Coming to Terms

Science, Technology, and Medicine in Ancient Cultures

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Volume 14

Coming to Terms

Approaches to (Ancient) Terminologies

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Preface

In May 2014, under the auspices of the Berlin-based cluster of excellence TOPOI II, a workshop took place at Humboldt-Universität zu Berlin that attempted to look at ancient terminologies with an interdisciplinary focus. While the initial motivation of our discussions was to understand terminologies as creating and maintaining microcosms of expertise, with its gains and losses, soon a more general awareness of a certain lack emerged: it seemed to us that currently the only ones who happily worked on terminologies were linguists, and all others mainly worked *with* terminologies, often even under their constraints. Therefore, one of the basic tenets of the workshop was to say more about terminologies, both ancient and modern ones, beyond the standard questions of morphology or usage. In particular, strategic and aesthetic reasons, such as authority and beauty, respectively, to opt for one set of terms or one morphological principle among many and instead of others seemed to call for our attention. In some cases, these hidden agendas are easy to find, in others less so. I hope that some of the chapters collected here still transmit that interest.

For various reasons, notably due to the long lapse of time between workshop and publication, for which I alone am to blame, many among the participants of the 2014 workshop eventually decided against publishing their contributions. Besides Matthias Schemmel (now Hamburg University), Anna-Maria Gasser, Werner Golder (Aix-en-Provence), and myself, whose papers are part of the present volume, among the members of the original group were Reviel Netz (Stanford), Mark Geller (then FU, now UCL), Gerd Grasshoff (HU), Nalini Kirk (FU), Werner Kogge (FU), Jens-Olaf Lindermann (FU), Gerhard Seher (FU), and Chiara Thumiger (then HU, now CAU Kiel). In the course of the years, Dominik Berrens, Sabine Föllinger, Marcel Humar, Loren Marsh, Courtney Roby, Francesca Schironi, Thomas Stolz, and Ingo Warnke kindly agreed upon contributing papers to the developing collection. In the end, the present collection emerged, which is admittedly heterogeneous, but, perhaps, therefore transmits an idea of what we can do with terminologies without any ambition to exhaust the topic. As we all know, terminology is everywhere: As the zoologist had to a long time ago, the terminologist, too, happily quotes Heraclitus: *et heic di sunt* (in the words of Aulus Gellius).

<p style="text-align:center">✳✳✳</p>

Neither the workshop nor the present collection would have been possible without the help of various people and institutions. A word of thanks is due to Arianna Zischow who handled the workshop's organization with her usual superlative reliability and circumspection. Special thanks go to Birgit Nennstiel and her splendid work on the conference flyer and poster. Work on the present volume would have been difficult or even impossible without the help of Brett Thompson, Friederike Brunzema, and Vanadis Knebel.

Berlin, October 23, 2023   Markus Asper

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Markus Asper

Introduction

Coming to Terms: Approaching (Ancient) Terminologies

Every scholar who works on ancient Greek science writing soon stumbles upon problems of expert communication and how it works practically as a form of boundary work. Often the first impression of any ancient piece of science writing upon the modern reader, say, the Hippocratic *Epidemics*, Biton's ballistic works or Archimedes' *Method to Eratosthenes* is that she is confronted with a set of words that are new and problematic. The obvious reason for this effect is that groups of experts come into being and sustain themselves by, among other means, communication. One part of expert communication is terminology, that is, the use of words in a way specific to this group, as their sociolect or, perhaps, technolect or 'lingo'. As an act of communication, such a sociolect exhibits linguistic features serving certain functions, but it also has a certain social impact on how the group locates itself in the wider fabric of discourse and, in the end, of society. Since terminology is still one of the significant features of modern science and its communication, it provides an obvious choice for a testing ground in a multidisciplinary dialogue on the history of knowledge.

In any case, ancient terminologies seem to invite not only linguistic but also social-historical approaches. They also lead to comparisons with terminological practices from other cultures and epochs. With this spectrum of possibilities in mind, the reader will find in this volume a selection of articles that focus more on cultural comparison than on linguistics-oriented approaches. It is clear that in order to understand the emergence and workings of terminology in ancient (or any) science, one needs to look at terminology in other fields of knowledge, whether ancient or modern. As is commonly accepted by now, we have to allow for some fuzziness with respect to the term 'science', especially with respect to ancient cultures.[1] Historians of knowledge who use the method of comparison need to determine a common ground adequately covering the spectrum of knowledge-forms extending from the ill-defined fields of ancient sciences and related systems of knowledge to the relatively clear concept of modern science. Terminology and its uses certainly belong to that common ground.

What aspects of terminology and terminologies can we study in these ancient fields? What can we do with terminology? The following list of aspects perhaps provides a notion of possible approaches.[2]

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1 For a good recent discussion see Lloyd 2009, 153–171.
2 For the approach known as "traditional terminology" and its mostly descriptive approach, see Temmerman 2000, 2–15.

First, one can simply try to identify certain elements of a given text or discourse as 'terminological' and then try to establish their precise meaning, that is, adopt the stance of the lexicographer of a given corpus. This is far from trivial when complicated topics such as Greek pharmacology or Roman surveying are concerned. Ideally, we would arrive at an expert's lexicon.

Second, one can ask what the more general *differences* are between terminological and ordinary discourse. It might seem that with respect to historical material, this leads almost automatically to questions of either a linguistic-synchronic (in a given discourse, what qualifies as 'terminological'?) or linguistic-diachronic, viz. historical, nature (in a given discourse, how did terminology emerge and develop?). In many of the fields of the papers that follow, the uncomfortable impression emerges that the difference between terminological and non-terminological is not always clear and sometimes difficult to determine (e.g., in Aristotle). Sooner rather than later, one would run into questions of how terminology is created in a linguistic sense. In that respect, the only systematic approach I can think of is to be found in investigations of metaphor. The role of metaphor in the emergence of terminology has often been in the focus of research with respect to both Greek science, especially the Presocratics, and modern science, especially physics, with a focus on it as a conceptual tool.[3]

Third, one can study certain *features* of any given terminology, such as its tendencies toward neologisms or certain aesthetics. Today, across the many different terminological areas we all participate in, acronyms and '-isms' are both very popular for reasons that are not exclusively attributable to linguistic motives. Very simply, neologisms can point us to changes in any traditional body of knowledge. For example, Ps.-Aristotle's *Mechanics* perhaps introduces a new term, σταθμός, for 'abstract weight' as opposed to σταθμόν for 'any given actual weight'. Obviously, such coinage indicates a new need for more precise terms and corresponds to new insights into the laws of mechanics. Here, some features of terminology may indicate progress or, at least, change within and differentiation of a certain field.[4]

Features of terminology might also tell us something about the aesthetic expectations of a 'scientific' term. Comparisons with modern expert groups could easily follow from this. Everybody knows that Greek and Latin, the source of many terminologies in European academia for so long, is currently being succeeded by English, which has, of course, its own share of Latin roots. Medical experts, probably varying by field, still tend to cling to Greco-Roman roots when coining new terms, whereas economists, sociologists, or engineers, I guess, come up with terminologies based on English. Any need for a new term has to answer to these expectations, too. Thus, closer study of any expert group's terminology could possibly reveal some elements of an implied 'poetics of ter-

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3 See, e.g., my paper on metaphors in Hellenistic literature (2015a; some literature at p. 54, n. 47).
4 Provided the phenomenon truly exists and it is not just some scribal decision (see Joyce van Leeuwen by e-mail, Feb. 5, 2014).

minology', that is, some implicit normative concepts (rules) of how terminology should look like to be effective, or, perhaps even 'beautiful'. By 'poetics of terminology' I mean some shared assumptions about what constitutes a useful, adequate or even elegant term. In other words, we could arrive at an aesthetics of terminology, always related to a group of users.

Fourth, one can ask what the *functions* of any given terminology are. Experts compete. We can assume, then, that their terminology is, to some degree, an index of such competition, both with other groups of experts and with non-experts. Terminologies, thus, could result from strategically motivated decisions or carry out certain strategies themselves. For example, the notorious terminological chaos of Hellenistic medicine and philosophy is usually conceived of as an indication of stiff competition among the participants of the game.[5] Here, terminology becomes an actor's tool to place herself in a market and perhaps even secure her position for years to come. Therefore, for us, terminology offers itself as a tool to reconstruct such markets. Notation and its great varieties provide another direction for functional exploration of terminology. Within the history of science, terminology might even become the index of certain qualities of a specific discourse of experts (what Fleck called "thought style").[6] Moreover, in these fields, meta-terminology emerges, that is, a discourse on how to choose terms (famous in our field is Galen's treatise *On Medical Terms* (*Über die medizinischen Namen*)).

Today, terminology studies, understood as a sub-discipline of *Fachsprachenforschung*, has become a field in itself, mostly concerned with linguistic aspects, more recently in the context of digital humanities research.[7] I hope that it is fair to say that descriptive approaches have been far stronger in this field than interpretive ones. One aspect of the interpretation of terminologies, boundary work, has already been mentioned. Boundary work might, however, be only one among many functions of experts' terminologies. Most and perhaps all terminologies have something we might call a 'hidden agenda'. This means that they come with some additional associations and vague implications, which may add new layers of meaning to the disciplinary discourse. Let me give some examples of different aspects:

(a) As I have already mentioned, during some part of its history, some fields in modern physics preferred terms based on Presocratic terminology. Obviously, the primary claim of such a labeling practice is the claim of a continuity with or a reaching back to some

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5 To my knowledge, Ludwig Edelstein was the first to identify this correlation, which has been made central to the analysis of Greek science by Geoffrey Lloyd and was then utilized by Netz for the analysis of the social field in which Greek mathematicians operated. See Lloyd 1983, 163 referring to Rufus, *Onom. med.*; sim. Lloyd 1996, 264; Netz 1999, 123; Netz 2009, 158 on Herophilus; cf. Edelstein 1963, 29.

6 Fleck 1979, 125–145 presents the example of an early nineteenth-century treatise on urine, which is largely opaque to the modern physician due to its terminology, which is steeped in Aristotelian and Galenian terms and concepts.

7 See the overview in Roelcke 2010, esp. 114–116, and L'Homme 2020.

charismatic past, that is, an unexpected form of classicism. Additionally, whoever tries to establish such terminology also attempts to make a statement about her own status, at least in terms of general education, probably even of constructing historical analogies.

(b) Sometimes terminology simply uses an individual's name, e.g., 'Grassmann's law' in optics or 'Graßmannsches Hauchdissimilations-Gesetz' in linguistics or 'Erlenmeyer flask' in chemistry. It is evident that such terminology adopts an ideology of monumentalization, which pays memorial tribute to a foundational figure. At the same time and similarly to what was stated in (a), everybody who uses the term constructs a certain analogical history; at the least, she provides historical perspective to her activities. In other words, such use of terminology tells us something about the ideological framework adopted by the group that uses such terms.[8]

(c) Modern science and administration sometimes adopt terminological acronyms that exhibit a certain playfulness. There are many examples, such as the device seductively named AMANDA (*Antarctic Muon and Neutrino Detector Array*, a kind of neutrino-based telescope)[9] or the ironically termed institution SIESTA (*Spanish Initiative for Electronic Simulations with Thousands of Atoms*, a method and a software implementation for performing electronic structure calculations in quantum chemistry).[10] Who gains here, and what? With such acronyms it seems that scientists display an ironic stance toward their work, a stance which is itself part of the performance and impacts the performer's status. While the playfulness here is obvious, its functions are not. It might be a move meant to distinguish oneself from competing actors as less ironically detached.

(d) Historians of science could mine terminologies for some facts about the communicating groups, e.g., about their internal structures or about cross-cultural transfers of knowledge. For example, if Greek medicine really did inherit some assumptions, arguments, concepts, treatments, and medicines from surrounding cultures, which at this point seems to be a commonly shared assumption, why are there so few medical loan-words? Compared to the fields of measurement and money, where loan-concepts and loan-words abound, this lack must highlight a certain difference in the manner of transmission of that knowledge.[11] More generally, the expert's lexicon will give us some information on how her group is structured: whether it's small or big, homo- or heterogeneous, how old its traditions are, and so on. For example, in comparison with other expert groups, a higher degree of institutionalization might be the reason for a more closely defined set of terms. For instance, early, viz. Hippocratic, Greek terms for disease include a remarkably high number of terms ending in -*itis* (*pleur-*

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8 It seems that such approaches, even to names as starting points for constructing terminologies, have not played a significant role in terminology studies (see L'Homme 2020, 1–6).
9 www.nsf.gov/pubs/1996/nstc96rp/sb5.htm, last accessed on Feb. 22, 2023.
10 www.simuneatomistics.com/products/siesta-code/, last accessed on Jan. 21, 2023.
11 See my 2015b, 29–31.

itis, *nephritis* (πλευρῖτις, νεφρῖτις)), some of them still in use today, thus betraying some desire for consistency and some interest in 'scientific' naming even before our earliest medical texts appear.[12] Another historical set of questions asks for when terminology became stable in Greek philosophy, in what fields, and why? It seems, for example, that while Aristotle has much to say on definition and its uses in apodeictic discourse, his own terms are not reliably stable, that is, are not really terminological (e.g., he uses *katholou* (καθόλου) differently in *Physics* I 1 and *Anal. Post.* II 19,[13] which has caused much confusion). Whether viewed as a charming feature or as a professional shortcoming, it tells us something about the degree to which stable terminology is expected in Aristotelian discourse. At times, he polemicizes against pedantry and accuracy beyond a certain degree, because he thinks it unworthy of a gentleman's approach to things (in other words, below the social level of his intended readership). In short, terminology might work for us as an index of professionalization in terms of a field's autonomy. Aristotelian philosophy is not 'professional' in the sense that it communicates entirely separately or mainly according to rules that are specific only to this field.

Today, the establishment of new terminology is itself an interesting area of study at the crossroads of history and sociology of science because it reveals power-struggles in each field.[14] On the one hand, there are communal attempts to establish a usable terminology in almost every field of modern science. Here is a quote from a paper on terminology in medical diagnosis (Baloch et al. 2008, 428) which includes the results of the terminological work of a committee: "The term 'suspicious' is favored for potential malignant lesions." We see that unlike Greek science, modern medicine does not attempt a definition, but gives a labeling recommendation instead. On the other hand, in the field of *Fachsprachenforschung*, that is, the linguistics of technolects, models of mapping the procedure of terminologization have emerged.[15] It is obvious that due to the lack of data, nothing comparable can be achieved with discourses of knowledge in ancient cultures. However, we can at least think about questions such as how, say, Aristotle or Euclid solve the problem of terminologization. The conclusion would be that they all use a similar approach, namely that of definition, an approach that is markedly different from, say, how the physicians in the Hippocratic corpus handle terminological matters.

(e) Contemporary students of science might think about the *risks* of terminology within the broader context of science studies. They may consider questions of the involvement and thus responsibility of experts in political decision-making and, more

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12 The *communis opinio*, however, states the exact opposite: see Lloyd 1987, 203 with n. 114 (Lonie).

13 Thanks to Jonas Dehn who has established the fact in his BA thesis (unpublished, HU Berlin 2014).

14 For an institutionalist view see Felber & Budin 1989, 221–228. This description of how, for example, DIN or ISO works, functions as a starting-point for comparison with ancient or non-Western cultures.

15 See Roelcke 2013.

broadly, of participation.[16] Among the many attempts to explain why scientific progress in Greece apparently stopped after the Hellenistic age (problematic as that impression may be), one is pointing out terminological chaos as an indicator of exaggerated competition. We all know the commonplace that most patients do not understand what their doctors are saying, but may be, at the same time, either impressed or disgusted by these carefully constructed linguistic barriers. This implies certain risks and gains of professional interaction between doctors and patients, but it also indicates some remarkable differences in Greco-Roman upper-class medicine, where convincing the patient of the correctness of the doctor's etiology and therapy was of utmost importance to the physician.

I am quite sure that this ad hoc list leaves much to be desired, certainly in terms of structure. For example, it is obvious that the sociological approach cannot be kept separate from the linguistic one, at least not with respect to ancient cultures. Any attempt to draw up a list of everything there is to do with respect to terminologies in ancient sciences would prove rather futile. However, I hope that the following papers can illustrate the range of possible fields to approach and of the various ways of approaching them.

