

TECHNICAL PRODUCT AS AN ARTIFICIAL SUBSTANCE

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This paper argues that Aristotle's ontology and logic can provide a systematic foundation for defining technical products, including software, in a clearer and more legally reliable way. The authors connect Aristotelian concepts such as substance, synonymy, and meaningful speech with Engineering Design Science and Methodology (EDSM), which they present as a uniquely suitable framework for identifying technical products in a standardized manner. Their central claim is that, although a technical product is not a substance in the strict Aristotelian sense, it can be conceived, for the purposes of identification and meaningful discourse, on the model of substance: not as a mere aggregate of parts, but as a functionally unified entity with stable identity and describable essential properties. In this qualified sense, the paper proposes the notion of an 'artificial substance'. This philosophical-technical synthesis aims to improve communication in design and contracting, reduce ambiguity, and strengthen legal certainty in the development and manufacture of technical products.

KEYWORDS

Aristotelian ontology, technical product, artificial substance, Engineering Design Science and Methodology (EDSM), meaningful speech (logos), software as technical product, legal certainty of contracts

1. INTRODUCTION

Advances in computer technology, though not exclusively in this domain, are currently outpacing both normative-ethical reflection on their societal impact and theoretical efforts to comprehend the transformations reshaping the contemporary world. This disparity contributes to what may be described as a general crisis of governance: social, political and business authorities frequently lack the conceptual and epistemic tools required to guide and regulate the introduction of new technologies into the practices of public institutions, private enterprises, and civil society actors.

The normative order, whose task is to help set the boundaries of what is acceptable for economic and social activity, namely the legal order, and those who professionally maintain it, i.e. judges, prosecutors, but also corporate lawyers, solicitors and others, encounter the same problem. In everyday legal practice, even the definition of a technical product such as soft-

ware becomes a problem, which directly affects contracts and their certainty – their binding nature. If there is no clear and consensual definition of software as a technical product, it is often difficult to agree on the definition of the subject matter of the contract and, therefore, on whether the contract has been fulfilled at all after its completion. The transaction costs of the contract increase.

The problem of a legally certain definition of the subject matter of a contract for work – the manufacture of a technical product – software is one of the main motivations behind this article. We start from the assumption that philosophy as a fundamental – underlying science can be of considerable importance for the needs of applied science and scientific and technical practice. This also applies to such seemingly distant activities as the development and production of technical products, including computer programmes.¹

In recent decades, contributions recognising Aristotle's contribution to the emergence of this field have appeared in computer science. They point in particular to the close connection between Aristotelian logic and ontology and later mathematical logic, which is perceived as the original theoretical framework of computer technology, or directly use Aristotle's ontological scheme to create object-oriented databases (see in particular Lewis 1990, Jansen 2007, Aleksander 2012, Dixon 2017, and others).

In our contribution, we share the intuition that Aristotelian ontology and logic may be relevant to the needs of applied science and scientific and technical practice. In our opinion, the findings of Aristotelian ontology and logic and the systematic philosophical research based on them can be the basis for solving some essential problems in the process of developing and manufacturing technical products, including the development of intangible technical products, i.e. software, in particular because these findings will significantly facilitate communication between the actors in this process. In the following, we therefore want to exploit the potential found on the one hand in Aristotle's ontology and conceptual logic and on the other hand in its connection with the most promising current method of design science, called Engineering Design Science and Methodology (hereinafter 'EDSM').

Our argument does not presuppose that artefacts are substances in precisely the same ontological sense as Aristotelian natural substances. Rather, we ask whether the categorial and semantic structure associated with substance – above all, the relation between individual and kind, essential and accidental predication, and synonymy and homonymy – can provide a normative model for the unambiguous identification of technical products. The stronger ontological question of whether and in what qualified sense an artefact may itself be regarded as a substance will be addressed separately below.

¹ We use the term 'computer program' as defined in the ISO Dictionary. – *Computer program (means) combination of computer instructions and data definitions that enable computer hardware to perform computational or control functions.*

2. TECHNICAL PRODUCT ACCORDING TO DESIGN SCIENCE

For the purposes of the present inquiry, not every description of a technical product is equally suitable. A definition capable of supporting both engineering communication and legal determination of the subject matter of a contract must satisfy at least three requirements. (1) First, it must be object-oriented: it must identify the product itself rather than merely the process of its design, manufacture, management, or use. (2) Second, it must be sufficiently general to apply to different classes of technical products, including intangible products such as software. (3) Third, it must provide criteria by which a particular object can be identified as an instance of the relevant kind, so that the definition can serve not merely explanatory but also normative and contractual purposes. It is against these three requirements that the following approaches are assessed.

A review of the available expert literature shows that among the approaches considered here, EDSM proves particularly suitable for defining a technical product as a specific category of artefact in a standardised and generally applicable manner. Although a number of current research approaches contribute to a deeper understanding of the processes of designing and creating technical systems, none of them provides an unambiguous and normatively applicable definition of a technical product as such in the sense indicated above by three requirements (1)–(3).

This conclusion is particularly evident when comparing EDSM with selected concepts published in recent years. Among them, we can distinguish (a) process-oriented, (b) sociopragmatic and (c) property-oriented approaches.

(a) The model of transitions between the states of synthesis, analysis and evaluation in conceptual design presented by Martinec et al. (2019) describes the dynamics of the creative process, but does not formulate a generally binding definition of the nature of a technical product. The absence of such a definition cannot be overcome even through project management methods such as PRINCE2, IPMA, PMI or agile approaches, based, for example, on the SMART criteria formulated by Doran (1981) or on Doerr's (2018) approaches to goal management. These methods focus primarily on the organisation, planning and control of the process, not on defining the nature of the product itself.

