Some Final Remarks

The coupling shown in Figure 5 above suggests that information, as given via the universals, and signification, as given by the second intentions, are one and the same aspect in the sense that for humans the processing of information, by and large what the Latin scholastics called *actus intelligendi*, and the corresponding signification, the *actus significandi*, are one and the same act, a perspective that is essentially contemporary, namely in cognitive science and (symbolic) artificial intelligence (e.g., Augusto, 2014). Consequently, the belief that human cognition as information processing is a 20th-century conception (e.g., Augusto, 2021a) appears to be unfounded. To be sure, one needs to contextualize the expression “information processing” as a 20th-century coinage, but the elaboration above suggests that since at least Aristotle there has been the conception that human cognition has to do with the processing of the forms of the objects, i.e. the information they contain in themselves. This, in turn, shows that the problem of human cognition and information processing (*the informational problem*) has been a constant one in ontology, even if this subject dates only from the early 17th century: In order to know the objects of reality – in the sense that we can actually identify them as being members of a species and a genus – we have to capture either the information they contain in themselves, as postulated by ancient and medieval metaphysics, or the ways we process the information given to us by them, as firstly proposed by Kant in the late 18th century and a standard viewpoint in contemporary cognitive science. The fact that this is an unsolved problem tells us that we (should) suspect that, as information processing agents, we fall short of our epistemic desiderata; after all, it seems to be the case that, as Nietzsche bluntly put it, we do not have an organ for knowledge (see Augusto, 2005).

How are these remarks to be interpreted in the context of the distinction postulated and analyzed above between ontology-based information and information-based ontology? It was suggested that the questions posed by them – Q1-2 and QK, respectively – are one and the same, i.e. to be or not to be informed, that is the question of \mathcal{O} ntology. Hence, it looks like we ought to study the ways in which \mathcal{O} ntology and information are related, and we ought to do so in a way more encompassing than has been the practice until now. The inclusion of Dietrich’s *De origine* IV in the discussion of this topic aims at recovering the concept of form, in order to apply it in \mathcal{O} ntology as a guideline for the many ways in which we can speak of information in ontological terms.

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