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As I have tried to illustrate above, there are many ways to address terminologies in knowledge systems. This volume presents 11 papers and probably as many ways to proceed, many of them combining several of the approaches described above.

We begin with an exemplary exposition of two distinct terminological fields: **Francesca Schironi** gives an account of the language of Greek astronomy. She stresses that, with respect to the perspective of human observers of the sky, Greek astronomers were quite effective in coining terms, sometimes more so than their modern successors. The field itself develops from early Hellenistic astronomy to Ptolemy who, in terms of terminology and other things, systematized and ordered it. **Courtney Roby** looks at the terminology of the Roman surveyors, a field that, unlike astronomy, was fraught with any number of legal and epistemic discourses. The surveyors developed their terminological system through interactions between landscape, their specific functional intentions, and texts; they had to adapt it continually and at the same time guarantee its usability for generations to come. In a way, while astronomy was a matter of description and explanation, surveying terminology is of more importance to coming to terms with one's surroundings and, thus, implicated in social and historical contexts on a different level than 'scientific terminology'. **My own paper** adds illustrations of 'rich' terminologies as opposed to 'lean' ones, that is, of the various implications that might come with terminological choices, exemplified through snippets taken from larger fields, namely rhetoric, medicine, and siege lore. Rich terminologies go beyond purely functional con-

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16 For a sample of such discussions, see Pilke et al. 2021, 3–9.

cepts of terminology; often, they contribute to the success of terminological choices. Located in a field of tension between aesthetics and ideology they have hitherto not received proper attention. In highlighting this aspect of terminology studies, I hope to provide something of an implicit commentary to many discussions of terminologies presented here.

Not surprisingly, Aristotle and Aristotelian science contributes much material to the historical study of terminologies. In the second section, five papers illustrate terminological practices in Aristotle's works and in (early) modern fields that have carried Aristotelian influences and patterns into zoology and botany. **Sabine Föllinger** discusses the terminological choices adopted by Aristotle in his *De generatione animalium*. She shows how theoretical and terminological work goes together and how analogization and metaphor play an important role in both. Since Aristotle had to face the challenges of already existent terminological facts and of integrating new observations and arguments that demanded new terms, Föllinger can observe his rhetorical practices in establishing new terms. In a different, but similarly influential field, the study of poetry, **Loren Marsh** carefully looks at terminology in the Poetics. As many studies and translations of the Poetics have shown, the terminological status of many terms used in the Poetics is difficult to access. Taking *mimēsis* as his example, Marsh argues that although usually considered a philosophical term, it might rather have a more technical meaning concerning the organization or arrangement of imitations. Such an assumption might solve some difficulties and confusions Aristotle's terms have provoked. With a view to the whole Aristotelian corpus, **Anna-Maria Gasser** in an especially rich paper discusses the terminological paradox of Aristotle, who establishes complex systems of terms, often defined or re-defined, but, on the other hand, falls short of modern standards of terminology that demand standardization and consistency. Focusing on clarity, she advocates, against Aristotle's own explicit statements, for flexibility and reusability as his primary intentions in using and coining terms. In addition, Aristotle seems to prefer simple and ordinary words as a basis for terminology, at least partly for aesthetical reasons. Taking a different stance, **Marcel Humar** surveys zoological naming practices, that is, the nomenclature of species, from Aristotle's to our times. He finds a host of naming practices that stress non-scientific agendas, for example, mythological allusions, memorial practices within the scientific community, strategic naming, and even ludic naming (suffice it to highlight *neopalpa donaldtrumpi*, a moth species). The material assembled suggests that naming practices in science can serve as tools for various intentions that are non-related to the zoological science. The section's last paper, by **Dominik Berrens**, shows in great detail how humanist botanical authors were coping with classic terminological systems in Latin on the one hand and an overwhelming number of new data that needed to be named and classified on the other. Berrens follows these struggles to the point at which our modern system of nomenclature emerges.

The last section brings together studies that touch upon a wide range of modern terminologies. In the contested field of modern professional and highly technical medicine, **Werner Golder** describes the different functions medical terminology serves between scientific discourse, medical procedure, economic considerations, and communication with patients. Golder has many critical things to say about current terminological practice in medicine and, thus, provides a view on the future of the ancient terminologies discussed in this volume, notably the Peripatetic ones. Occasionally, professional terminology obscures deficient practices (one might wonder whether this, i.e., the back and forth of exclusion and inclusion, is one of the most attractive social functions of terminologies). **Matthias Schemmel**'s contribution touches upon a topic that resonates through all of this volume, namely how terminology relates to everyday language. He adopts an historian's stance and discusses three rather unrelated fields: ancient Chinese theoretical texts and their terminology of space, Newtonian mechanics, and the terminologies of relativity theory in the twentieth century. He shows that despite their many differences, all three exhibit the same tendency whereby the integration of knowledge leads to an increasing distance of terms from their everyday equivalents. The final paper of our volume, by **Thomas Stolz** and **Ingo Warnke**, describes in detail how in a highly specialized field, the semiotics of geographic names, a new research current, namely an interest of language on maps, leads to coining a new term, *epikhartikon*. It brings, to me, a certain satisfaction that this new term is, essentially, an ancient Greek one.

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It is to be feared that this volume exhibits, once again, the usual weaknesses of the *sammelband*.[17] Nonetheless, I do hope that its heterogeneous content and manifold aspects, leading into different, and sometimes unforeseeable, directions, can document that there is much to find in terminologies.

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17 As eloquently described by Kemp 2009, esp. 1018f.

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Francesca Schironi

The Language of Astronomy

Abstract: In this preliminary survey of the terminology of Greek astronomy, I have focused on the terms used to name the different circles of the celestial sphere, as well as on stellar positions and their phases. The analysis shows how Greek terminology is very effective at describing many phenomena as seen by an observer on the Earth – possibly even more precise (or clear) than modern analogues. In fact, even when the latter are derived from the Greek, they have lost the richness of their etymological primary meaning, which is important to understand the astronomical phenomena they express. The nomenclature of star phases also shows the development of a complete set of technical terminology for one specific field, which we can trace from the Hellenistic period until Ptolemy, who systematizes it and gives it consistency and order.

The technical terminology of Greek astronomy is fascinating and rich – yet no studies of it exist except some short discussions within the introductions of some foundational texts.[1] Starting from these studies and using my own work on astronomical texts, I will here provide a preliminary survey of some important features of this technical language. I will limit most of the analysis to the description of the celestial sphere, to star positions and phases since covering other fields like planetary motions or astrology would go beyond the scope of this chapter.[2] Yet, as I will show with some ad hoc examples, some technical terms used for the fixed stars apply to the planets as well.

The Greeks considered astronomy to be a branch of mathematics; in fact, an astronomer (*astronomos* (ἀστρονόμος) but also *astrologos* (ἀστρολόγος)) could also be called *mathēmatikos* (μαθηματικός).[3] Indeed, Greek astronomers modeled the sky geometrically on the idea of the celestial sphere on which all the heavenly bodies move, and their astronomy, which is mostly concerned with the motions of the celestial bodies, is to a large extent spherical geometry. Therefore, some of their prose is very similar to Euclid's *Elements* but applied to the sphere (e.g., Euclid's *Phaenomena*, Autolycus' *On the Movement*

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1 See for example, Toomer 1984, 17–24; Evans & Berggren 2006, 68–72, 140–145, 291–299. A very good discussion of some key astronomical terms is offered by Jones 2016, 481–486, who also provides an exemplary translation of a passage of Theon's *The Mathematics Useful for Reading Plato*, in which he attempts to translate the text without 'modernizing' the ancient terminology using modern astronomical counterparts (which, for example, Toomer does in his translation of the *Almagest*).

2 For some discussion of the language of astronomical papyri, mostly horoscopes, see Jones 1999, 1, 9–11, 61–63. For a glossary of terms used in horoscopes, see Neugebauer & Van Hoesen 1959, 2–13.

3 In fact, Ptolemy only uses *mathēmatikos* and never *astronomos* or *astrologos*.

of the Sphere, and parts of Ptolemy's *Almagest*). Yet astronomy is also concerned with the 'appearances' or 'visible phenomena' (*ta phainomena* (τὰ φαινόμενα)), which means that astronomical texts often also have a strong descriptive component. For this component, as well as for the new concepts introduced by different astronomers, terminology is very important and rich in Greek astronomy.

The names of the Greek constellations are traditional. Those of some stars and constellations are already attested in Homer and Hesiod: the Pleiades (*Iliad* 18.486, *Odyssey* 5.272; Hesiod *Works and Days* 383, 572), the Hyades (*Il.* 18.486), Orion (*Il.* 18.486, 488, *Od.* 5.274, *WD* 609), the Great Bear or Wagon (*Il.* 18.487, *Od.* 5.273), Boötes (*Od.* 5.272), the stars Sirius (*WD* 609), also called the 'dog of Orion' (*Il.* 22.29–30), and Arcturus (*WD* 566, 610). The most complete and ancient list of constellations is offered by Aratus, whose poem *Phaenomena* (based on the work of the astronomer Eudoxus) is the first description of constellations in the Greek world. The list became traditional and these names standard, as they were 'canonized' in Ptolemy's Catalogue of Stars (in books 7 and 8 of the *Almagest*) and transmitted by the Islamic astronomers to the modern world. Precisely because they are not 'technical' terms, I will not discuss constellation names here;[4] rather, I will focus on how Greek astronomers built a technical terminology around stars and their motions in the celestial sphere.

1 Naming the Celestial Sphere

The celestial sphere is an innovation of Greek astronomy, since the Babylonians never conceived of the cosmos in geometrical terms and their astronomy was mostly based on arithmetical computations and observations. For the Greeks, however, the cosmos is a sphere with the Earth at its center. Euclid's *Phaenomena* describes the celestial sphere and all the main circles upon it (Fig. 1). To a large extent, we still use the same model. Yet an analysis of the Greek words used to describe the celestial circles will highlight some additional features of the Greek conception of the celestial sphere as well as underscore some interesting differences with modern terminology.

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4 For a discussion of the traditional names of Greek constellations, see Schironi (forthcoming), Chapter 9.
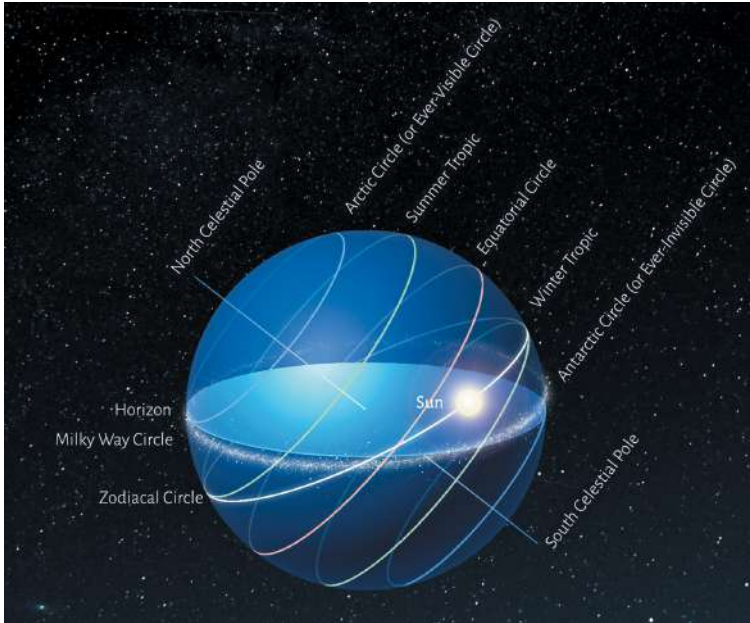
Fig. 1: The Main Celestial Circles – except the South Meridian and the Colures.

Some of the names of these circles are clearly derived from what an observer on the Earth perceives. One is the 'horizon' (*ho horizōn* (*kuklos*) (ὁ ὁρίζων (κύκλος))), the circle that 'delimits' (*horizein* (ὁρίζειν)) the visible and invisible parts of the cosmos. Furthermore, for an observer on the Earth there is a portion of the sky that is always visible and one which is never visible. The Greeks call these 'the ever-visible circle' (*ho aei phaneros kuklos* (ὁ ἀεὶ φανερὸς κύκλος)) or 'arctic' circle (*ho arktikos kuklos* (ὁ ἀρκτικὸς κύκλος)) and 'the ever-invisible circle' (*ho aei aphanēs kuklos* (ὁ ἀεὶ ἀφανὴς κύκλος)) or 'antarctic' circle (*ho antarktikos kuklos* (ὁ ἀνταρκτικὸς κύκλος))[5] – since of course the Greek point of observation is the northern hemisphere. In modern translations, they are often rendered with 'Arctic Circle' and 'Antarctic Circle'. However, this is not strictly correct. For the Greeks these circles, just like the horizon, were firmly connected with the observer and changed according to the position of the latter (assumed to be in the northern hemisphere). In addition, these circles were imaginary circles on the celestial sphere; they delimited the area of circumpolar stars that never set and the area in the southern hemisphere where stars are never visible for someone in the northern hemisphere. Indeed, one of the first phenomena that an observer on the Earth notices is that some stars are always visible in the sky, and that they trace circular orbits. The Greeks

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5 For example, Hipparchus mostly uses ὁ ἀεὶ φανερὸς κύκλος and ὁ ἀεὶ ἀφανὴς κύκλος while Geminus (*Isagoge* 5.2 and 5.9) speaks of ὁ ἀρκτικὸς κύκλος and ὁ ἀνταρκτικὸς κύκλος.

noted this phenomenon (which led Aristotle to say that circular movement is typical of the heavens) and named those circles after it. On the contrary, the modern 'Arctic Circle' and 'Antarctic Circle' are actually imaginary circles on the surface of the Earth: in particular, the Arctic Circle is located at +66°33′ and the Antarctic Circle at −66°33′. In other words, these circles are measured relatively to their distance from the terrestrial equator and, most importantly, are fixed and do not depend on the location of the observer, since they delimit the zones in the northern (Arctic) and southern (Antarctic) hemispheres in which, at certain times of the year, there is no day or no night. Yet the modern names do not reflect this definition: 'arctic' and 'antarctic' are borrowed from the Greek (*arktikos* (ἀρκτικός)) and *antarktikos* (ἀνταρκτικός)), but the Greeks used the terms for a different concept and named them according to their supposed proximity to the Great 'Bear' (*arktos* (ἄρκτος) in Greek), i.e., close to the north celestial pole, or in opposition (*anti-* (ἀντι-)) to it.

Another name derived from the observer's perception concerns the only circle really visible in the celestial sphere: the Milky Way, which appears as a whitish luminescent strip in the sky. In Greek, it is called *ho galaxiou kuklos* (ὁ γαλαξίου κύκλος) or *ho galaxias* (ὁ γαλαξίας), from *gala* (γάλα), 'milk'. Interestingly, modern terminology loaned the word but gave it a different meaning. In fact, the Greeks, who could only see this single whitish strip, simply named it 'Milky Way' or *Galaxias*. Modern astronomers borrowed the term but changed its meaning after better understanding the physical phenomenon. They realized that the Milky Way is the stellar conglomerate hosting our solar system and extended this name generically to refer to any similar conglomerate in the universe (the galaxies), giving each either its own identifier (e.g., NGC 224 or M 31 according to the catalogue) and in a few cases its own name (e.g., the Andromeda galaxy).

Other celestial circles are connected with other observable phenomena: the time passing on the Earth and the Sun's motions in the sky. The celestial equator is *ho isēmerinos (kuklos)* (ὁ ἰσημερινός (κύκλος)), literally meaning '(the circle) with days of equal duration' or 'equinoctial (circle)'. Ptolemy himself explains the etymological reason for this name:

> *Syntaxis* 1.8. (vol. 1,1, 26.19–23 Heiberg): ὁ μέγιστος κύκλος ἰσημερινὸς καλεῖται διὰ τὸ μόνον αὐτὸν ὑπὸ μεγίστου ὄντος τοῦ ὁρίζοντος δίχα πάντοτε διαιρεῖσθαι καὶ τὴν κατ' αὐτὸν γιγνομένην τοῦ ἡλίου περιστροφὴν ἰσημερίαν πρὸς αἴσθησιν πανταχοῦ ποιεῖν.