(b) The concept of shared professional vision according to Comi et al. (2019) focuses primarily on the socio-cognitive dimensions of design practice, i.e. how a common understanding of a problem and its solution arises within professional communities. Similarly, Lloyd's (2019) theory of 'social turn' in design broadens the perspective of design to include social and cultural dimensions and emphasises the role of communication, interpretation and user relationships. However, we find no attempt to provide an unambiguous and legally applicable definition of the artefact itself. Similarly, the description of the relationship between craft, materials and creators offered by Aktas and Mäkelä (2019) provides valuable insight into the processes of production and the cultural situatedness of design, but does not provide conceptual tools for the precise identification of a technical product as a legal or normative entity.

(c) The principle of 'weaker dependencies' in the axiomatic design according to Benavides and Lara-Rapp (2019) is primarily

ly oriented towards optimising the design structure and reducing the interdependence of design variables, but not towards a legally or normatively relevant definition of the final product. Similarly, special methods used in the field of IS/IT, such as the FURPS classification system, describe the qualitative characteristics of software products, but not their general structural and legally determinable definition.

It can therefore be concluded that, despite the wealth of current theoretical and practical approaches to design, EDSM is particularly well-suited to the present inquiry as it provides a systematic, unambiguous and legally applicable definition of a technical product. This fact is of fundamental importance not only for technical design, but also for legal regulation, standardisation and life-cycle management of technical systems. We believe this is because EDSM focuses more than any other design theory we know of on the object side of technical design, offering the best conditions for addressing the aforementioned issues using philosophical thinking methods.

3. MEANINGFUL SPEECH – LOGOS

Meaningful speech is the basis of communication in any field of human activity, including the development and manufacture of technical products. Meaningful speech is a prerequisite for factual agreement and therefore also a prerequisite for success in any activity in which we cooperate. If the risk of misunderstanding is to be eliminated in pragmatic cooperation, such agreement must be based on something real: on an object that is one and the same for both sides of the communication. However, language grasps real objects as generalities. For this reason, we must therefore seek a relationship between the general name and the given object, e.g. a specific technical product. In other words, every human communication involves a search for unity of meaning.

With these basic facts in mind, we can formulate our hypothesis, which will be the core of a systematic theory of meaningful speech about a technical product. Our hypothesis is that a technical product can be grasped as such through meaningful speech, objectively and univocally, and that therefore meaningful speech about a technical product can be measured by logical and ontological rules specific to the relationships between speech and natural objects (substances).

Within the framework of our hypothesis, this means searching for a communication code and taxonomy (in the field of technical product development and manufacturing) that we can apply in specific lexically organised statement constructions and through which we describe not only the random attributes of a technical product, but also its essential properties and propria (i.e. non-essential but characteristic qualities that allow a given thing to be clearly identified). In other words, the aim is to find a taxonomy that corresponds to the second substance (kind, species) in Aristotelian conceptual logic. In the following, we will refer to a technical product as the second substance.

As mentioned above, communication between participants in the development and production of a technical artifact must be based on meaningful speech – logos. By meaningful speech, we mean reasonable speech about something on which the participants in the communication agree. For the purposes of the effectiveness of the development and production process of a technical artifact, however, such agreement must not be

merely apparent. It must not be based on superficial agreement or on a misunderstanding of the subject matter of the contract that establishes the development and production of the technical product, and, last but not least, it must not be based on an emotionally driven desire to reach an agreement.

In the area of contractual (legal) security for the development and production of a technical product, we agree with the theory of governance ethics that the nature of every contractual relationship is imperfection or incompleteness. In other words, we cannot ensure the 'flawlessness' of a contract, even with the best possible wording. The decisive fact is that every contract relies at least partially on non-legal factors of mutual trust, clarity – certainty of expression, etc. (Wieland 1999). This makes the means of genuine, qualified agreement on what is objective reality all the more important.

Object-directed communication of the kind relevant to engineering and contractual practice must therefore ultimately presuppose conditions of identity that are grounded in, or directed towards, something real, something 'substantial'. This does not imply that meaningful discourse as such is possible only about actually existing substances. Meaningful discourse is undoubtedly possible about fictional entities (*entia rationis*), which may themselves be conceived under a general concept and may be conceived as having determinate essential characteristics. This is particularly relevant to technical design, since a technical product can be meaningfully specified before it has been physically realised.

Where discourse is intended not merely to be meaningful but to identify an object in engineering and contractual practice, its terms must ultimately be answerable to conditions of identity that are not exhausted by linguistic convention alone. In the case of a product that has not yet been realised, these conditions specify what an eventual product must be in order to count as an instance of the kind agreed upon. The Aristotelian notion of substance is introduced here precisely as a model for such reality-directed conditions of identity.

From a methodological point of view, this approach differs from theories that locate the relevant criterion of meaning primarily in convention, linguistic use, or coherence. The most notable example of this is the view associated especially with the later Wittgenstein (2009 § 43), according to which the meaning of a word is to be sought in its use within a language. For the specific normative purpose pursued here, however, an account of meaning in terms of linguistic use alone is insufficient. In engineering and contractual practice, it is not only necessary to establish how a term is conventionally used, but also to determine whether it has been correctly applied to a particular product. Contractual parties may agree on a linguistic usage yet still disagree about whether the delivered object satisfies the conditions specified by that usage. To this end, a theory of meaning must enable linguistic practice to be tested against identifiable features of its subject matter. The Aristotelian framework adopted here offers a reality-oriented semantic framework that is particularly well-suited to identifying and specifying technical products.