> [Of the parallel circles on the celestial sphere] the greatest circle is called 'equinoctial' because it is the only one to be always divided in half by the horizon, which is a great circle, and because the course of the Sun along it always produces 'an equinox' to our perception.[6]

The equator is the only one of the parallel circles (i.e., the circles lying on planes perpendicular to the Earth's rotation axis) which is also a great circle, such that it is al-

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6 All translations are mine unless otherwise noted.

ways cut into two equal parts by the horizon (another great circle). In addition, the equator includes the equinoxes or equinoctial points (*isēmerina sēmeia* (ἰσημερινὰ σημεῖα)), which are the points where the equator intersects the ecliptic. They are temporally significant because, as Ptolemy says, when the Sun is on those points, the length of the day is equal to the length of the night. Indeed, *isēmeria* (ἰσημερία) is the 'equinox', which is the 24 h period in which night and day are of equal length.[7] The adjective *isēmerinos* (ἰσημερινός), 'equinoctial', is also often used in connection with time, rather than space – this is the case with *isēmerinai hōrai* (ἰσημεριναὶ ὧραι), 'the equinoctial hours', which are the hours of 60 min each as opposed to the 'seasonal hours' (*kairikai hōrai* (καιρικαὶ ὧραι)).[8] What seems at first to be an ambiguity between 'equator' and 'equinox' in fact demonstrates the way in which Greek terminology connects the place on the sphere (the celestial equator) with its important function regarding time. On the contrary, the modern terminology, which derives from the Latin equivalents, *aequator* and *aequinoctium* (the latter from *aequus* and *nox*), keeps the two ideas distinct, concealing the astronomical connection between the Sun's trajectory and its important function in terms of time on the Earth.

Another important circle on the celestial sphere is the tropic, *ho tropikos* (*kuklos*) (ὁ τροπικὸς (κύκλος)), the point at which the Sun 'turns' (*trepetai* (τρέπεται)) its course.[9] There are two tropics: *ho therinos tropikos kuklos* (ὁ θερινὸς τροπικὸς κύκλος), the 'summer tropic circle', which we call the Tropic of Cancer because the sign of Cancer lies on it, and *ho kheimerinos tropikos kuklos* (ὁ χειμερινὸς τροπικὸς κύκλος), the 'winter tropic circle', which we call the Tropic of Capricorn, because the sign of Capricorn lies on it. Just as in the case of the equator, the Greek names connect these circles on the celestial sphere with a time in the year: the two tropics are linguistically connected with the solstices, the *therinē tropē* (θερινὴ τροπή), 'summer solstice', and the *kheimerinē tropē* (χειμερινὴ τροπή), the 'winter solstice', which occur when the Sun is on the solstitial points (*tropika sēmeia*, τροπικὰ σημεῖα), that is, the points at which the ecliptic, which is slanted with respect to the celestial equator, reaches its maximum or minimum declination. These points mark the beginning of

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7 As Geminus clarifies there are two meanings of 'day': *Isag.* 6.1 Ἡμέρα λέγεται διχῶς, καθ' ἕνα μὲν τρόπον χρόνος ὁ ἀπ' ἀνατολῆς ἡλίου μέχρι δύσεως, καθ' ἕτερον δὲ τρόπον ἡμέρα λέγεται χρόνος ὁ ἀφ' ἡλίου ἀνατολῆς μέχρις ἡλίου ἀνατολῆς (the word 'day' is used in two ways: in one way, [it is used for] the time from the rising of the Sun to its setting; in the other way, 'day' is used for the time from the Sun's rising until the [next] Sun's rising).

8 The latter are a twelfth part of a day or a night, independent from the time of the year. As such they were hours of unequal length. They were commonly used in Greece. In the Hellenistic period, 'equinoctial' hours were introduced for astronomical calculations, becoming the standard for Greek mathematical astronomers.

9 As Geminus clearly says: *Isag.* 5.5 Μετὰ μέντοι γε τὴν θερινὴν τροπὴν οὐκέτι πρὸς τὰς ἄρκτους παροδεύων ὁ ἥλιος θεωρεῖται, ἀλλ' ἐπὶ τὰ ἕτερα μέρη τρέπεται τοῦ κόσμου, διὸ καὶ κέκληται τροπικός (after the summer solstice the Sun is not seen proceeding any longer toward the north but it turns toward the other part of the cosmos, and for this reason it has been called 'tropic').

the signs of Cancer (northernmost declination) and of Capricorn (southernmost declination). Just like the previous case, the modern terminology blurs this distinction. 'Solstice' is derived from the Latin *solstitium*, from *sol*, 'sun', and the verbal root of *sistere*, which means 'to stand still' (as the Sun 'stands still' at the tropics just before 'turning'); yet in English (as well as in other modern languages with similarly Latin-derived terms), this sense is lost, as well as the connection between the longest or shortest day of the year and the Sun's position in the sky.

To conclude, while Greek terminology makes it easier to connect the celestial sphere and the Sun's motion in it with what occurs on the Earth in terms of seasonal changes, this connection is far less evident in modern terminology, where the 'tropics' and the 'equator' both refer to circles in the celestial sphere and on the Earth, and 'equinoxes' and 'solstices' no longer linguistically connect these times in the year to the positions of the Sun on those circles.

Another name that connects what we see from the Earth to the path of the Sun is *ho mesēmbrinos* (ὁ μεσημβρινός (κύκλος)), 'the meridian'. In this case, the modern terminology is close to the ancient one but, again, far less precise: in Greek, μεσημβρινός is the standard word for 'midday'; hence, it indicates the south meridian because in the northern hemisphere this is where the Sun reaches the highest point in its daily path (i.e., culminates).[10] Yet, because of this reason, μεσημβρινός can also indicate 'south', as we will see below. As a consequence, unlike in modern astronomy, there is only one 'meridian' in Greek that changes with the observer, but always points at south/midday. Any other 'meridian' is simply called 'the circle [traced] through the poles' (*ho dia tōn polōn [graphomenos] kuklos* (ὁ διὰ τῶν πόλων [γραφόμενος] κύκλος)) by Hipparchus and Ptolemy. There are only two more specific meridians: the colures (*kolouroi* (κόλουροι)). The solstitial colure passes through the poles and the solstitial points, and the equinoctial colure passes through the poles and the equinoctial points. They bear the name κόλουροι – 'with a cut tail' (κόλος + οὐρά) – because their respective segments located around the antarctic circle are always hidden.[11]

Similar is the case with the other great circle, the ecliptic. It has a Greek-sounding name which derives from the word 'eclipse', since eclipses occur near it. This is so because, from the point of view of an observer on the Earth, the ecliptic path is that which the Sun travels relative to the fixed stars; the Moon too moves along this path

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10 Gem. *Isag.* 5.64 Μεσημβρινὸς δέ ἐστι κύκλος ὁ διὰ τῶν τοῦ κόσμου πόλων καὶ τοῦ κατὰ κορυφὴν σημείου γραφόμενος κύκλος, ἐφ' οὗ γενόμενος ὁ ἥλιος τὰ μέσα τῶν ἡμερῶν καὶ τὰ μέσα τῶν νυκτῶν ποιεῖται (the meridian circle is the circle traced through the poles of the cosmos and through the zenith point; when it comes upon it, the Sun marks the middle of the days and the middle of the nights).
11 Achilles, *Isag.* 27.3 κόλουροι δὲ κέκληνται διότι δοκοῦσιν ἡμῖν κεκολοῦσθαι ὥσπερ τὰς οὐρὰς διὰ τὸ ἡμῖν μὴ φαίνεσθαι αὐτῶν τὰ ἀπὸ ἀνταρκτικοῦ καὶ ἀεὶ ἀφανοῦς κύκλου καὶ δοκεῖν κεκολοῦσθαι αὐτοὺς κατὰ τοῦτο τὸ μέρος· (They have been called colures because they seem to us to have been 'cut' [*kekolousthai*] like 'tails' [*ourai*] because their parts from the antarctic and ever-invisible circle are not visible to us and they seem to have been cut [*kekolousthai*] at this part) (trans. Aratus Project: https://aratus.classics.lsa.umich.edu/).

(with a deviation of around 5° relative to the orbital plane of the Earth around the Sun); because of this, we can only see eclipses of the Moon or of the Sun along this path. However, the term 'ecliptic' is almost never used by Greek astronomers,[12] who use 'zodiacal [circle]' (*ho zōdiakos* [*kuklos*] (ὁ ζῳδιακὸς [κύκλος])) or circle through the middle of the 'zodiacal signs' (*ho dia mesōn tōn zōdiōn kuklos* (ὁ διὰ μέσων τῶν ζῳδίων κύκλος)). Indeed, in the night the ecliptic is marked by the zodiacal constellations and this is how the ancients could identify it in the sky – hence it is a much more natural way to denote this circle than our 'ecliptic', which requires some in-depth knowledge of astronomy to understand what it is.

2 Naming Star Motions

Most of Greek astronomy is concerned with tracking the positions of the heavenly bodies in the sky. Most often this means expressing the relative position of a heavenly body with respect to one specific point. We are used to spherical coordinates and above all to cardinal points to place objects in spheres, specifically on the Earth and on the celestial sphere. This is the result of the many efforts of Greek astronomers to define 'points of reference' on the sky in order to measure the celestial bodies' paths in it. Still, there are important differences between our terminology and the Greek terminology when discussing directions and motions in the sky.

2.1 Positions of Stars as Viewed from the Earth

The Greeks had two ways of naming cardinal points, either with respect to the winds or with celestial phenomena. In the latter system, North is called *arktos* (ἄρκτος), which means 'bear' and, more specifically, the Ursa Major. We have to remember that at the time there was no Polaris to indicate the north, while the Great Bear is a very recognizable constellation close to the northern celestial pole. All other directions are connected with the Sun. East and west are, respectively, *anatolē* (ἀνατολή), the place of the 'rising' of the Sun, and *dusis* (δύσις) or *dusmē* (δυσμή), the place of the 'setting' of the Sun, while south is *mesēmbria* (μεσημβρία), 'noon', where the Sun can be seen at midday when it culminates. Of course, since μεσημβρία, ἀνατολή and δύσις also (and primarily) indicate the positions of the Sun, sometimes this can create confusion in translating an astronomical text. On the other hand, this system makes it very easy

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12 The term 'ecliptic' occurs only once in Achilles who in his *Isagoge* says: 23.2 διὸ καὶ ἡλιακὸς ὑπὸ τῶν ταῦτα δεινῶν προσηγόρευται καὶ ἐκλειπτικός, ἐπειδὴ ἐν αὐτῶι αἱ ἡλιακαὶ ἐκλείψεις γίνονται (Therefore it has been called both the heliacal [i.e. the 'Sun's'] and ecliptic [circle] by those who are experts in these things, since the heliacal [i.e. solar] eclipses occur on it) (trans. Aratus Project).

for a user to orientate himself according to the Sun. Just like with the circles of the celestial sphere, Greek terminology exploits specific phenomena which we can all perceive to indicate points in space. These four terms are the standard in Greek to indicate directions; yet they are also used by astronomers.

Another option is using wind directions; however, in this case, the terminology seems to be less standardized. North and south are indicated by the winds that come from those directions: north is *boreas* or *borras* (βορέας or βορρᾶς) and south is *notos* (νότος). In fact, while Notos is the wind from the south, Boreas is sometimes considered a wind from the north and sometimes from north-east.[13] On the other hand, the two names for east and west vary. In Aratus (*Phaen.* 933–934), for example, east is Euros, properly a wind from south-east, and west is Zephyrus, the wind from west.[14] However, geographers and astronomers also use *apēliōtēs* (ἀπηλιώτης) for east and *lips* (λίψ) for west. Among astronomical texts, the use of νότος, βορέας, ἀπηλιώτης, and λίψ to indicate the four cardinal points is found in the so-called *Ars Eudoxi* or Leptines papyrus (P.Par.1 = Paris, Louvre N 2388 Ro, and Louvre N 2329 Ro). The papyrus, dated to the second half of the second century BCE, contains a rather basic introduction to several astronomical concepts; in cols. i.9-ii.25 and xxi.6–14 these four winds are used with reference to the yearly journey of the Sun. Ptolemy most often uses βορέας for north, νότος for south, ἀνατολή for east, and δύσις or δυσμή for west. However, he uses ἀπηλιώτης and λίψ for east and west in a passage which we will analyze below. The noun ἀπηλιώτης is a compound from ἀπό and ἡλιώτης, which is the region of the Sun (*hēlios* (ἥλιος)), i.e., the east – so, in a way it becomes a synonym of ἀνατολή. The noun λίψ is derived from λείβω, 'to drip', and indicates the 'rainy wind' from south-west.[15] In fact, Ps.-Aristotle says that the name λίψ derives from Libya from where the wind blows.[16] If this is right, then, since Ptolemy is writing at

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13 For example, in Aristotle, Boreas is from the north (see Bowen 2020, 2) but in Ptolemy's *Geography* it is from north-north-east (see Berggren & Jones 2000, 15).

14 *Phaen.* 933–936: Αὐτὰρ ὅτ' ἐξ εὔροιο καὶ ἐκ νότου ἀστράπτῃσιν, / ἄλλοτε δ' ἐκ ζεφύροιο καὶ ἄλλοτε πὰρ βορέαο, / δὴ τότε τις πελάγει ἔνι δείδιε ναυτίλος ἀνήρ, / μή μιν τῇ μὲν ἔχῃ πέλαγος, τῇ δ' ἐκ Διὸς ὕδωρ (But when it flashes with lightening from the Euros wind and from the Notos wind and sometimes from the Zephyr wind and sometimes from the Boreas wind, then some sailor on the open sea fears that the sea might take him on the one hand or the rain from Zeus on the other).

15 See chart in Berggren & Jones 2000, 15 and Bowen 2020, 3. While in the *Geography* Ptolemy uses δύσις for west, he also states (*Geog.* 1.8.6) Δι' ὧν εἰκὸς ἢ τερατεύσασθαι τοὺς ἄνδρας ἢ τὸ πρὸς μεσημβρίαν οὕτως εἰπεῖν, ὡς εἰώθασιν οἱ ἐπιχώριοι λέγειν εἰς τὸν νότον ἢ εἰς τὸν λίβα, καταχρώμενοι τῷ μᾶλλον ἀντὶ τῆς ἀκριβείας (For these reasons it is likely that [these] men either told travelers' tales or used the expression 'to the south' for 'toward the Notos wind' or 'toward the Lips wind', as the locals tend to talk, misusing the rough [term] in place of the exact) (trans. Berggren & Jones 2000, 68); here it looks as if Ptolemy uses εἰς τὸν λίβα to indicate the south-west and εἰς τὸν νότον to indicate the south, while he considers 'πρὸς μεσημβρίαν' as a less precise term for 'south' in general.

16 Cf. Bowen 2020, 13.

Alexandria, λίψ can indicate the west (and not the south-west).[17] The same location must then be assumed for the author of the *Ars Eudoxi*.