Because logos grasps real objects as generalities, we must address the question of what mode of generality is appropriate for meaningful speech – communication – between the actors in the process of technical product development. This is

not a theoretical question of the status of universals, i.e. whether universals exist in reality outside of things, in things, or only in words. Rather, it is a question of the appropriate method of grasping the general. Aristotle's theory of meaning offers such a method.

Aristotle's theory of meaning assumes a fundamental difference between words and the nature of things. At the same time, however, this difference has the ability to connect the two: language as a sign and being as that which is signified (*De int.* 1; *Cat.* 1). The decisive factor here is the insight that speech is always attributive; speech is always about something, whether in the form of predication or definition. However, this something is not simply an idea or a highest genus as a model of all relevant things (as Platonism might claim), but rather a kind of 'one' between the (limited) multitude of words and the (almost unlimited) multitude of phenomena. When properly grasping meaning, it is therefore a matter of choosing the appropriate degree of unity. This unity is not only ontological identity, but it is also not merely a linguistic entity. In this middle sphere between being and language, the speaker's intention plays a decisive role, which is focused on being, but at the same time presupposes the possibility of reasonable agreement. It is therefore something intersubjective: it is a unity of intentions – the intentions of different people whose intentions correspond in conversation. However, it is not (because intentions relate to the substantial) intersubjective only in the sense that if communication (or a contractual relationship) collapsed, reality would also collapse.

The basic tool for clarifying the unity of meaning is categorical distinction. For meaningful speech – logos – about a technical product as a general concept, a twofold distinction is key: the distinction between unambiguous (in classical terminology: synonymous, i.e. having the same meaning) and ambiguous (homonymous, i.e. having the same name) expressions, and the distinction between the primary meaning of a thing, which is its substance, and secondary meanings, which correspond to accidental categories. The problem with many technical, economic and legal practices, as seen through the lens of Aristotle's concept of meaning, is that they obscure this dual distinction, which is the basis of all meaningful communication. It is quite common for the subject matter of a contract to be described accidentally, by its quality or quantity in the form of random characteristics such as colour or font, etc. Here it is necessary to recall Aristotle's warning that 'a set of attributes does not constitute a single being' (*Met.* V,4,1007b10), that it does not constitute a single substance.

The question that follows is therefore not yet whether a technical product is a substance in the strict Aristotelian ontological sense. It is first whether the categorial structure of second substance provides an adequate model for distinguishing what a technical product is from the properties that it merely happens to possess. Only after this semantic and categorial question has been answered can the stronger ontological question be addressed.

4. TECHNICAL ARTIFACT AND THE CRITERIA OF SECOND SUBSTANCE

For the unambiguous designation of the subject matter of the contract, and thus for the establishment of meaningful communication, the distinction between what a thing is and the properties it happens to possess is crucial. Aristotle's category of second substance offers a model for making this distinction. Since our immediate concern is with predication and definition, we shall therefore examine whether the conceptual identification of a technical product can be modelled on the categorial structure of second substance. In the sense of our above hypothesis, we therefore ask about the extent of this identification. We want to operationalise our hypothesis by using the properties of the second substance, which together constitute a suitable taxonomy of substantiality applicable to a technical product.

This formulation deliberately leaves open the stronger ontological question of whether a technical product is itself a substance. Second substances do not, for Aristotle, exist separately from individual first substances. Species and genera are predicated of individual substances and answer the question what they are; unlike Platonic Forms, they are not independently existing entities. The present section therefore asks whether technical-product kinds exhibit the characteristic structure of such essential predication. The ontological status of the individual artefact to which they are applied will be considered in Section 5.

The properties of the second substance, as they follow from Aristotle's reflection, are the properties of the second substance as opposed to other entities, i.e. as opposed to accidents (properties 1 and 3–5) and the first substance (property 2). The fact that they are exclusive in relation to other entities means, on the contrary, that cumulatively they are exhaustive criteria of the second substance (Inek 2018, 22 n. 68). This can be applied in the analysis of properties – if technical-product kinds cumulatively display these properties, whether it is a 'classic' tangible technical product or an intangible technical product, e.g. a computer program, their conceptual structure can be regarded as analogous to that of second substance. The properties or criteria of the second substance can be summarised as follows:

1. It is not in any substrate;
2. It is only predicated synonymously;
3. It has no opposite;
4. It has no more and no less; and
5. It accepts opposite determinations.

For the analogy with second substance to hold at the categorial level, all of the following criteria must be satisfied. When we examine them in more detail and apply them to the characteristics of a technical product, the following conclusions can be reached:

1. The property or criterion 'not being in a subject' means that a second substance or species (such as 'human') is said of an individual (= individual human being) but is not in that individual as in a subject. By contrast, an accident (such as a particular colour) is in an individual substance as its subject. The species therefore possesses no separate existence comparable to a Platonic Form; its distinctive status consists rather in the

mode in which it is predicated of first substances. A second substance is related to the first substance by the intention of the speaker or thinker ('it is predicated in relation to it'). The second substance can exist without a particular, specific substance, but not without any individual substance whatsoever.

For our purposes, this criterion should therefore be understood as categorial non-inherence rather than ontological independence. If a technical product is to be treated analogously to a second substance, the properties that constitute what the product is must not merely be conceived as accidents inhering in an otherwise independently identifiable subject. Rather, the relevant kind must provide an answer to the question of what the individual product is. Thus, 'database' 'computer program', or 'technical system', insofar as these terms function in an essential succession (see below, 2), are predicated of particular products. They are not properties that inhere in them in the same way that a particular colour, size, speed or user interface design may inhere in them.