2.2 Positions of Stars as Viewed in the Celestial Sphere

All the terms analyzed above are used when the observer on the Earth is somehow implied, since they depend on the latter's own perception of certain natural phenomena (the Sun's motion in the sky or wind direction). When Greek astronomers wanted to describe the position of a heavenly body and especially a star within the celestial sphere without reference to the observer, they used a different system based on the apparent motion of the Sun and fixed stars in the sky, which is from east to west. For example, to describe positions of stars Hipparchus uses two sets of verbs, most often used as participles:

> *hēgoumenos* (ἡγούμενος) = leading
> *hepomenos* (ἑπόμενος) = trailing
>
> *prohēgoumenos* (προηγούμενος) = preceding
> *hupoleipomenos* (ὑπολειπόμενος) = remaining behind

While these two sets of verbs only indicate two relative positions ('eastward' for ἑπόμενος and ὑπολειπόμενος, and 'westward' for ἡγούμενος and προηγούμενος), Hipparchus uses them in specific contexts and never as synonyms. He uses ἡγούμενος, 'leading', and ἑπόμενος, 'trailing', when describing a group of stars, often within the same constellation. The stars that 'lead' in a constellation are those on the western part of it; the stars that 'trail' are those in the eastern part of it. In this case, ἡγούμενος and ἑπόμενος are used absolutely. On the other hand, Hipparchus uses προηγούμενος, 'preceding', and ὑπολειπόμενος, 'remaining behind' in a transitive way, taking the local (i.e., south) meridian as its most common (genitive) object. In this case, Hipparchus gives the relative position of a star not within its constellation but rather with respect to its culmination, that is, its crossing of the south meridian. If a star has yet to reach it (so it is ὑπολειπόμενος τοῦ μεσημβρινοῦ), it is still in the eastern part of its nightly path; if it has passed it (so it is προηγούμενος τοῦ μεσημβρινοῦ), it is now in its second, western part of its nightly path. Ptolemy adopts the same system, but since in his catalogue of stars (in Books 7 and 8 of the *Almagest*) he is only concerned with describing the position of stars within their constellation, he never speaks of the position of a star relative to the meridian. Ptolemy generally uses both ἡγούμενος and προηγούμενος (which cor-

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17 Cf. Rehm 1916, 62 n. 1. In the passage of the *Geography* quoted above in n. 15 the *Lips* wind indicated the south-west, but there Ptolemy is reporting Marinus' account of Septimius Flaccus' campaign in Ethiopia. Thus, it is possible that *Lips* wind was used in that context in a different sense than in the *Almagest*, where it definitely means west (and this is the only occurrence of *Lips* in the *Geography*).

respond to Hipparchus' ἡγούμενος) and ἑπόμενος (in the sense of Hipparchus' ἑπόμενος). However, he can also say that that a star is προηγούμενος another one (in the genitive, to mean that it precedes it) or ἑπόμενος another one (in the dative, to mean that it is behind it). The same conventions are applied to the planets that move relatively to the stars; hence, the Greeks called the former 'wandering stars', as Geminus puts it (using the same verbs):

> *Isag.* 12.22 (. . .) ἐκεῖνοι γὰρ ὁτὲ μὲν ὑπολείπονται τῶν ἀπλανῶν ἀστέρων, ὁτὲ δὲ προηγοῦνται, ὁτὲ δὲ κατὰ τοὺς αὐτοὺς ἀστέρας μένουσιν, οἳ δὴ καὶ καλοῦνται στηριγμοί.

> (. . .) for they [i.e. the wandering stars] sometimes remain behind the fixed stars, sometimes they precede them, and sometimes they stay still with respect to those stars— which are called their 'stations.'[18]

Clearly this system is based on the idea that stars move from east to west on the celestial sphere. In fact, while fixed stars do indeed have fixed positions relative to each other (so that one star will always be 'leading' or 'preceding' with respect to another one), the Greeks perceived them to be constantly moving westward on the celestial sphere. Yet ancient astronomers did not use cardinal points to measure this motion but rather looked at the position of the stars relative either to another or to the south meridian. Therefore, translating these phrases as 'eastward' and 'westward' is a modernization of the original Greek.

3 Describing Celestial Phenomena: Rising, Setting, and Culmination

An observer from the Earth sees celestial bodies rising on the eastern horizon and setting on the western horizon. 'To rise' is *anatellein* (ἀνατέλλειν) and 'to set' is *(kata) dunein* ((κατα)δύνειν). Again, these are standard Greek verbs maintained by Greek astronomers. Yet astronomers were also interested in other aspects of a star's path. In its trajectory in the night sky a star draws an arc from the east, where it rises, to the west, where it sets. In modern terminology, the highest point of this arc is called the 'culmination' or 'transit'. It occurs when the star passes through the local south meridian. In Greek, the verb used to indicate the culmination is *mesouranein* (μεσουρανεῖν),

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18 A problem, already noted by Toomer 1984, 20, arises with *proēgēsis* (προήγησις), which he translated as 'retrogradation' (of planets). In Greek it literally means 'motion in advance'. Since for us the natural movement of planets is eastward relative to the fixed stars, when they move westward they seem to us to go backward, hence our 'retrogradation'. For the Greeks, however, the main movement of the sky was the daily revolution of the stars from east to west: hence when the planet goes westward, it 'leads ahead' or moves 'in advance to' the fixed stars; see also Jones 2016, 485.

which means 'to be in the middle of the sky'. This is a more technical term, not because it is a particularly difficult compound to understand but because it is used in a very specific context – yet its meaning is quite transparent per se, while the modern 'culmination' and 'transit' require some more abstract thinking.

4 Star Phases: The Building of a Scientific Terminology

Greek astronomers were particularly interested in tracking the so-called simultaneous risings and settings, that is, when a star rises or sets together with another star, the Sun or even a specific point in the celestial sphere, most often a point on the ecliptic. So, for example, Hipparchus uses ἀνατέλλειν and (κατα)δύνειν for generic rising and setting, but *sunanatellein* (συνανατέλλειν) and *antikatadunein* (ἀντικαταδύνειν) for a star that 'rises simultaneously with' or 'sets in opposition to' a specific arc of the ecliptic rising.

A specific type of simultaneous rising and setting is the so-called 'stellar phase' – this is the modern terminology but for now I will use the Greek word, *phasis*, for reasons that will become clear in what follows. The Greeks, like many other ancient civilizations, were greatly concerned with the risings of stars as they indicated important moments of the farming seasons. In particular, star *phaseis* are the risings and settings of stars that occur close to sunrise or sunset.[19]

4.1 Autolycus and the Simultaneous Risings and Settings

Because knowledge of stellar *phaseis* was crucial for agricultural practice, Greek astronomers had begun to study the phenomenon from early on. The first treatise we have on the topic is *On Risings and Settings* (Περὶ ἐπιτολῶν καὶ δύσεων) by Autolycus (ca. 320 BCE). In this treatise in two books, Autolycus makes an important distinction between 'true' (*alēthinai* (ἀληθιναί)) and 'visible' (*phainomenai* (φαινόμεναι)) risings (*epitolai* (ἐπιτολαί)) and settings (*duseis* (δύσεις)) (*De ort. et occ.* 1.1). The true risings and settings occur when the stars rise or set at the exact same moment when the Sun is rising or setting. However, due to the brightness of the sky, these 'real' risings and settings are not visible. In order for an observer to see a star rising or setting, the Sun needs to be sufficiently below the horizon. For Autolycus, sufficient meant at least 15° below the horizon along the ecliptic. As a result, the visible risings and settings occur shortly before sunrise or shortly after sunset. Taking into account all these distinc-

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19 See Lehoux 2007, 2–12. On star *phaseis* from a more technical point of view, see Neugebauer 1975, 760–763; Evans 1998, 190–199.

tions, for each star we have the following possibilities, each taking place at a different time of the year:

> <u>True risings and settings</u> (αἱ ἀληθιναὶ ἐπιτολαί τε καὶ δύσεις)
> True morning rising (ἀληθινὴ ἑῴα ἐπιτολή) = star rises at sunrise
> True morning setting (ἀληθινὴ ἑῴα δύσις) = star sets at sunrise
> True evening rising (ἀληθινὴ ἑσπερία ἐπιτολή) = star rises at sunset
> True evening setting (ἀληθινὴ ἑσπερία δύσις) = star sets at sunset
> <u>Visible risings and settings</u> (αἱ δὲ φαινόμεναι ἐπιτολαί τε καὶ δύσεις)
> Visible morning rising (φαινομένη ἑῴα ἐπιτολή) = star rises before sunrise
> Visible morning setting (φαινομένη ἑῴα δύσις) = star sets before sunrise
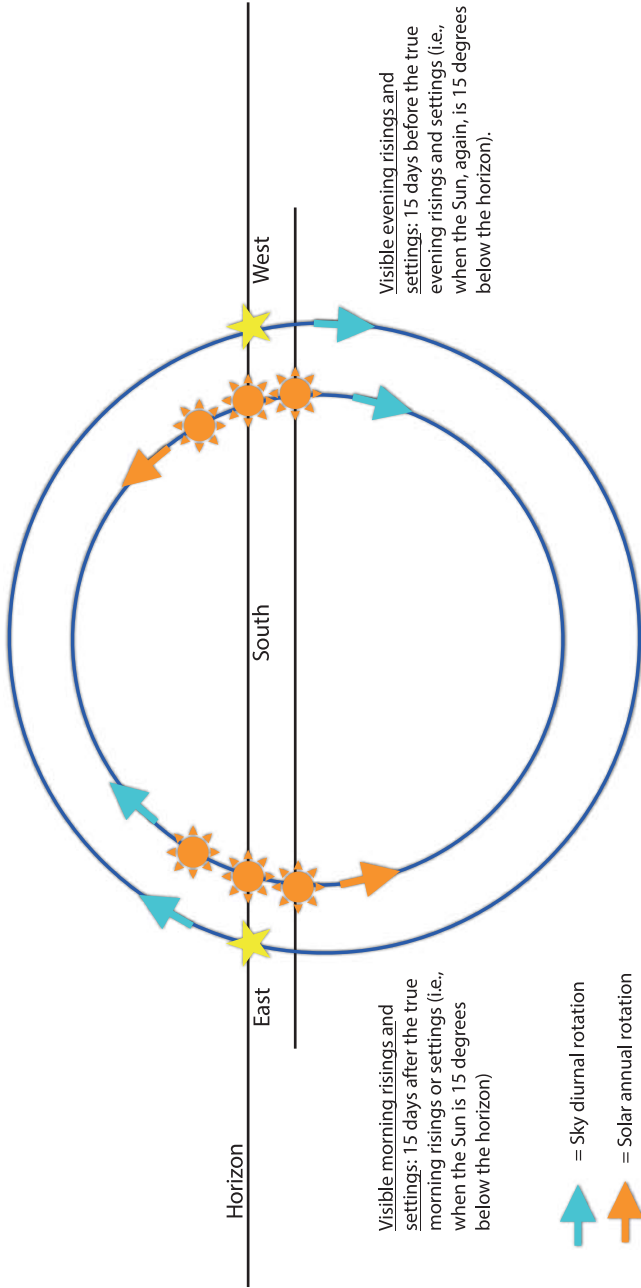> Visible evening rising (φαινομένη ἑσπερία ἀνατολή) = star rises after sunset
> Visible evening setting (φαινομένη ἑσπερία δύσις) = star sets after sunset

The visible risings and settings are those of interest to farmers and sailors because they are the only ones which can be observed with the naked eye. However, Greek astronomers working on a celestial globe could also study the true risings and settings, which are not visible to those who observe the sky. During the year, the visible morning risings and settings occur 15 days after the true morning risings and settings (that is, when the Sun is 15 degrees below the horizon), while the visible evening risings and settings occur 15 days before the true evening risings and settings (that, is, when the Sun, again, is 15 degrees below the horizon). This is due to the Sun's apparent motion on the ecliptic from west to east (due to the orbit of the Earth around the Sun) which is contrary to the apparent motion of the other celestial bodies from east to west (due to the Earth's rotation on its axis). Since the Sun needs to be 15° below the horizon along the ecliptic and the Sun moves ca. 1° per day along the ecliptic, there are 15 days between visible and true risings and settings (see Fig. 2).

4.2 Geminus and the Simultaneous Risings and Settings

A rather intense debate arose among ancient astronomers about how to differentiate between these concepts. It is interesting to analyze it in detail because it shows a specific example of 'terminology' *in fieri* from the late Hellenistic period to Ptolemy. After Autolycus, Geminus makes a distinction between 'generic' risings and 'simultaneous' risings and how they should be expressed:

> *Isag.* 13.2–4 Καὶ ἔστιν ἀνατολὴ μὲν ἡ καθ᾽ ἑκάστην ἡμέραν γινομένη πρὸς τὸν ὁρίζοντα φάσις, δύσις δὲ ἡ καθ᾽ ἑκάστην ἡμέραν γινομένη ὑπὸ τὸν ὁρίζοντα κρύψις. Ἄλλως δὲ λέγονται ἐπιτολαὶ καὶ δύσεις, ἃς ἔνιοι ἀγνοοῦντες κατὰ τὴν αὐτὴν ἔννοιαν ὑπολαμβάνουσι λέγεσθαι. Μεγάλη δέ ἐστι διαφορὰ ἀνατολῆς καὶ ἐπιτολῆς. Ἀνατολὴ μὲν γάρ ἐστιν ἡ προειρημένη, ἐπιτολὴ δὲ ἡ γινομένη πρὸς τὸν ὁρίζοντα φάσις μετὰ τῆς πρὸς τὸν ἥλιον ἀποστάσεως ἀπολαμβανομένη. Ὁ δὲ αὐτὸς λόγος καὶ ἐπὶ τῆς δύσεως· ἄλλως μὲν γὰρ λέγεται δύσις ἡ καθ᾽ ἑκάστην ἡμέραν γινομένη ὑπὸ τὸν ὁρίζοντα κρύψις, ἄλλως δὲ ἡ γινομένη πρός τε τὸν ὁρίζοντα ἅμα καὶ τὸν ἥλιον.

Horizon

East

South

West

Visible morning risings and
settings: 15 days after the true
morning risings or settings (i.e.,
when the Sun is 15 degrees
below the horizon)

Visible evening risings and
settings: 15 days before the true
evening risings and settings (i.e.,
when the Sun, again, is 15 degrees
below the horizon).

= Sky diurnal rotation

= Solar annual rotation

Fig. 2: True Risings and Settings vs. Visible Risings and Settings.

And 'rising' (*anatolē* (ἀνατολή)) is the 'appearance' (*phasis* (φάσις)) at the horizon that occurs every day; and 'setting' (*dusis* (δύσις)) the 'hiding' (*krupsis* (κρύψις)) below the horizon that occurs every day. In a different sense one speaks of 'risings together' (*epitolai* (ἐπιτολαί)) and settings (δύσεις); yet some, ignoring this distinction, assume that they are used to mean the same concept. But there is a great difference between 'rising' (ἀνατολή) and 'rising together' (ἐπιτολή). For a 'rising' (ἀνατολή) is what has already been defined but a 'rising together' (ἐπιτολή) is an appearance (φάσις) occurring at the horizon in relation to the distance to the Sun. The same account also [applies] to the setting. For the word 'setting' (δύσις) is used for the 'hiding' (κρύψις) below the horizon that occurs every day but otherwise is also the [hiding] that occurs at the horizon together with the Sun.[20]

Geminus makes the distinction between a generic rising of a star, for which he uses the verb *anatellein* (ἀνατέλλειν), 'to rise up', and the noun *anatolē* (ἀνατολή), and a rising connected with the Sun, in which case he uses the verb *epitellein* (ἐπιτέλλειν), 'to rise together', and the noun *epitolē* (ἐπιτολή).[21] He criticizes those who do not make this distinction, which was apparently quite old, since it seems to have already been used by Hesiod in the phrase *Plēiadōn (. . .) epitellomenaōn* (Πληιάδων (. . .) ἐπιτελλομενάων, *WD* 383) to indicate the first visible rising of the Pleiades in May. On the other hand, the setting is not linguistically differentiated – the verb *dunein* (δύνειν), 'to set', and the noun *dusis* (δύσις) are used for both the generic and the simultaneous setting.[22]

4.3 Ptolemy and the Configurations of the Stars

Ptolemy further develops this distinction. In *Almagest* 8.4 he discusses the various 'configurations' (*skhēmatismoi* (σχηματισμοί)) in which stars can be observed with respect to:

1. the planets, Sun and Moon, or the parts of the zodiac alone;
2. the Earth alone;
3. to both the Earth and the planets, the Sun and the Moon, or the parts of the zodiac alone.

The configurations with respect to the planets and the parts of the zodiac (1) mostly concern positions that are important in astrology, so we will not discuss them. In this section, however, Ptolemy gives an important definition concerning the positions of

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20 See also *Sch. Arat.* 137 B.
21 On this terminology, see Evans & Berggren 2006, 70–72.
22 The verb ἐπιδύνειν/ἐπιδύειν is used only in late Greek and by Christian or Jewish authors; the noun ἐπίδυσις is not attested. In the rest of the section, Geminus follows Autolycus' distinction between morning and evening risings (*Isag.* 13.5) and between true and visible risings (*Isag.* 13.6). The same distinctions apply to the settings (*Isag.* 13.14–18).

stars relative to the Sun and the Moon. He says (*Synt.* 8.4, vol. 1.2, 186.9–15 Heiberg) that with respect to the Sun and the Moon, we can have the following stellar configurations:

1. 'Hiding' (*krupsis* (κρύψις)), when stars cease to be visible because of the rays of the Sun or Moon;
2. 'Conjunction' (*sunodos* (σύνοδος)), when they are eclipsed by them; and
3. 'Visibility' (*epitolē* (ἐπιτολή)), when they escape their rays and start to become visible.