This is crucial for the theory of meaning, since unlike accidents, which 'are in' a substance, there is a fundamental correspondence – an element of identity – between the first and second substances. Therefore, a general name can successfully denote a particular thing.

This criterion also serves as a touchstone for determining whether a technical product can be considered a substance. Is a technical product something substantial, or merely an aggregate – a collection of components whose unity is given, in a secondary sense, by the engineering plan in the designer's mind? In other words, an important question arises in connection with the first characteristic of the second substance, which can be summarised in two possibilities for the ontological determination of a technical product: Is a technical product really more substantial, or is it merely an aggregate? It must be admitted that what has been said so far does not establish that technical products are substances in the strict Aristotelian ontological sense. It only establishes that the conceptual structure by which technical products are identified can reproduce the categorial relation characteristic of second substances. Whether this conceptual analogy is grounded in a corresponding unity of the artefact itself is a separate question that will be addressed in the following section.

2. The property 'It is only predicated synonymously' (or also: univocally, unambiguously) means that the second substance is a concept that places a given thing in a unified context of genus and species. The second substance is therefore what makes many things into one thing in the sense that it allows many different predicates to be used for one and the same thing, univocally, i.e. without the risk of misunderstanding. We can call this unified context 'essential' succession, because it concerns the unity of being, of essence, in such a way that it manifests itself in predication as the transitivity of genus and species (*Cat.* 3a7). If we speak – hypothetically – of a computer programme as a second substance, then we are potentially placing it within a similar essential succession in which we find its other genera, whilst maintaining the unity of name and definition – in which case we may speak of it, for example, as a technical system. It must be said that essential succession also applies to certain categories other than substance, albeit secondarily, so that the application of the second property discussed to a technical product is not yet a decision on the dilemma discussed in point 1: It is possible that, in the transi-

tivity of the predicate 'technical product – software', we are referring to an essential succession within a different category (although this would be somewhat surprising given the grammatical form of the predicate, which uses only nouns).

The more general a given predicate is on the 'scale of synonymy', the less precise our understanding of the thing is. Nevertheless – and this is crucial to our purposes – every such understanding we have of the thing will still be true and unambiguous.

Examples of this kind of transitive reference can be found in the ISO Explanatory Dictionary under the terms 3.4090 – System; 3.726 – Computer programme; 3.3783 – Software; 3.167 – Application (ISO 2024). The definitions of the individual terms given here² allow for synonymous statements. If we apply the 'scale of synonymy' to them, ranging from the most precise to the least precise predication, then we can refer to a database in the general sense as an application, but also as a computer programme and, at the same time, as a system.³ The precision of such statements will decrease, but since a database is both an application, a computer programme and a system, each of our statements will be true. A database falls under the genus of an application, which falls under that of a computer programme, and that in turn falls under that of a system. To put it in Aristotelian terms: the second substance of a system is predicated synonymously in relation to the second substance of a computer programme, the second substance of an application and the second substance of a database; this means that a system is described in relation to a database (and all preceding genera in the essential sequence).

This regularity is by no means accidental. Although ISO is an artificial human creation, its creators do not follow the arbitrary logic of conventional definitions legitimised solely by institutional authority, but rather strive for systematicity by

² System (3.4090) – A combination of interacting elements organised to achieve one or more stated purposes.

Computer programme (3.726) – A combination of computer instructions and data definitions that enable computer hardware to perform computational or control functions.

Database (3.1042) – A collection of interrelated data stored together in one or more computerised files.

³ We present the full argument here: Since (1) a computer programme is a *combination of computer instructions and data definitions that enable computer hardware to perform computational or control functions* and, at the same time, (2) a system is a *combination of interacting elements organised to achieve one or more stated purposes* and (3) *computer instructions and data definitions* undoubtedly constitute elements within the meaning of (2), every computer programme is a system. What applies to a system applies to a computer programme.

Since a database is a *collection of interrelated data stored together in one or more computerised files*, and since this data and these files are a necessary condition for the performance of computational and control functions within the meaning of (1) – specifically, they enable work with the stored data – every database is a computer program and therefore also a system. What applies to a system also applies to a database.

capturing the laws governing the organisation of reality in the form of logically subordinate species and genera. The relevant rules are set out in specialised ISO standards (ISO 1087: 2019 and ISO 704: 2009). Let us leave aside, for the time being, the question of the source of motivation behind this approach. For now, it suffices to note that it is certainly desirable to follow this practice in other situations not explicitly covered by ISO.

From the perspective of our pragmatic and linguistic objectives, it is therefore necessary to anchor this generality of a technical product in a system of synonymy. A certain type of technical product, e.g. a computer programme, which as the lowest common denominator can become the subject of reasonable linguistic communication, and therefore also the subject of a contract, is both a technical system and a technical product (which are two differently general generic designations). In order to reliably grasp the substance of a computer program, it is important to understand its essential connection to various levels of generality, all of which analytically express the same second substance (in this case, that of a technical product). It is therefore important that a computer program can only be understood as a technical product (and not, for example, as a network, a harmony of relationships, a sequence of conceptual connections, etc.).

3. The property 'Having no opposite' means that there is no other thing that is the opposite of the second substance. The substance of 'human' is not opposed by 'non-human' (at least not on the same ontological level), just as 'light' in the category of quality is opposed by 'dark'. It is clear that this property is closely related to the ontological non-inherence of the second substance discussed in point 1.

This property can be easily applied to the sphere of technical products. If we take the example of a database in the general sense mentioned in the previous point, we find no opposite to it. There is no opposing second substance to the second substance of the database, just as there is a slow (machine) to contrast with a fast one, or a moving (machine) to contrast with a machine at rest.

4. The property 'Having no more or less' means, when applied to the concept of a database under consideration, that no database can be more or less of a database. It cannot, therefore, be characterised by the general definition of 'being a database' in any stronger or more intense sense than another database. Similarly, no database can be less of a database than another database. A particular database may be simpler than another, or more user-friendly, and so on, but it can never be a database in any weakened sense of the word. Either a computer programme is a database, or it is not; *tertium non datur*.

This logical figure of the exclusion of the third is directly applicable to linguistic practice, but also, for example, to legal practice. Of course, everything then depends on whether the conceptual characteristics of a database are defined clearly and unambiguously, which, based on what has been stated so far, should be reflected in particular by its specification in relation to the superordinate genus, in this case a computer programme (provided that this is correctly defined).

5. The property 'It accepts opposite determinations' means that a database in the general sense can be, for example, fast or slow, that it can meet security requirements or not meet such security requirements, etc.

The preceding analysis suggests that technical-product kinds can reproduce several characteristic features of Aristotelian second substances at the level of predication: they can answer the question what an individual product is; they can enter into relations of synonymous predication within a hierarchy of genera and species; they have no contrary; they do not admit of more and less; and their individual instances can receive contrary accidental determinations. This shows that the conceptual structure through which they are identified can be modelled on the logic of second substance. It can be readily agreed that a technical product according to ISO corresponds to the second substance in points 2–5. The critical point of consideration is therefore point 1, which includes the question of whether the categorial analogy identified above is grounded in a sufficiently unified individual artefact. Can an individual artefact possess the kind of unity required for this structure of essential predication to have an objective foundation, or is such unity imposed upon an aggregate solely by human thought and intention? This question requires a separate examination of the relation between natural and artificial substance.

5. NATURAL AND ARTIFICIAL SUBSTANCE

The problem we have outlined is that a technical product – unlike a natural substance – is not a bearer of ‘evidence of species’ in the Aristotelian sense. Natural entities, which, according to the normative list in *Metaphysics* VII,2, include animals, plants, the elements and their parts, as well as that which is ‘derived from them’: the sky, the stars, the moon and the sun (VII,2,1028b8–13; similarly in *Met.* V,8,1017b10–13), though paradigmatically, of course, particularly humans or animals, are bearers of their species *in and of themselves*: they are the result of internal causality, which establishes in them the unity of matter, form, potentiality, and actuality. In contrast, a technical product, although often intuitively likened to a living organism, does not have this internal causal coherence. Aristotle’s famous statement that ‘a tree does not grow from a chair’ seems to suggest that the age-old analogy between nature and art is misleading (*Phys.* II,1,193a10–15).⁴ Moreover, modern scientific developments appear to confirm that such an analogy is slightly misleading: man was able to fly precisely when he moved away from the idea that a flying machine – a technical product – is an ‘artificial bird’.⁵ From the perspective of the logic of synonymy under consideration here, the situation is critical: Aristotle commonly refers to the artificial imitation of natural substances as ‘homonymy’ (*De an.* II,1,412b19 ff.; *Pol.* I,2,1253a20–22).

However, the initial failure of the analogy between the living and the artificial can be mitigated by reference to Aristotle’s well-known figure, through which he reintroduces homonymy into the realm of scientifically relevant knowledge. He speaks

of so-called ‘non-contingent homonymy’ (*Eth. Nic.* I,4,1096b26–29), which he systematically develops into the concept of *pros hen*, that is – in later terminology – into the notion of ‘analogy of internal attribution’ (πρὸς ἓν, or ἀφ’ ἑνός; *Met.* IV,2,1003a33 ff., b6; V,6,1016b34; VII,4,1030b3; IX,6,1048a36; XII,10,1075a19; XIV,6,1093b19; *Eth. Nic.* V,6,1131a31 ff.; cf. Merlan 1934, pp. 46–47). According to this view, secondary or homonymous meanings can be traced back to the true meaning through their relationship to the primary or ‘focal’ bearer of that meaning. Thus, the accidental meaning of the case is intrinsically related to the true, substantial meaning. In a similar way, the artificial substance could relate to the natural substance by way of imitation.

However, can such a fundamental ontological difference between the natural and the artificial be bridged by the metaphysical figure of analogy? This question can be translated into our concepts of language and meaning.⁶ Can the question ‘what a thing is’ be grasped conceptually in the case of a technical product in such a way as to enable objective communication even where metaphysical nature, in the strict sense, is absent?

It is certainly no coincidence that, when examining the limits of substantiality, Aristotle turns to an analysis of homonymy and synonymy – key categories of the theory of meaning (*De part. anim.* I,1,640b35 ff.; *Pol.* I,2,1253a18–29; *De an.* II,1,412b17–413a3). Classic examples – the hand, the eye or the leg – show that a particular thing ceases to be itself when it loses its connection to the living whole: a severed hand (or the hand of a dead body) is a ‘hand’ only in a homonymous sense, because it has lost the function (*ergon*) and potentiality (*dynamis*) that originally constituted it. Similarly, a painted doctor or a stone whistle are homonymous – these two cases, in turn, draw our attention to the concepts of form (*eidos*) and matter (*hylê*). Aristotle’s analysis thus sets out a set of four criteria that determine both the meaning and the identity of a given thing:

- (a) matter (*hylê*)
- (b) form (*morfê, eidos*)
- (c) potentiality (*dynamis*)
- (d) actuality (*ergon*)

Substance, as the union of matter and form, establishes the corresponding capacity and its actualisation. In Aristotle’s biology, these four criteria are unified and internally connected by a living form.