While κρύψις and σύνοδος are standard terms, Ptolemy uses the term ἐπιτολή, which was previously used by Autolycus and Geminus for any (i.e., true and visible) rising with the Sun, for the *first* visible rising or, better, 'visibility' of a star. With respect to the Earth (2), a star can have four main configurations:

1. Rising (*anatolē* (ἀνατολή))
2. Culmination above the Earth (*mesouranēma huper gēs* (μεσουράνημα ὑπὲρ γῆς))
3. Setting (*dusis* (δύσις))
4. Culmination below the Earth (*mesouranēma hupo gēn* (μεσουράνημα ὑπὸ γῆν))

There are nine configurations of stars with respect to the Sun and the Earth (a subdivision of configuration 3), each divided into subcategories, each with its proper name. They are discussed in detail in *Almagest* 8.4 (1.2, 189.11–193.13 Heiberg).[23] Here I have organized Ptolemy's detailed definitions into a table in order to make his taxonomy easier to grasp:[24]

Configuration (*skhēmatismos* (σχηματισμός))	Variety (*diaphora* (διαφορά))
(1) Early easterly position (πρωινὸς ἀπηλιώτης) = the star is on the eastern horizon together with the Sun	Morning invisible later rising (ἑώα μὴ φαινομένη ἐπανατολή) = the star starting its hiding (κρύψις) rises right after the Sun
	Morning true simultaneous rising (ἑώα συνανατολὴ ἀληθινή) = the star is on the eastern horizon together with and at the same moment as the Sun
	Morning visible earlier rising (ἑώα προανατολὴ φαινομένη) = the star starting its visibility (ἐπιτολή) rises right before the Sun

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23 Cf. Toomer 1984, 409–410. My translations, however, differ from those of Toomer.
24 What follows in the table is a pretty close translation of Ptolemy's text, hence, the inconsistencies in describing similar moment (e.g., 1(b) and 9(b)). When his phrasing was too convoluted I have added a footnote to explain Ptolemy's precise words.

(continued)

Configuration (*skhēmatismos* (σχηματισμός))	Variety (*diaphora* (διαφορά))
(2) Early culmination (πρωινὸν μεσουράνημα) = the star is on the meridian either above or below the Earth while the Sun is on the eastern horizon	Morning invisible later culmination (ἑῷον ἐπιμεσουράνημα μὴ φαινόμενον) = the star culminates right after the rising of the Sun
	Morning true simultaneous culmination (ἑῷον συμμεσουράνημα ἀληθινόν) = the star culminates together with the rising of the Sun
	Morning earlier culmination (ἑῷον προμεσουράνημα) = the star culminates right before the rising of the Sun;[25] when the star culminates above the Earth, it is visible
(3) Early westerly position (πρωινὸς λίψ) = the star is on the western horizon while the Sun is on the eastern horizon	Morning invisible later setting (ἑῷα ἐπικατάδυσις μὴ φαινομένη) = the star sets right after the rising of the Sun[26]
	Morning true simultaneous setting (ἑῷα συγκατάδυσις ἀληθινή) = the star sets together with the rising of the Sun
	Morning visible earlier setting (ἑῷα πρόδυσις φαινομένη) = the star sets right before the rising of the Sun[27]
(4) Meridian easterly position (μεσημβρινὸς ἀπηλιώτης) = the star is on the eastern horizon while the Sun is on the meridian	Daily invisible [rising] (ἡμερινὸς καὶ μὴ φαινόμενος[28]) = the star rises while the Sun culminates above the Earth
	Nightly visible [rising] (νυκτερινὸν καὶ φαινόμενον[29]) = the star rises while the Sun culminates below the Earth

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25 Yet Ptolemy says: "The Sun rises right after the star has culminated."

26 On the reading adopted here, see Toomer 1984, 409, n. 195.

27 Yet Ptolemy says: "The Sun rises right after the star has set"; on the reading adopted here, see Toomer 1984, 409, n. 196.

28 Here Ptolemy uses the masculine singular (ὃ μέν τί ἐστιν ἡμερινὸς καὶ μὴ φαινόμενος), probably assuming a σχηματισμός. I have supplied 'rising' (which would be the feminine ἀνατολή) to make the concept clearer.

29 Here (τὸ δέ τι νυκτερινὸν καὶ φαινόμενον) and in other cases below Ptolemy uses the neuter; it is less clear what he assumes to be the referent; but it might be a generic neuter to indicate the 'position' of the star (e.g., τὸ τοῦ ἀστέρος). I have supplied 'rising' (which would be the feminine ἀνατολή) to make the concept clearer.

(continued)

Configuration (*skhēmatismos* (σχηματισμός))	Variety (*diaphora* (διαφορά))
(5) Meridian culmination (μεσημβρινὸν μεσουράνημα) = both the star and the Sun are on the meridian at the same time	Daily and invisible [culminations] (ἡμερινὰ καὶ μὴ φαινόμενα) = while the Sun culminates above the Earth, the star culminates either (1) above the Earth together with it, or (2) below the Earth diametrically opposite to it
	Nightly [culminations] (νυκτερινά) = while the Sun culminates below the Earth, the star culminates either (1) below the Earth together with the Sun, and so it is invisible (τὸ μὲν μὴ φαινόμενον), or (2) above the Earth diametrically opposite to it, and so it is visible (τὸ δὲ φαινόμενον)
(6) Meridian westerly position (μεσημβρινὸς λίψ) = the star is on the western horizon while the Sun is on the meridian	Daily invisible [setting] (ἡμερινὸν καὶ μὴ φαινόμενον) = the star sets while the Sun culminates above the Earth
	Nightly visible [setting] (νυκτερινὸν καὶ φαινόμενον) = the star sets while the Sun culminates below the Earth
(7) Late easterly position (ὀψινὸς ἀπηλιώτης) = the star is on the eastern horizon while the Sun is on the western horizon	Evening visible later rising (ἑσπερία ἐπανατολὴ φαινομένη) = the star rises right after the setting of the Sun
	Evening true simultaneous rising (ἑσπερία συνανατολὴ ἀληθινή) = the star rises together with the setting of the Sun
	Evening invisible earlier rising (ἑσπερία προανατολὴ μὴ φαινομένη) = the star rises right before the setting of the Sun[30]

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30 Yet Ptolemy says: "The Sun sets right after the star has risen."

(continued)

Configuration (*skhēmatismos* (σχηματισμός))	Variety (*diaphora* (διαφορά))
(8) Late culmination (ὀψινὸν μεσουράνημα) = the star is on the meridian either above or below the Earth while the Sun is on the western horizon	Evening later culmination (ἑσπερινὸν ἐπιμεσουράνημα) = the star culminates right after the setting of the Sun [it is visible when the star culminates above the Earth[31]]
	Evening true simultaneous culmination (ἑσπερινὸν συμμεσουράνημα ἀληθινόν) = the star culminates together with the setting of the Sun
	Evening invisible earlier culmination (ἑσπερινὸν προμεσουράνημα μὴ φαινόμενον) = the star culminates right before the setting of the Sun[32]
(9) Late westerly position (ὀψινὸς λίψ) = the star is on the western horizon together with the Sun	Evening visible later setting (ἑσπερία ἐπικατάδυσις φαινομένη) = the star starting its hiding (κρύψις) sets right after the Sun
	Evening true simultaneous setting (ἑσπερία συγκατάδυσις ἀληθινή) = the star sets together with and at the same moment as the Sun
	Evening invisible earlier setting (ἑσπερία πρόδυσις μὴ φαινομένη) = the star starting its visibility (ἐπιτολή) sets right before the Sun

In this very specific list of definitions Ptolemy adopts an interesting linguistic strategy. The 'configurations' are organized in nine kinds (*tropoi* (τρόποι)), formed by two terms. One is a noun indicating a position of the star in the sky, which can be *apēliōtēs* (ἀπηλιώτης), 'easterly position' (i.e., the star is rising on the eastern horizon), *mesouranēma* (μεσουράνημα), 'culmination' (i.e., the star is in the middle of the sky, halfway between its rising and setting), or *lips* (λίψ), 'westerly position' (i.e., the star is setting on the western horizon). The other term is an adjective and refers to the Sun; it too focuses on the position of the Sun but does so through the time of the day, rather than with a position in space – but, of course, since the Sun indicates time with its position in the sky, *prōinos* (πρωινός), 'of early morning', *mesēmbrinos* (μεσημβρινός), 'of midday', and *opsinos* (ὀψινός), 'of late evening', also indicate the Sun's position in the sky as seen from the Earth. In particular, μεσημβρινός means both 'midday' and 'midnight' since it refers to the culmination of the Sun on the meridian either above or

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31 On this passage and the reading adopted, see Toomer 1984, 410 n. 197.
32 Yet Ptolemy says: "The Sun sets right after the star has culminated."

below the Earth.[33] This combination of noun and adjective identifies a 'configuration' of two heavenly bodies: the noun refers to the star's position and the adjective refers to the Sun's position. In this way, each of the nine 'configurations' is unambiguously defined and quite straightforward to discern.

The same clarity and systematicity in covering every possible phenomenon apply to the 'varieties' (*diaphorai* (διαφοραί)) of these configurations, which are described with three defining terms, a noun and two adjectives. The noun identifies the star phenomenon in relation to the Sun. Starting from the generic terms 'rising' (*anatolē* (ἀνατολή)), 'culmination' (*mesouranēma* (μεσουράνημα)), and 'setting' (*dusis* (δύσις) or *katadusis* (κατάδυσις)), Ptolemy uses prefixes to define additional astronomical concepts that define the position of a star with respect to the Sun:

Before the Sun	Simultaneous with the Sun	After the Sun
Earlier rising (προανατολή)	Simultaneous rising (συνανατολή)	Later rising (ἐπανατολή)
Earlier culmination (προμεσουράνημα)	Simultaneous culmination (συμμεσουράνημα)	Later culmination (ἐπιμεσουράνημα)
Earlier setting (πρόδυσις)	Simultaneous setting (συγκατάδυσις)	Later setting (ἐπικατάδυσις)

The first prefix in these double compounds has a temporal meaning: *pro-* (προ-) for earlier, *sun* (συν-) for simultaneous, and *epi-* (ἐπι-) for 'later' (in the latter case, then, ἐπί has not the comitative value of the ἐπί in ἐπιτολή, which Ptolemy still uses to indicate the first visible rising of star, as we saw above). Then, one adjective defines the time at which the phenomenon takes place (morning, evening, or night) and the second one clarifies whether the phenomenon is 'true' or 'visible'. In this case, the head noun focuses on the temporal relationship between the positions of the star with respect to the Sun – which is key for star *phaseis*. The two adjectives then specify the time of the event (in absolute terms) and its quality. This complex linguistic *tour de force* thus allows Ptolemy to define and, more importantly, almost to explain these 24 phenomena (i.e., the 24 'varieties') by providing labels that describe the configuration of the star relative to the Sun for each of them. The system is exhaustive, economic, and unambiguous – the goal of any technical terminology.[34]

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33 Unfortunately, it is impossible to render this term in English using one specific noun. I have therefore used 'meridian', albeit less transparent than the Greek μεσημβρινός.

34 Cf. Schironi 2019, 245–246. On some characteristics of ancient technical language, see Langslow 2000, 6–26; Fögen 2003; Willi 2003, 51–57. For theoretical studies on (modern) technical language, see Fluck 1996; Roelcke 2020.

4.4 Ptolemy: From Stellar Configurations to Stellar Phaseis

A further refinement of the terminology connected with the stellar *phaseis* is carried out in Ptolemy's *Phaseis*, a work specifically dedicated to the topic. In the introductory chapters, Ptolemy is concerned with the definition of *phasis:*

> *Phaseis* 2, vol. 2, 5.4–17 Heiberg: Φάσιν μὲν δὴ καλοῦμεν ἁπλανοῦς ἀστέρος τὸν πρὸς ἥλιον καὶ τὸν ὁρίζοντα λαμβανόμενον αὐτοῦ σχηματισμὸν τὸν πρῶτον ἢ ἔσχατον τῶν φαινομένων, παρ' ὃ καὶ τοιαύτης ἔτυχε προσηγορίας. τῶν δὲ τοῦτον τὸν τρόπον ὑποτιθεμένων σχηματισμῶν τέσσαρες αἱ γενικώτεραι συνίστανται διαφοραί· τοσαῦται γὰρ θέσεις μεταλαμβάνονται τοῦ τε ἡλίου καὶ τοῦ ἀστέρος πρὸς ἀλλήλους τε καὶ τὰ δύο τοῦ ὁρίζοντος ἡμικύκλια τό τε πρὸς ἀνατολὰς καὶ τὸ πρὸς δυσμάς. σημαίνεται δὲ ἡ μὲν τῶν ἀστέρων καθ' ἑκάτερον τῶν ἡμικυκλίων θέσις <u>κοινότερον</u> ἀπό τε τῆς ἀνατολῆς καὶ δύσεως, ἡ δὲ τοῦ ἡλίου κατὰ τὸ τῶν ὑπ' αὐτοῦ δεικνυμένων χρόνων ἴδιον ἀπό τε τῆς ἑῴας καὶ τῆς ἑσπερίας.

> By 'phasis' [i.e. appearance] of a fixed star we mean its first or last visible configuration taken with respect to the Sun and the horizon, and it gets this name from this [i.e. φάσις from φαίνεσθαι = "to appear", "to be visible"]. Among the configurations assumed in this manner, there are four varieties that are more significant; for they all involve positions of the Sun and the star relative to each other and to the two semicircles of the horizon, the one to the east and the one to the west. The position of the fixed stars on either of the semicircles is signified more commonly as 'east' and 'west', and that of the Sun [is signified] according to the particular character of the times exhibited by it as 'morning' and 'evening'.[35]

So far, I have not translated the word *phasis*, because the English 'phase', which we still use for these phenomena (e.g., stellar phases and lunar phases), is quite misleading. As Ptolemy clarifies, *phasis* comes from *phainesthai* (φαίνεσθαι), 'to be visible'. As he clearly says, a *phasis* is a type of configuration (σχηματισμός), and indeed a visible one – so the best translation for φάσις is 'appearance' or 'visibility'.

As for stellar configurations (σχηματισμοί), Ptolemy returns to the classification of the *Almagest* but here he uses the 'more common' (*koinoteron* (κοινότερον)) terminology, so *pros anatolas* (πρὸς ἀνατολάς) and *pros dusmas* (πρὸς δυσμάς) for 'east' and 'west', rather than *apēliōtēs* (ἀπηλιώτης) and *lips* (λίψ), and *apo tēs heōas* (ἀπὸ τῆς ἑῴας) and *apo tēs hesperias* (ἀπὸ τῆς ἑσπερίας) for 'morning' and 'evening', rather than *prōinos* (πρωινός) and *opsinos* (ὀψινός). This confirms what I suggested regarding the two set of labels for the cardinal points. Those connected with the winds, especially ἀπηλιώτης and λίψ, are technical and used only by professionals.[36] It also suggests that the terminology in the *Almagest* is more technical (as expected); the *Pha-*

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35 For this translation of the *Phaseis* I am using (and adapting) a provisional, unpublished translation by Alexander Jones, who kindly shared his text with me.