If we wish to apply Aristotle’s theory of meaning to a technical product, we must demonstrate that an artificial object – despite its ontological difference from natural objects – can be the bearer of a unified meaning, and can therefore, in a certain sense, be *conceived* as a substance. Of the four criteria

⁴ This corresponds to the passage, according to which synonymy is an expression of the essential correspondence between parent and offspring (*Met.* XII,3,1070a4–5).

⁵ See also the belief expressed by one of Aristotle’s pupils, the author of the pseudo-Aristotelian *Mechanics*: ‘Mechanism is a means of changing the course of nature.’

⁶ Language itself can, of course, fall into verbalism – for example, something that is not an ‘IT machine’ can be nominally presented as one. This risk is universal – which is why, in the empirical natural world, we seek to rely on natural kinds; however, where natural kinds do not exist – that is, in the realm of manufacturing and technology – we have only language and thought at our disposal.

mentioned, the substantial form is particularly problematic here: traditional Aristotelianism reserves the substantial form solely for natural substances. It is certainly no coincidence that it is precisely here that we encounter the example of the painted physician (*De part. anim.* I,1,640b35), reminiscent of the central example from *Cat.* 1 of the painted man.⁷

The central problem of the absence of form is confirmed by Aristotle's statement that the living parts of substances, such as a hand, are merely wrongly regarded as substances because they are not separated from the body; however, if they are separated, then they are rather matter (ὡς ὕλη). The reason lies in the fact that, as separated entities, they are not one (ἓν), but merely a heap (σωρός), 'until they are processed and become one' (πρὶν ἢ πεφθῇ καὶ γένηται τι ἐξ αὐτῶν ἓν, *Met.* VII,16,1040b5–10).

This unity, which is lacking in a mass of matter, is also the decisive motivation for the primacy of the individual substance, as set out in the *Categories*: 'In the case of the first substances, it is certainly indisputable and true that substance denotes a specific something, for that which is revealed is indivisible and, in number, one (ἓν).' (*Cat.* 5,3b11–14). Conversely, matter is the least unified. From a categorical perspective – that is, not from a hylomorphic point of view, but from the perspective of the systematics of categories, which are distinguished from one another by criteria such as 'more and less' (see Jinek 2018, 164–165) – the counterpart to the unity of essence is the category of relation. According to the Aristotelian tradition, an artificial product is also classified within this category as a conglomerate of interrelated elements.

However, the quoted conclusion of the passage from *Met.* VII,16 offers yet another perspective. The condition stated here clearly opens up the sphere of activity of art – *technē* – which is capable of processing material and making it one. Once this hypothetical condition is met, it should therefore be possible to designate the given part as a substance. Another passage from *Metaphysics* VII offers a metaphysical explanation for this: artificial products come into being when a form, which previously existed in the soul (mind) of the creator, is imprinted upon matter. An architect or artist conceives a house or an instrument in their mind as an immaterial form and, through their activity, realises it in the real world. And the famous passage from Book I of *Politics* puts forward an even bolder hypothesis: Aristotle is clearly prepared to consider the possibility that the actions of persons – natural substances – might be fully replaced by machines, were they capable of acting independently (*Pol.* I,4,1253b33–1254a1). In the light of the previous hypothesis, this can be interpreted as opening up the possibility of perceiving them as substances as well.

It is significant, however, that Aristotle himself, in his works on natural philosophy, very readily moves from biological exam-

ples to technical ones: a flute or an axe are associated with the same four criteria as natural substances. A flute, too, has matter, form, capacity and function: it is a flute only in so far as it has the appropriate shape (form), the capacity to produce sound (*dynamis*) and enables the production of a tone (*ergon*). The same applies to an axe (see *De an.* II,1,412b11–14; *De part. anim.* I,1,642a9 ff.). In Aristotle's approach, a technical product is thus characterised by the unity of these criteria just as a hand or an eye is – though this unity is external, not internal; it is determined by the purpose intended by the creator.

Is this sufficient reason to move beyond homonymy towards synonymy? Probably not quite. It is, however, conceivable to lean towards the concept of non-accidental homonymy in the sense of *pros hen*, where the 'one' sought would be a purposeful structure pursuing a defined human goal.

We shall therefore use the expression 'artificial substance' in a deliberately qualified sense. It does not designate a further class of Aristotelian substances alongside natural substances. Rather, it designates an artefact whose matter, form, capacities and function are unified sufficiently to provide objective conditions of identity and thereby to support a structure of essential predication analogous to that of natural substance. Its unity is externally instituted and functionally normative rather than internally generated by nature.

This brings us close to modern artefact metaphysics. In recent decades, this field has sought to demonstrate that human-made products are not mere aggregates, but rather entities defined by a normative function that constitutes their identity. In a similar vein, Baker (2004) introduced the concept of an 'intentional material object', which possesses its own 'artifactual essence' determined by function. Elder (2007) argues for 'artifactual kinds' that exist independently of individual intentions once a certain norm of use has been established. Thomasson (2003, 2007), in a similar vein, emphasises the dependence of products on human intentions as a 'constitutive condition of the kind'. Similarly, Koslicki (2008) and Fine (1994) draw attention to the hylomorphic structure of artefacts, which, whilst of a different type to that of natural substances, is no less real.

From this perspective, Aristotle's four criteria prove compatible with modern artefact theory: matter, form, capacity and performance are unified in an artefact primarily through a functional norm, which plays the role of a sort of 'artificial telos'. Of course, from a metaphysical point of view, this does not bridge the gap between nature and art. Purpose, capacity, form and performance remain intrinsically unconnected to matter; they are external to it – existing in the creator's mind or as an accidental form on matter. Nevertheless, the purposefulness, the functional orientation of the product, is that very thing towards which human productive practice is directed and which makes the artefact more than just a separate material component. The human mind serves as an analogy for the internal attribution between essence and machine. Productive, purpose-driven practice seems to require a certain type of thinking – not merely to regard the artefact as an essence (that is, an aeroplane as a bird – which need not necessarily work), but rather to subordinate pragmatic, purpose-driven rationality to the conceptual logic of synonymy and the succession of genera and species, precisely in the sense we observed among the compilers of the ISO dictionary.

⁷ This example actually summarises all four criteria, because the painted doctor (and, similarly, the painted human being) lacks not only the substantial form of a real doctor (or human being), but also the corresponding matter, and possesses neither the capacity nor the performance of a doctor. Nevertheless, form is, in a sense, central, insofar as it identifies the thing in question (see *Met.* VII,3,1029a27–30).

If we were to be content with defining a machine as an aggregate, we could scarcely aspire to the degree of systematicity that characterises this practice. An aggregate falling under the category of relation cannot be conceived within the logic of genera and species. We have already stated that, in terms of its specific properties, the relation is the category furthest removed from essence of all. Unlike, for example, the category of quality, it does not allow for the imitation of essential succession, as paradigmatically established in the category of substance. Aristotle states that its characteristic property is that it is 'spoken of in relation to its opposite' (πρὸς ἀντιστρέφοντα λέγεται, *Cat.* 7,7a23). The metaphysical reason lies in the fact that the being of their elements is fully determined by their relation to other elements (see *Cat.* 7,8a34–35), not by their relation to higher genera. In the case of relation, we find neither a distinction between genera and species nor a distinction between the general and the particular analogous to the distinction between the second and first substance. Whilst it is possible to identify an individual quality (the specific colour of a particular person's skin) by analogy with the first substance without any difficulty, it is not possible to identify a specific relation – a relation is always merely an intention; its basis at the concrete level being other categories (the essence of Aristotle's dilemma regarding the issue of slavery is, from a metaphysical point of view, that a slave *qua* slave is a relation, not a concrete person; but as a human being, it is a concrete living individual belonging to the species 'human' – see Jinek 2026 on this).

A machine is therefore not a substance in the strict sense in which an Aristotelian natural substance is a substance. Nevertheless, neither is its unity reducible to an arbitrary conceptual imposition upon a mere aggregate. Its form, capacities and performance are objectively constrained by the function for which it is produced. This functionally constituted unity provides the basis for treating the artefact, in the qualified sense defined above, as an 'artificial substance'. The Aristotelian model thus functions normatively without being merely fictional: it specifies the conditions under which an artefact can be identified as one thing of a determinate kind.

6. DEFINING A TECHNICAL PRODUCT ON THE MODEL OF SECOND SUBSTANCE

The principles set out above can be applied with regard to the use of language and meaning, that is, in relation to the issue of the reliable identification of a technical product. To define the natural essence of the human species, Aristotelian logic prescribes a scientific, i.e. essential, definition using the *genus proximum* and *differentia specifica*. Whilst it cannot be expected that the ontological prerequisites for the validity of such a strong definition will be met in the case of an artificial product, it is nevertheless necessary to insist on its normativity and necessity.

Nor will design science – at least object-oriented design science of the EDSM type – be satisfied with the mere conventionality of a purely nominal definition, but will strive for a definition that is measurable in terms of its accuracy; that is, it will operate at the level of a real definition, albeit not always an essential one. EDSM, insofar as it is a science, will endeavour to emulate that fundamental structure of genus and difference; at the same time, however, its endeavour will not shy away from attributive definition. To identify a technical product unambiguously in practice, one may focus on properties necessarily associated with the identity of the relevant technical-product kind. The identity conditions of a technical product can therefore be defined on the model of substance which, for meaningful discourse – *logos* – is graspable not only through definition but also through a series of properties that are necessarily, or at least contingently, linked to the essence of the given nature, whilst the crucial task will be to systematically distinguish between these two cases.

We left the question of the ISO dictionary compilers' motivation unanswered earlier. In this regard, it must first be said that this omission is perhaps to be expected, and indeed common – in applied fields, we do not usually trace matters back to fundamental questions, but rather proceed on the assumption that the basics are defined in normative texts such as textbooks or standards, such as the ISO dictionary itself. Our current enquiry, however, goes beyond this common practice, as we regard it as inadequate and potentially risky given the rapid pace of development in the IT sector. It is therefore appropriate to ask about the underlying principles and, where applicable, the motivation of the authors of the ISO normative text. If we encounter a situation where individual ISO entries and definitions satisfy the requirements of synonymic consistency, as we have seen, we may surmise that this is because only a system that *imitates* natural genera and species (1) contributes significantly – through the method of imitating natural states of affairs – to the legitimacy and authority of the dictionary, (2) enables a verifiable, namely unambiguous, linguistic and definitional practice, (3) also opens the way for further conceptual clarifications, which the dictionary itself does not provide but whose future necessity it anticipates.

The desirable communicative practice for a technical product when determining the unambiguous meaning of the subject matter of the contract would then be as follows:

(1) Using prior understanding of the relevant concepts, reach an initial consensus on the subject in question, based on agreement regarding the linguistic domain in the sense of the common attribution of properties.

(2) Against the backdrop of an imaginary essential hierarchy of genera and species of the thing in question, create a definition of the product.