36 Here Ptolemy is dealing with two sets of synonyms to indicate the same phenomena. While technical languages should avoid synonyms, it is common, even in modern technical languages, to have two terms, one used by professionals when addressing colleagues, and one used by professionals when speaking to laypeople. To take a recent example, what we normally call 'COVID-19' or 'coronavirus', is technically 'severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)'.

seis instead uses a more common terminology, probably because this work was addressed to a wider audience. Indeed, the bulk of Ptolemy's short treatise, after this introduction, is a *parapēgma*, a calendar connecting celestial phenomena, and especially star phases, with weather predictions, which was a rather popular genre in agricultural societies such as the Graeco-Roman one; hence, the readership of the *Phaseis* was not limited to professional astronomers.[37] Yet the point that Ptolemy makes here, namely that the stars are measured on the basis of a spatial criterion and the Sun on the basis of a temporal one, corresponds to the same terminological distinction for the configurations in the *Almagest*. In what follows (*Phaseis* 2, vol. 2, 5.17–6.2 Heiberg), Ptolemy selects four configurations as the most important ones and they coincide with four listed in the *Almagest*:

1. Morning rising (ἑῴα ἀνατολή) = configuration 1 in the *Almagest*: early easterly position (πρωινὸς ἀπηλιώτης)
2. Morning setting (ἑῴα δύσις) = configuration 3 in the *Almagest*: early westerly position (πρωινὸς λίψ)
3. Evening rising (ἑσπερία ἀνατολή) = configuration 7 in the *Almagest*: late easterly position (ὀψινὸς ἀπηλιώτης)
4. Evening setting (ἑσπερία δύσις) = configuration 9 in the *Almagest*: late westerly position (ὀψινὸς λίψ)

He then clarifies that all these configurations can be 'true' (*alēthinoi* (ἀληθινοί)) or 'visible' (*phainomenoi* (φαινόμενοι)). This is exactly what we read in Autolycus, where the only difference is the use of ἐπιτολή, for what Ptolemy calls ἀνατολή.[38]

However, in this work, Ptolemy adds a further important terminological distinction to better describe the phenomena. Ptolemy further explains that when we speak of 'true' configurations (ἀληθινοὶ σχηματισμοί), we take into account both the Sun and the stars, as they must both lie on the horizon. However, for the 'visible' ones, 'insofar as we understand them in a simplistic way' (*eph' hoson houtōs haplōs autous akouomen* (ἐφ' ὅσον οὕτως ἁπλῶς αὐτοὺς ἀκούομεν)), we do not consider the Sun any longer, since the only requirement for the Sun is to be far enough below the horizon that the sky is dark enough for the star's rising or setting to be visible. This requirement

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37 On *parapēgmata*, including the one by Ptolemy, see Lehoux 2007.
38 *Ort. et Occ. Praef.* 8–13: Τῶν δὲ φαινομένων ἑῴα μέν ἐστιν ἐπιτολή, ὅταν πρὶν τὸν ἥλιον ἀνατεῖλαι ἄστρον τι πρώτως φανῇ ἀνατέλλον· ἑῴα δὲ δύσις, ὅταν πρὶν τὸν ἥλιον ἀνατεῖλαι ἄστρον τι πρώτως φανῇ δῦνον· ἑσπερία δὲ ἐπιτολή, ὅταν μετὰ τὸ τὸν ἥλιον δῦναι ἄστρον τι ἐσχάτως φανῇ ἀνατέλλον· ἑσπερία δὲ δύσις, ὅταν μετὰ τὸ τὸν ἥλιον δῦναι ἄστρον τι ἐσχάτως φανῇ δῦνον (of the visible [risings and settings], the morning rising is when a star is first seen rising before the Sun rises; the morning setting is when a star is first seen setting before the Sun rises; the evening rising is when a star is last seen rising after the Sun sets; the evening setting is when a star is last seen setting after the Sun sets).

would be met by any position of the Sun below 15° along the ecliptic.[39] As a result of this additional important scientific distinction, Ptolemy can now give a better definition of '*phasis*':

> *Phaseis* 4, vol. 2, 7.9–21 Heiberg: διόπερ οὐδέτερον τῶν κατειλεγμένων σχηματισμῶν ἤδη καὶ φάσεις ῥητέον· ἡ μὲν γὰρ φάσις δήλωσίς ἐστιν ὡρισμένου τε ἅμα καὶ φαινομένου σχηματισμοῦ, τῶν δ' ἐκκειμένων οἱ μὲν ἀληθινοὶ τοὺς χρόνους αὐτοὺς καθιστῶσιν ἀφανεῖς, οἱ δὲ φαινόμενοι τοὺς τοῦ ἡλίου τόπους. ὅταν οὖν τοὺς φαινομένους μηκέθ' ἁπλῶς οὕτως εἰκῇ καὶ ὡς ἔτυχεν ἐκδεχώμεθα, προσδιοριζόμενοι δὲ τοὺς πρώτους ἢ ἐσχάτους τῶν ἀνατολῶν καὶ τῶν δύσεων, τότε καὶ τὸ τῆς φάσεως ἴδιον περιέξουσιν ἑνὸς ἤδη γινομένου καὶ τοῦ κατὰ τὸν ἥλιον τόπου, καθ' ὃν ὄντος αὐτοῦ πρῶτον ἢ ἔσχατον οἱ ἀστέρες ἀνατέλλοντες καὶ δύνοντες φαίνεσθαι δύνανται.

> For this reason, neither of the configurations that have been described so far ought to be called 'phaseis' [i.e. 'appearances']. For an 'appearance' is a revelation of a configuration that is at the same time well defined and visible, but among those under consideration the true ones result in the times themselves being invisible, and the visible ones [result in] the positions of the Sun [being invisible]. Hence, when we no longer take the visible ones in this careless and random manner but further define them as the first or last of the risings and settings, then they will possess the characteristic of an 'appearance' since now the position for the Sun is also unique, where it is when the stars can first or last be seen rising and setting.

'True' risings and settings are unambiguously defined moments in time: they occur when the star and the Sun are both exactly on the horizon. On the contrary, the definition of 'visible' rising and setting is ambiguous, since it can indicate many different configurations of a star with respect to the Sun, namely, whenever a star can be seen either rising or setting due to the position of the Sun sufficiently below the horizon. Yet Ptolemy wants to define one precise moment called 'phasis', so he rejects this approximate definition (*mēketh' haplōs houtōs eikē kai hōs etukhen* (μηκέθ' ἁπλῶς οὕτως εἰκῇ καὶ ὡς ἔτυχεν)) and redefines it as the *first* and *last* visibility of a star. In other words, while 'true' risings and settings are phenomena unique in time (hence Ptolemy accepts the traditional definitions), he adds a further category to the 'visible' phenomena in order to single out a phenomenon occurring only once in a year: the *phaseis* or 'appearances'. In this way, a *phasis* indicates one precise moment in time when the position of the Sun is also fixed. Once Ptolemy has established this new definition he can proceed with more precise definitions:

> *Phaseis* 4, vol. 2, 7.23–8.2 Heiberg: ἑῴα μὲν ἀνατολικὴ φάσις ἡ πρώτη τῶν φαινομένων ἀνατολή, ἑσπερία δὲ ἀνατολικὴ φάσις ἡ ἐσχάτη τῶν φαινομένων τοῦ ἀστέρος ἀνατολή, καὶ πάλιν ἑῴα μὲν δυτικὴ φάσις ἡ πρώτη τῶν φαινομένων τοῦ ἀστέρος δύσις, ἑσπερία δὲ δυτικὴ φάσις ἡ ἐσχάτη τῶν φαινομένων τοῦ ἀστέρος δύσις.

> The 'morning-rising appearance' is the first rising of the visible ones, and the 'evening-rising appearance' is the last rising of the star's visible ones, and again the 'morning-setting appearance'

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[39] In fact, Ptolemy does not mention explicitly the 15° along the ecliptic as a minimum distance below the horizon.
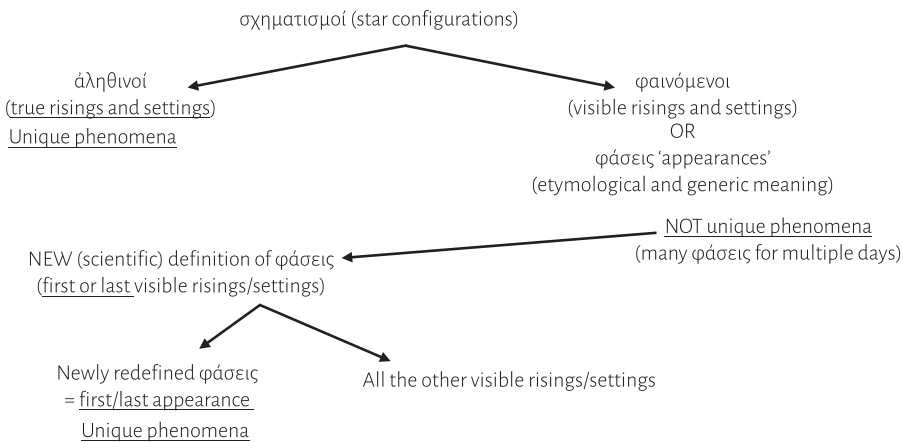
is the first setting of the star's visible ones, and the 'evening-setting appearance' is the last setting of the star's visible ones.

The terminology is the usual one; however, by placing additional adjectives (*prōtē* (πρώτη) and *eskhatē* (ἐσχάτη)) into the definitions, Ptolemy can now identify one specific event in time. In other words, whereas in the *Almagest* he distinguished between 'configurations' (σχηματισμοί) and their 'varieties' (διαφοραί), in the *Phaseis* he adds a further subgroup to some of these 'varieties': the 'phasis' or first or last appearance, as follows:

Visible morning rising (φαινομένη ἑῴα ἐπιτολή) = star rises before sunrise
    Morning-rising appearance (ἑῴα ἀνατολικὴ φάσις) = <u>first</u> visible [morning] rising
Visible evening rising (φαινομένη ἑσπερία ἀνατολή) = star rises after sunset
    Evening-rising appearance (ἑσπερία ἀνατολικὴ φάσις) = <u>last</u> visible [evening] rising
Visible morning setting (φαινομένη ἑῴα δύσις) = star sets before sunrise
    Morning-setting appearance (ἑῴα δυτικὴ φάσις) = <u>first</u> visible [morning] setting
Visible evening setting (φαινομένη ἑσπερία δύσις) = star sets after sunset
    Evening-setting appearance (ἑσπερία δυτικὴ φάσις) = <u>last</u> visible [evening] setting

Ptolemy's New 'Phaseis'

σχηματισμοί (star configurations)

ἀληθινοί
(<u>true risings and settings</u>)
<u>Unique phenomena</u>

φαινόμενοι
(visible risings and settings)
OR
φάσεις 'appearances'
(etymological and generic meaning)

<u>NOT unique phenomena</u>
(many φάσεις for multiple days)

NEW (scientific) definition of φάσεις
(<u>first or last</u> visible risings/settings)

Newly redefined φάσεις
= <u>first/last appearance</u>
<u>Unique phenomena</u>

All the other visible risings/settings

Fig. 3: Ptolemy's taxonomy of stellar phases.

Once he has defined the specific term (φάσις) as first or last appearance (see Fig. 3), Ptolemy can then add further specifications, or rather connect this new term to previously defined labels: the first visibility is also called ἐπιτολή (first visible rising) and the last visibility is also called κρύψις (hiding).[40] This is exactly the same distinction

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40 *Phaseis* 5, vol. 2, 8.12–15 Heiberg: τούτους δέ, ὅτε μὲν ἀφανίζονταί τινα χρόνον, καλοῦμεν ἐπιτέλλοντας καὶ κρυπτομένους, καὶ τὴν μὲν ἑῴαν αὐτῶν ἀνατολὴν ἁπλῶς ἐπιτολὴν καλοῦμεν, τὴν δ' ἑσπε-

Ptolemy had spelled out in *Almagest* 8.4 (vol. 1.2, 186.9–15 Heiberg), quoted above, however, there the term φάσις was not used.[41]

Within these two concepts, first φάσις or ἐπιτολή (first visibility or first rising) and last φάσις or κρύψις (last visibility or hiding), Ptolemy can then classify stars according to how they behave in the sky. In addition to being *epitellontes* (ἐπιτέλλοντες), 'first rising', when we see them in the sky rising after a period of invisibility or being *kruptomenoi* (κρυπτόμενοι), 'hidden', when we do not see them in the sky for a period of time, stars can also display different behaviors during the night according to their positions within the celestial sphere. A star can be *kolobodiexhodos* (κολοβοδιέξοδος), 'with a truncated (*kolobos* (κολοβός)) path', when it rises and sets with the Sun, meaning that it cannot be seen in its rising and setting but it can be seen during the night; this is typical of stars that lie close to the ecliptic.[42] Alternatively, a star can be *nukti-diexhodos* (νυκτιδιέξοδος), 'with a nightly path', when it rises after sunset and sets before sunrise, so it can be seen for the entire night; this is typical of stars that lie below the tropic of the Capricorn (for an observer in the northern hemisphere).[43] Finally, a star can be *amphiphanēs* (ἀμφιφανής), 'doubly visible', when it sets after sunset and rises before sunrise, so it can be seen twice in a night but not throughout the entire night; this is typical of stars that lie above the tropic of Cancer (for an observer in the northern hemisphere). Ptolemy also calls them *eniautophanēs* (ἐνιαυτοφανής), 'year-visible', since they never hide.[44] Without discussing what these labels mean astronomically, since this would go beyond the scope of this chapter, I have included this final

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ρίαν δύσιν ἁπλῶς κρύψιν (We call these [stars], when they disappear for some time, 'rising' and 'hidden', and we call their morning rising simply 'rising', and the evening setting simply 'hiding').

41 The word φάσις is used only in the final section (6) of Book 8 (Περὶ φάσεων καὶ κρύψεων τῶν ἀπλανῶν; *Synt.* 1.2.198.9–10 Heiberg) when Ptolemy discusses the trigonometrical methods for calculating the first and last visibility of stars – concluding that they are too complicated and so he will simply use past records or the globe. Yet Ptolemy never defines what a *phasis* is in the *Almagest.*

42 *Phaseis* 5, vol. 2, 8.15–17 Heiberg: ὅτε δὲ φαίνονταί τινα χρόνον μήτε ἀνατέλλοντες μήτε δύνοντες κολοβοδιεξόδους καλοῦσιν (But when they are visible for some time without either rising or setting, they call them 'with a truncated path').

43 *Phaseis* 6, vol. 2, 9.4–9 Heiberg: ἀλλὰ τὸ τῶν καλουμένων νυκτιδιεξόδων, ἐπειδὴ τὸν ἀπὸ τῆς ἑῴας δύσεως ἕως τῆς ἑσπερίας ἀνατολῆς χρόνον καὶ ἀνατέλλοντες καὶ δύνοντες καὶ ὅλον τὸ ὑπὲρ γῆν ἡμισφαίριον διεξιόντες φαίνονται μετὰ μὲν τὴν τοῦ ἡλίου δύσιν ἀνατέλλοντες, πρὸ δὲ τῆς ἀνατολῆς αὐτοῦ καταδύνοντες (but the [property] of what are called 'with a nightly path' [applies to them], since for the time from the morning setting until the evening rising they are visible both rising and setting and travelling the whole of the hemisphere above the Earth, since they rise after the setting of the Sun and set before its rising).

44 *Phaseis* 6, vol. 2, 9.17–22 Heiberg: ἀλλὰ τὸ τῶν καλουμένων ἐνιαυτοφανῶν, ἐπειδὴ καὶ τὸν ἀπὸ τῆς ἑῴας ἀνατολῆς ἕως τῆς ἑσπερίας δύσεως χρόνον φαίνεσθαι δύνανται δύνοντες μὲν μετὰ τὴν τοῦ ἡλίου δύσιν, ἀνατέλλοντες δὲ πρὸ τῆς ἀνατολῆς αὐτοῦ· καλοῦνται δὲ οἱ τοιοῦτοι καὶ ἀμφιφανεῖς (but [this is rather] the [property] of the [stars] that are called 'year-visible', since for the time from the morning rising until the evening setting they can be visible setting after the setting of the Sun and rising before its rising; such [stars] are also called 'doubly visible').

example to show fully Ptolemy's extraordinary attempt to build a coherent and systematic vocabulary regarding stellar *phaseis*. Just like in the previous cases, here the new terms are technical and yet clear. They are organized in two connected sets: (1) κολοβο-διέξοδος and νυκτι-διέξοδος and (2) ἀμφι-φανής and ἐνιαυτο-φανής, which again immediately give a clear picture of the phenomena they 'name'.

This detailed overview of the terminology for star phases clearly demonstrates Ptolemy's efforts at building a terminology which is clear, consistent, and comprehensive for phenomena that are complex and yet important for both the common people and the agricultural calendar. He accomplishes this in two works: the *Almagest*, where he gives a more technical description of the configurations, and the *Phaseis*, where he uses a more common terminology and at the same time further specifies distinctions and introduces new definitions.

Compared to Ptolemy's efforts and accomplishments, the modern terminology is much scantier and in fact also confusing. Indeed, modern astronomers speak of '*heliacal*' rising/setting for a star's first and last visibility. While 'heliacal' is rather clear (if one knows Greek), the names 'heliacal rising' and 'heliacal setting' do not really convey the idea that the star is seen rising or setting because it *rises right before* or *sets right after* the Sun. In fact, 'heliacal' suggests that the solar phenomenon is contemporaneous to the rising or setting of the star – which is not the case. In addition, there is no suggestion that this is the first rising and the last setting. Indeed, other modern names for these phases are far less technical (and yet similarly ambiguous): 'morning first' and 'evening last'.