In the event that an essential definition is unavailable or impractical, create an attributive definition using *propria* or accidents, which

(a) expresses the *propria* of the technical product in question

(b) distinguishes these *propria* from accidents

(c) operationalises them so that it is clear to all parties to the communication (including, for example, before the contract is concluded) when they are or are not present.

(3) Verify both the definition and the relevant essential succession in a normative publication (such as ISO), and then, where necessary, cross-check these definitions against the specific reality of the subject matter of the contractual relationship.

(4) Definitively establish the content of the term within the given essential succession, or, where necessary, amend the relevant definitions retrospectively.

7. APPLICATION OF ARISTOTELIAN ONTOLOGY IN EDSM

The above systematic considerations based on Aristotelian ontology and logic can apparently also be applied in the field of construction science – EDSM. We assume that both the system of philosophical concepts and the system of concepts of construction science form highly organised and coherent wholes.

In the case of EDSM, this is an area that is only seemingly remote from philosophy. EDSM is conceived as an effort to identify (recognise and describe), generalise, verify, systematically process and explain knowledge for the rational design and construction of technical products. In this endeavour, EDSM strives for a higher quality of knowledge organisation, which will enable more effective sharing (transfer of knowledge, know-how) and, consequently, more effective practical application. Everything that is common to the design of technical products as such can be explained and further developed more effectively and, at the same time, integrated with knowledge from other fields, such as contract law (see below).

The central concept of the EDSM is the term ‘technical product’, which the EDSM defines as:

a manufactured movable product (complex machinery, machine, device, etc.) as well as immovable technical equipment (buildings, transport structures, engineering networks, factories, power plants, etc.), i.e. an object with significant engineering content, including its parts, even in the development stages (foundations, shell construction, etc., complexes, assembly units, components, semi-finished products, raw materials) and the design stage (i.e. in the form of technical documentation). (Hosnedl, 2021)

This definition can be relatively easily linked to the findings of Aristotelian logic and ontology. In it, a technical product is captured by the generic term product, which is specified both by a pair of opposites (movable or immovable) and by a specific difference, which is ‘engineering content’. This undoubtedly includes both the formal aspect of the substance (the structure of the parts of the engineering content, which is reflected in the technical documentation, is mentioned) and the material dimension (the aforementioned semi-finished products, raw materials), which is, however, always determined by a form (engineering content is also manifested in semi-finished products and raw materials). The definition lacks a reference to the potentiality of the technical product and its performance (*ergon*), but there is no doubt that both aspects are represented – as in Aristotle – in the pair of matter and form.

However, when defining a technical product, we will tend to focus on its *propria*. It is therefore very appropriate that EDSM distinguishes between two types of properties: constructed properties (a certain organ or structural structure), which play, within the proposed model, a role analogous to *propria* in metaphysical theory, and reflected properties (which include functions – outputs, towards the user, the environment, etc.), which can be interpreted as the functional analogue to accidental properties (Hosnedl 2021)⁸. EDSM distinguishes between six classes of reflected properties and two classes of constructed properties of a technical product, and it is no coincidence that the constructed properties structurally correspond to the formal aspect of the technical product within the proposed analogical model. The properties of a technical product are clearly recognisable by means of a given property indicator⁹.

8. CONCLUSION

The preceding analysis allows the initial hypothesis to be confirmed in a qualified form. While a technical product cannot be considered a substance in the same ontological sense as an Aristotelian natural substance, it can be modelled on the concept of substance as a unified whole. Three related conclusions have emerged in particular:

Firstly, identifying technical products requires more than agreement about linguistic usage. While it is possible to engage in meaningful discourse about fictional and merely conceived entities, engineering and contractual discourse require object-directed conditions to determine whether a particular product satisfies the agreed specification.

Secondly, the conceptual identification of technical products can be modelled on Aristotelian second substance logic. Technical product kinds can answer the question ‘What is a particular product?’; they can be ordered within structures of synonymous, generic, and specific predication; and they can be distinguished from accidental properties that merely characterise individual products. This does not imply that second substances exist independently of their individual instances. On the contrary, the model presupposes the Aristotelian distinction between what is said of a subject and what is inherent in a subject.

Thirdly, an artefact can have a functionally constituted unity, which provides an objective basis for the structure of predication. Unlike natural substances, whose unity arises from internal causal principles of generation and activity, artefacts’ unity is externally instituted through productive intention and function. Nevertheless, in relation to language, meaning and identity, a technical product is a stable unity that meets the same four criteria as natural substances. We have therefore used

⁸ An example of constructed properties in the case of a technical software product is security against intrusion through Java technology; an example of a reflexive property is the form of the user interface.

⁹ In the above example, the indicator would be the use of Java technology in a given computer programme.

the term ‘artificial substance’ in a qualified and analogical sense, referring to an artefact whose matter, form, capacities, and performance are sufficiently unified to establish stable conditions of identity.

Therefore, a technical product need not be conceived as a mere aggregate, but rather as a functionally unified entity whose identity can be modelled analogically on substance. This qualified substantial unity provides an objective basis for factual communication and allows elements of Aristotle’s doctrine of synonymy to be applied to artificial entities.

The synthesis of Aristotelian philosophy and EDSM may therefore result in a taxonomy of technical products, viewed through the lens of the essential, necessary and accidental properties of a given substance. Based on the confirmed hypothesis that a technical product can be modelled on substance, such a synthesis will solve one of the fundamental problems in concluding contracts for the development and manufacture of technical products (including computer programs): the problem of providing a legally certain definition of the subject matter of such a contract. This provides an integrative framework capable of contributing to a philosophically more precise and, consequently, legally more reliable description of technical products, including software.

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