Modern astronomers also use 'acronychal rising' and 'cosmic setting', but what these terms indicate tends to vary. Generally, 'acronychal rising' is used to mean the 'visible evening rising' and 'cosmical setting' the 'visible morning setting'.[45] However, these labels are neither defined precisely nor used in a very specific way. Rather, a simple internet search verifies that a variety of definitions can be found.[46] 'Acronychal rising' is not immediately clear for an English speaker. The term 'acronychal' derives from the Greek *akronuktos* (ἀκρόνυκτος), meaning 'at the edge of the night'. Yet this could mean either the sunset or the sunrise. Theon correctly understands this when he uses it (*Exp.* 137.7–20) for both the visible evening rising and invisible morn-

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45 See Evans 1998, 197; Lehoux 2007, 10–11.

46 See, for example, Kelley & Milone 2011, 40: "Several terms are used to describe the visibility of an object. When a star or planet formerly invisible due to proximity to the Sun first becomes visible in the morning sky, it is said to be at *heliacal rising*. When the object is last seen to set in the west after the Sun in the evening sky, it is said to be at *heliacal setting*. Two other pairs of terms are often confused with heliacal risings and settings. Either the rising or setting of a star in the evening, i.e., at or just after sunset, is referred to as *acronychal* and either the rising or setting of a star at sunrise is said to be *cosmical*. Thus, a star that is first seen to rise as the Sun sets is said to be at *acronychal rising*, and if it sets with the Sun, *acronychal setting*; one that sets as the Sun rises is at its *cosmical setting*, and if it rises as the Sun rises, it is at *cosmical rising*. Astronomers do not always follow these definitions strictly, however; so the context must be used to understand what the terms are intended to mean."

ing setting, as the former takes place when the night has begun and the latter when the day has begun, namely at the 'edges' of the night.[47] And yet, modern astronomers seem to have forgotten the true meaning of the word and how it was correctly used by the ancients. 'Cosmical setting', on the other hand, is clear but very generic. No doubt, the Greeks were much more precise than we are in naming and describing these phenomena, because, for them, these were crucial phenomena for daily life. We no longer need to observe when a star first rises or sets, nor are modern astrophysicists interested in tracking the phases of stars – and so we do not even need to 'name' those moments with precision.

5 Conclusions

Greek astronomical terminology is extremely rich, aimed at describing the phenomena as precisely as possible. The focus is 'positional', since this vocabulary is the natural result of the Greek approach to astronomy, which is fundamentally geometrical and concerned with tracking the motions and positions of the heavenly bodies. In particular, the examples discussed in this chapter make at least five important points.

First, Greek astronomical terminology, while 'technical' in the sense that it indicates very specific phenomena, is not obscure. All the terms used are either taken from common Greek or neologisms formed as compounds that are quite easily understandable. This might indeed have had an impact on the popularization of astronomy. While a poem like Aratus' *Phaenomena* is clearly nontechnical in its lack of use of these words, works like Ptolemy's *Almagest* and *Phaseis* as well as Hipparchus' *Commentary on Aratus* were certainly written by experts. A layperson, however, could

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47 Theon, *Exp.* 137.7–20 ἀνατολὴ δὲ λέγεται πλεοναχῶς· κυρίως μὲν καὶ κοινῶς ἐπί τε ἡλίου καὶ τῶν ἄλλων ἄστρων ἡ πρώτη ἀναφορὰ ὑπὲρ τὸν ὁρίζοντα· ἕτερον δὲ τρόπον ἐπὶ τῶν ἄλλων ἡ πρώτη φαῦσις ἐκ τῶν τοῦ ἡλίου αὐγῶν, ἥτις καὶ κυρίως <φαῦσις> ὀνομάζεται· λοιπὴ δὲ ἡ καλουμένη ἀκρόνυχος, ἐπειδὰν ἡλίου δύνοντος τὸ κατὰ διάμετρον ἄστρον ἐπὶ τῆς ἀνατολῆς βλέπηται· καλεῖται δὲ ἀκρόνυχος, ἐπειδὴ ἡ τοιαύτη ἀνατολὴ γίνεται ἄκρας νυκτός, τουτέστιν ἀρχομένης. παραπλησίως δὲ καὶ δύσις κοινῶς μὲν ἡ πρώτη κάθοδος ἡ ὑπὸ τὸν ὁρίζοντα· τρόπον δὲ ἄλλον ὁ πρῶτος ἀφανισμὸς ἄστρου τινὸς ὑπὸ τῶν τοῦ ἡλίου αὐγῶν, ἥτις καὶ κυρίως κρύψις πάλιν προσαγορεύεται· λοιπὴ δὲ καὶ ἀκρόνυχος, ἐπειδὰν ἡλίου ἀνατέλλοντος τὸ κατὰ διάμετρον ἄστρον ἀντικαταδύνη (the word 'rising' is used in many ways; in the proper and common sense, for the Sun and the other stars, [it is] the first ascent above the horizon; in another way, for the other stars, [it is] the first illumination [the receive] from the Sun's rays, which is also properly called 'illumination'; then there is the [rising] called 'acronychal' when once the Sun has set, a star on the opposite side is seen at its rising; and it is called acronychal because this rising happens at the edges of the night, that is, when the [the night] begins. Similarly, also 'setting' is commonly the first descent below the horizon; in another way, [it is] the first occultation of a star because of the Sun's rays, which is again also properly called 'hiding'; then there is also the 'acronychal' [setting] when once the Sun has risen, a star on the opposite side sets). Interestingly, here Theon uses *phausis* (φαῦσις), 'illumination' for first visibility and *krupsis* (κρύψις), 'hiding', for last visibility.

read and understand them, at least in the descriptive parts. In fact, Greek astronomi-cal terminology is characterized by what I call 'etymological transparency'. Because of its transparency, this terminology is often more precise and clearer than ours. At the same time, Greek astronomers strove toward building this (intelligible) terminol-ogy in the most precise way, as proven by the example of Ptolemy grappling with de-fining and re-defining '*phaseis*' on the basis of its etymology, which clearly exclude the 'true' phases, which are in fact invisible, and so they cannot be 'appearances' (i.e., *phaseis*). In other words, an 'invisible phase' is nonsense to a Greek astronomer, while it is a reality for a modern one.

Second, the terminology used to express positions of the stars in the sky reflects another important aspect of Greek astronomy: its obsession with tracking the motions of the heavenly bodies. It is often said that while modern astronomy is concerned with the nature of celestial bodies and the physical processes occurring in them, an-cient astronomy is concerned with their motions, and this is so because their instru-ments and physical understanding only allowed them to measure and study their motions. This is no doubt true, and the language they used to express those concepts clearly reflects this interest: heavenly bodies are described in relation to each other, some preceding and some trailing, or in relation to important reference points, most often the south meridian.

Third, in addition to being 'positionally' significant, Greek astronomical terminol-ogy can also express important perceptible (to us) characteristics of the celestial bodies. Star phases are described by their names in a way that makes it easier to visualize the specific moment in the sky relative to the Sun's and star's positions. Similarly, the celes-tial circles have names that clearly connect them to the Sun's motion in the sky and to specific seasonal or temporal changes on the Earth, making these geometrical abstrac-tions of the celestial sphere much more evident. Moreover, the cardinal points are named after celestial phenomena (a constellation pointing to the north or the position of the Sun in the sky) or winds – again, phenomena perceptible by people.

Fourth, by defining and re-defining a full-fledged system of terms for star phases, Ptolemy presents himself as the one who finally systematized a field that started in the fourth century BCE but was never precisely defined until his day. This is indeed Ptolemy's role in Greek astronomy in general – yet the example of star phases has shown that Ptolemy not only systemized astronomy as a science but also provided it with a better language to express its content. In other words, Ptolemy became an *auc-toritas* not only because he had written the *Almagest* but also because he had created a specific and precise terminology to name astronomical concepts. The way he presents these definitions in the *Almagest* is also proof of his authorial attempt. Although written in continuous prose, the discussion of star configurations and varieties is almost a list with bullet points, lending itself to easy tabulation. This stylistic choice, where there is no discussion but just definitions one after the other, makes this systematization even more authoritative. Only in the *Phaseis*, which seems to be addressed to a more general audience, is Ptolemy more interlocutory and inclined to discuss his definitions, yet the

aim is always the same: to impose his own system, both of scientific concepts as well as of terminology.

Fifth, the detailed analysis of the star phases has shown another aspect of astronomical terminology: its systematic nature. The specific obsession with defining a full set of names and definitions is of course connected with the importance of stellar phases in ancient astronomy. The calculation of star phases needed trigonometrical concepts that were not trivial (and explained by Ptolemy in *Synt.* 8.5–6), yet its results were not limited to highly technical treatises such as the *Almagest*; they were also used in *parapēgmata* (like the one that follows in the *Phaseis*), a much more popular genre. The example of star configurations and phases has shown how an entire vocabulary with its own taxonomy was built up over the centuries (from Autolycus to Ptolemy) to clarify and name phenomena that were key to the science of that time.[48] They were also important for the common people, since stellar phases were connected to the farming calendar. The modern version of this vocabulary is not as precise because we are far less interested in these phenomena. In this respect, this is a clear instance where interest *creates* language. Greek astronomical terminology for stars and their motions reflects the interests of its users: the precise description of the *phainomena*, their geometrical interpretation, and their use to measure time and predict seasonal changes.

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48 On some principles of technical taxonomy, see Alinei 1991.

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Courtney Roby

Terminology in the Wild: Enactive Meaning-Making in the Roman Surveyors

Abstract: The Roman land surveyors (*agrimensores*) engaged with a rich and variable set of terminological systems defined the technical and legal aspects of how land was divided and allocated in the Roman Empire. Their extensive vocabulary for the varied types of land was encoded in media like the bronze maps in the imperial *tabularium* and bound to the systems of material boundary markers the surveyor would need to identify and differentiate in the landscape, which might exhibit considerable local variations. The surveyor could not master these terminological systems merely from text; only direct and active experience allowed the surveyor to negotiate the terminological systems that organized the Roman landscape. In this chapter, I use cognitive science theories of embodiment and enaction to trace the role the surveyors' lived experiences would have played in the ongoing construction of the terminological systems that guided their work.

1 Introduction

The Roman land surveyors (*agrimensores*) spent their days negotiating semantic boundaries both material and legal, seeking to read rules for ownership, land use, and taxation not only out of a body of legal guidelines but out of the landscape itself. Both domains were subject to slippage, as boundaries crept from their appointed locations through natural causes or human intervention, while legal disputes arose over land granted in many different ways, under a range of legal statutes, to owners whose identities could shift over time or who might themselves make illicit interventions in land assignments.[1] Developing a clear, fixed terminology for the wide range of land allocation types the surveyor would encounter (or create) in the landscape proved impossible, as agrimensorial techniques and statutes changed over the centuries.[2] Instead, the writings of the Roman land surveyors emerge as a lively site of terminological transformations and adjustments based on the surveyors' lived experiences.

Most of the extant writings of the Roman land surveyors are collected in the *Corpus Agrimensorum Romanorum*, a compilation perhaps dating to the fifth century CE

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1 Surveyors' techniques for addressing disputes between landowners both public and private are outlined at Cuomo 2007, 103–130. More detailed treatments of the topic include Brugi 1968; Moatti 1993; Maganzani 1997.

2 On specific elements of agrimensorial terminology, and the religious, legal, and other questions those terms raise, see the papers in Conso et al. 2006.

but incorporating texts from as early as the first.[3] Many of the texts are accompanied by images, from map-like drawings to representations of the inscriptions found on the boundary stones the surveyors used to demarcate divisions of land.[4] The markings on these stones ranged from simple signs like a letter or number situating them in a grid, to images of animals or other symbols that carried detailed information about the location of features like mountains or springs to those educated in their language. These inscriptions are themselves a fascinating wrinkle in the surveyors' terminological system, which was not merely verbal but visual as well.

Many contemporary studies of terminology bear the mark of the 'Vienna school' associated with Eugen Wüster. In a volume dedicated to studies of terminology, I do not need to replicate here the details of Wüster's approach.[5] Very briefly stated, Wüster viewed terminology as emerging from an array of extralinguistic concepts, which must be clear-cut and clearly delineated from one another. Terminological definitions can then be derived from the concepts in three ways: intensionally through specifying their characteristics, extensionally by collecting exemplars, or by defining a composite concept by enumerating its parts; the first of these is strongly preferred. The terms thus assigned should be univocal (i.e., each term should map onto exactly one concept) and should remain stable once assigned. The highly ordered terminological system that results from this process reflects Wüster's own background as an engineer rather than a linguist.

Highly desirable in theory, in practice it turns out to be more difficult to establish such a clear, orderly, and univocal terminological system in many domains. These difficulties emerge not just from the complexity and ambiguity of the real-world objects of study but also from features of how humans actually use language. As Roelcke points out, empirical studies of technical terminology indicate that in practice these terms are often polysemic, not completely clear-cut, and subject to metaphorical transfers between domains.[6] Such attributes are pathological within the Vienna school's highly constrained hierarchy of precise and univocal terms. But studied from

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3 The *Corpus Agrimensorum Romanorum* is available in Lachmann's 1848 edition. More conveniently for English speakers, the *Corpus* has been lightly edited and translated into English by Brian Campbell, and supplemented with useful notes, diagrams, texts from inscriptions, and other helpful materials: Campbell 2000. *The writings of the Roman land surveyors: introduction, text, translation and commentary*. London. For an introduction to the techniques of the surveyors, see Dilke 1971. For a more comprehensive guide to the surveyors and their practices, as well as the texts of the *Corpus* and other surviving evidence like maps, see Chouquer & Favory 2001.

4 For a good introduction to these images, see Dilke 1967. For more detailed analysis of the images in the principal manuscript of the *Corpus*, see Carder 1978. On the caution necessary in labeling these images as actual maps, see Dilke 1961.

5 An overview of the principles and aims of the 'traditional Terminology' thus defined is given by Temmerman 2000. *Towards New Ways of Terminology Description: The Sociocognitive-Approach*, Amsterdam, 2–15.

6 Roelcke 2018, 178–179.

the perspective of linguistic pragmatics, with a focus on how terms are actually used, these features are interesting and worthy of study in and of themselves. A pragmatics approach might study how terms are *understood* in the context of use by technical practitioners, how their meanings change as disciplines develop, how terms are trans- ferred metaphorically from one domain to another, and so on.

Other recent approaches to the study of terminology build on the pragmatists' in- terest in how terms are actually used by humans to inquire more deeply into the cog- nitive processes that result in the formation of the categories of concepts that the Vienna school's approach rather takes for granted.[7] Cognitive linguistic approaches to terminology often draw on prototype theory to explain how conceptual categories are built up around entities experienced as exemplary ('prototypical').[8] The prototype- based schema can accommodate additional entities that may not perfectly match the prototype but still have sufficient features in common to qualify as a category mem- ber. As Temmerman notes, some such categories may in fact display logical or onto- logical structure rather than prototype structure without being excluded.[9] The crucial factor is a focus on the *process* of category construction, regarding meaning-making as an experientially based activity rather than the discovery and interpretation of classical 'objective' categories. Geeraerts proposes replacing the image of meanings as "chunks of information that are contained in and carried about by word bags" with an active schema in which 'words are searchlights' that illuminate an area of their domain of application *upon that application*.[10]

Reinterpreting the 'meaning' of a term from an objective attribute out in the world to an active, experientially based creation recalls some of Gärdenfors's princi- ples of cognitive linguistics. Whereas the 'realistic' approach to cognitive semantics locates the meaning of an expression 'out there in the world', where sentences are assessed as mapping on to truth values (or not), the cognitive semantics view instead identifies meaning as a 'conceptualization in a cognitive model', a model that is itself largely determined through perception and experience.[11] Like Temmerman, Gärden- fors focuses on the development of concepts through experientially derived prototype effects rather than an 'Aristotelian' theory of necessary and sufficient conditions. He likewise emphasizes the social aspects of making and changing meanings of terms, particularly in technical domains: meaning-making is a fluid process influenced by actors who for culturally contingent reasons are endowed at any given moment with particular social, technical, and linguistic power.

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7 Roelcke 2018, 182–183.

8 On prototype theory's relationship to the formation of terminological categories, see for example Taylor 1995.

9 Temmerman 2000, 43.

10 Geeraerts 1993, 259–260.

11 Gärdenfors 1999, 19–22.

In emphasizing the importance of lived experience for forming terminological systems, cognitive linguistic approaches to terminology draw on related branches of cognitive science. Most relevant here is perhaps the 'enactivist' approach championed by Gallagher, Hutchins, and others.[12] While enactivism includes a very wide range of views and approaches, they share a common commitment to the idea that cognition depends on (or, in some of the more radical views, is constituted by) a feedback loop between perception and action. Given the inextricability of perception and action to cognition in the enactivist model, these approaches automatically entail a commitment to embodied cognition. 'Embodiment' here labels a set of viewpoints, again quite varied, that insist on the central cognitive roles of proprioception, bodily affordances, and the body's context within a (culturally marked) environment.

To close the loop back to questions of terminology: in what follows I will examine how the embodied, lived experiences of Roman surveyors in the field informed the ways in which they created and adapted their suite of terminological tools. These tools allowed them to navigate and shape anew a landscape marked by a complex lexicon of verbal and visual signs, which were themselves subject to disruption by natural forces as well as human interventions (legal and otherwise). While some of the texts in the *Corpus Agrimensorum* hint at a clear-cut, fixed system of labels that would find itself right at home in an ISO standard manual of terminology, many others sketch out the complications, irregularities, and polysemic variations that seem to have marked many surveyors' actual experiences with land boundaries. The markers themselves were inscribed in stone or bronze, scarred into trees, or written into the land itself as ditches, walls, and hedgerows; the *media* of the surveyors' terminological systems were themselves an important aspect of their lived experience. Exploring, applying, and refining the *agrimensores'* terminological lexicon meant physically grappling with stones and other markers to resolve ambiguities that elude purely textual study. The complex categories evolved in the course of those explorations reflect a long and never-ending process of enactive meaning-making, where the surveyors wring their terminologies from the land itself.

2 The Letter of the Law

Several short texts in the *Corpus Agrimensorum* are attributed to Julius Frontinus who is likely to be identified with the first-century consul who governed Britain and also composed a *Strategemata* and *De aquis urbis Romae*. If this identification is correct, his texts are among the earliest surviving texts of the *Corpus*, and they are writ-

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12 For enactivism's place within the spectrum of 'extended cognition' theories, see Rowlands 2009, 53–62. A collected volume that demonstrates the breadth of enactivist views is Stewart et al. 2011. For connections between enactivism and phenomenology, see Gallagher's work, particularly Gallagher 2017.

ten in an uncomplicated style that reflects a relatively simple typology of land and land disputes compared to the more elaborate taxonomies of the later texts. His *De agrorum qualitate* gives a neat hierarchical overview of types of land. At the top level, land may be "divided and allocated (*agri divisi et adsignati*)," "contained by measurement from end to end (*[agri] mensura per extremitatem conprehensi*)," or peripheral, informally occupied land not included in a survey (*[agri] arcifini*).

Frontinus then redefines the first two categories in terms more closely linked to the practicalities of the survey itself, as (on the one hand) land bounded by *limites* and (on the other) land which is allocated differently for some reason. For the second category, Frontinus gives the example of Suessa Aurunca, where because there was no woodland near the allocated land, the colonists were instead assigned land on a nearby mountain. Land demarcated by *limites* (themselves differentiated into *decumani* and *kardines*, which typically ran east-west and north-south, respectively) is then allocated by *strigae* (longer than they are wide) or *scamna* (wider than they are long). The third category is redefined in practical terms of its own: this is land marked by long-standing informal boundaries like rivers, mountains, or trees. Such informal holdings are, unsurprisingly, hotbeds of territorial disputes, and Frontinus cites Varro's explanation that *ager arcifinius* derives from the act of 'driving off (*arceo*)' enemies.

Frontinus is careful to add that *ager arcifinius* is subject to different legal rights than the 'leftovers (*subseciva*)' from the process of dividing land into *centuriae* (a rectilinear grid of sectors of land 20 *actus* on a side).[13] These scraps of land, either lying on the periphery of the centuriated land or irregular unallocated bits of land inside *centuriae*, are themselves subject to constant disputes over ownership. Frontinus does not discuss them in much detail, but in a work written some centuries later, Agennius Urbicus fills in the details that while *subseciva* were not allocated at the initial founding of a colony, later waves of settlers were allocated *subseciva*. The newly minted owners then found themselves in conflict with the owners of land in the adjacent *centuriae* who had encroached on the formerly unallocated land at their borders.[14] Finally, Frontinus acknowledges that there is another kind of land as well, which like *subseciva* is not allocated or enclosed, and neither given to the *res publica*, nor to the colony, nor given up as sacred territory; this land remains under the jurisdiction of the colony's founder. All this is to say that even Frontinus's apparently simple and straightforward categorization of land turns out to conceal terminological complexities that emerge as the surveyor's neat theoretical categories are entangled in legal disputes, political acts like sending additional waves of colonists, and timeless human behaviors like stealthily expanding one's holdings into unprotected adjacent territory.

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13 On centuriation see Gabba 2003.

14 Campbell 2000, 38.

Another short text from the *Corpus Agrimensorum*, this one anonymous, gives a more complex typology of land right from the start.[15] The list once again begins straightforwardly: allocated (*adsignatus*) land, centuriated land, *subseciva*, and land on either side of the *decumanus* and *kardo* (*dextratus*, *sinistratus*, *citratus*, and *ultratus*). But as the list goes on, the taxonomy burgeons into a more multifarious collection of terms, since it turned out sometimes to be necessary to classify land by its shape (the author lists, for example, the terms *ager tetragonus*, *tessellatus*, or *normalis*, all for rectangular areas of land), by the ruler under whom it was distributed (*ager triumviralis*, *Syllanus*, *Caesarianus*, and even *ager commutatus ex beneficio Augusti*), by its topography (*ager epipedonicus* and *cultellatus*), or by the units in which it was allotted (*ager iugarius in quinquagenis iugeribus*).

The follow-up companion text that defines the various types of *limites* ends up ranging over a still broader set of possible axes of definition, at times reminiscent of Borges' *Celestial Emporium of Benevolent Knowledge*. Clear-cut categories include *limites* running east or north (*orientales* or *septentrionales*) or facing south (*austrinales*), the principal *decumanus* and *kardo* (*limites maximi*), continuous (*perpetui*) *limites*, and so forth. But the categories must also reflect peculiarities of certain types of land, such as those demarcated by *limites Gallici*, *limites maritimi*, or *limites colonici*. Others reflect the practicalities of the specific acts of observation that created a given *limes*, like *limites nonani*, *sextanei*, and *undecumani*, all of which are defined by the hour when these north-south lines were measured. Still further criteria for categorization include temporary *limites*, *limites* defined *per antica et postica* (i.e., using antiquated terminology), and stand-alone (*solitarii*) *limites*. The fragmentation of terminological strategies in these texts reflects the rich experiential contexts of the land defined by seemingly simple surveying techniques. Potentially interesting attributes differentiate land divisions from the very moment of measurement (was it at noon or in the afternoon?), and continue to accrue as the land thus measured out presents obstacles like mountains or seas, takes a particular shape once divided, and is allocated to successive waves of owners by political authorities at different levels.

Another short text, aptly labeled *De paludibus*, addresses some of the murkiness of the surveyor's classificatory work:

> Boundary markers have not been totally described (*perdescribantur*)(. . .) This system should be expounded with legal abbreviations in accordance with the lex, and in line with the art of grammar, philosophy, and geometry. (. . .) But *leges* should be expounded according to the art of geometry, with reference to relevant written material in accordance with the report on the place which is to be analyzed, and also in accordance with observation on the place, whether it has ditches, *subseciva*, straight lines, *centuriae*, or boundary stones.[16]

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15 Campbell 2000, 242–244.

16 Campbell 2000, 268. Translations here are adapted from Campbell.

The multiple approaches – mathematical, legal, and experiential – suggested here are needed to combat the varied axes of classification suggested by the many types of land and *limites* the surveyor might confront, to say nothing of the local variations in topography or materials, cases of boundary sabotage by acquisitive neighbors, and all the other local peculiarities the surveyor will grapple with. The lack of complete description or definition of boundary stones the text's author mentions at the start is not so much a complaint about incomplete classification as it is a realistic reflection of the fact that there are some disorderly aspects of the surveyor's craft that cannot be fully captured in neat terminological categories or by any one analytical strategy.

Some of the texts in the *Corpus Agrimensorum Romanorum* attempt to sweep the complexities and ambiguities the surveyors faced in the field under the rug, suggesting instead a cooperative world of clear-cut boundaries and rules that would define a perfect set of operating procedures if only they were followed scrupulously. Chief among these is the *De controversiis agrorum* transmitted under the name of Agennius Urbicus, about whom virtually nothing is known other than that this rather didactic text is cited in the *Commentum*, which may be dated to the fifth or sixth century CE, which provides a very loose *terminus ante quem*.[17] The text we have is heavily interpolated, and Lachmann's typographical differentiation of the parts of the text he deemed most likely to have been written by Urbicus himself from the interpolation has influenced later treatments (though Thulin's edition does not follow such a convention). As we shall see, the 'voices' of Urbicus and the interpolation appear to suggest somewhat different priorities and possibilities for distinguishing and naming categories of land and disputes.

The surviving text of the *De controversiis* begins with a programmatic statement (which Lachmann identifies as an interpolation) about the relationship between signified and signifier, revealing an idealized image of the connection between a term and its meaning. The author argues that if speech (*vox*) is natural and defined in terms of the various meanings of words (*varia verborum significatione*), then it requires its own educational method (*institutio*). Even the basic ability to read written words relies on a system of agreed-upon conventions about how to interpret a given shape made from lines (*linearum illam figurationem*), which must be consistently deployed in order to be interpreted in the first place. Likewise, reckoning with numbers only becomes possible once 'one,' 'two,' and so forth are defined. These demands remain even when one moves on to more realistically complex affairs:

> If we introduce related discussions into our treatment of the subject and examine them in order, very many preliminaries are necessary (. . .) for we are subject to the working of nature in such a way that all things with which we have an affinity, or which have an affinity with us, are of-

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17 Campbell 2000, xxxi. On Urbicus see also Chouquer & Favory 2001, 26–27; Castillo Pascual 1998, 95–108.

fered to our senses in a rather confused way, and we have learned to distinguish these very things with our minds (. . .).[18]

In this model, semantically active speech (*vox*) is defined as a natural system relying on semantic elements with fixed defining features (both formal and semantic). The relationships between those features and the concepts they define are initially a matter of agreed-upon convention, but once one 'buys into' the system by accepting the rules for interpreting letters, words, and numbers, those meanings appear fixed and intensionally defined.[19] These fixed definitions of concepts labeling referents in the world are then located within the orderly epistemological system suggested (though not explored in any depth) in the *De controversiis*. Finally, the distinction between the natural 'confusion' of sensible objects in the world and the 'discerning (*dinoscere*)' performed by the mind suggests the author believes it is possible to establish necessary and sufficient conditions for defining concepts without ambiguity. The system optimistically suggested here might fit quite well into the strictures of the Vienna school.

The learning process the author recommends relies above all on delimitation: categorizing and defining small areas of investigation so that the inquiring mind is not baffled by the distracting task of trying to comprehend everything at once. He defines the mind as an instrument that must be shaped for inquiry just as iron is shaped for cutting (*nec ferrum in genere secare potest, nisi ad secandum habilem acceperit figuram*), and the mechanism of that shaping is a 'fixed order of learning (*certo disciplinae ordine*).'[20] The particular order prescribed here for surveyors proceeds from the nature of the cosmos, to the division of the Earth into *oecumene* and other, and finally the division of the *oecumene* into regions.

At this point in the text an authorial voice deemed by Lachmann more likely to be Urbicus's own takes over, moving from the conceptual musings on division in the preface to more specific questions of the differences between the various categories of land ownership (*condiciones possidendi*) and the kinds of disputes that affect them.[21] The variations between geographical regions reappear here in a more practical context. It emerges that the categories of land ownership differ in Italy from the conventions of the provinces, where land may be tax exempt, or belong to non-Romans, or be subject to different terms of legal ownership but nevertheless treated as though privately owned. Moreover, the climatic differences between regions complicate matters still further, as for example water disputes in Italy tend to focus on rules for preventing landowners for diverting rainwater to neighboring land, whereas the opposite is true in Africa. Another interpolation celebrates the potential for geom-

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18 Campbell 2000, 16.21–24.
19 That is to say, defined by their properties rather than by listing objects matching the term. On the role of intensional definition in traditional terminology, see Temmerman 2000, 6–16.
20 Campbell 2000, 18.4–8.
21 Campbell 2000, 20.1.

etry, 'delightful in its order (*delectabilis ordine*),' to bring reason and proportion to these disputes, though to be sure geometry encounters challenges of its own when put to the test in the world of surveying practice.[22]

The *De controversiis* is thus itself the site of an unfolding dispute between a 'theoretical' voice emphasizing rigorous order and definition, and a more practical voice (attributed to Urbicus himself) that paints a messier picture of legal and material variations and human interventions. The interplay between the two voices is neatly captured later in the text, in a discussion of how to manage disputes over land allocation under the *status effectivus*: "(. . .) there is a distinction depending on how it is heard by a judge. In this dispute the surveyor will need to pay attention to (boundary) lines *until some inconsistency obtrudes on consistency. For no truth can be demonstrated if even the tiniest morsel of falsehood obtrudes. For the truth should have self-similarity under all circumstances.*"[23] The 'practical' voice emphasizes the sociocultural context and the need for physical observation of the particular site, while the 'theoretical' voice insists that an unambiguous, consistent, and permanent truth can be discovered for every disputed arrangement of land ownership. The 'practical' voice does insist at the end that truthfulness is a vital virtue of the surveyor himself, while acknowledging that the human weaknesses of inexperience and poor judgment can interfere with its expression. However, this is a far cry from the 'theoretical' voice's idealistic appeal to the possibility of discovering permanent objective truths through eliminating inconsistencies.

The two voices overlap as well in the tricky case of defining the term *rigor*. The various terms for straight lines used by the surveyors (principally *finis*, *limes*, and *rigor*) might be thought of by laymen as interchangeable. However, the *agrimensores* made finer distinctions: *limes* typically refers to the *decumani* and *kardines* as defined in the landscape by roads or paths, while *finis* is a more general term that can refer to various types of boundaries as well as the physical structures like roads or hedgerows that mark them. Balbus's *Expositio et ratio omnium formarum*, which probably dates to the first or second century CE, gives the shapes of land areas the surveyor must deal with a Euclidean treatment. In this work, Balbus defines *rigor* as "whatever is seen (*perspicitur*) to stretch straight between two points in the form of a line" and as "whatever occurs on land as part of the work of measuring to establish a straight boundary."[24] Balbus here distinguishes the *rigor* from the *linea* that represents it on the map, apparently by defining it as something visible in the landscape. Does that mean the *rigor* has breadth like the principal *limites*? Not necessarily; the act of sight-

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22 Campbell 2000, 22.7. These challenges are addressed elsewhere in the *Corpus*; see Roby 2014, 9–52. For comparable issues in Hero of Alexandria's *Dioptra*, the principal surviving Greek text on surveying, see Roby 2018, 67–88.

23 Campbell 2000, 32.30–32. Roman type here indicates the text associated with Urbicus himself, and italics the interpolation.

24 Campbell 2000, 208. On Balbus see Campbell 2000, xxix–xl; Santini 1990, 137–142; Roby 2014.

ing that reifies the *rigor* in the field could refer to the surveyor's establishing a straight line using sighting-poles and a sighting instrument like the *groma* rather than seeing a pre-existing boundary ditch, road, or some other structure visible because of its breadth.[25] Moreover, Balbus elsewhere defines a road as a breadth delimited by two parallel *rigores*.[26]

Balbus thus appears to regard the *rigor* as breadthless, like a Euclidean line, but this definition was not universal. The 'practical' voice attributed to Urbicus calls the discussion over the term 'nuanced (*subtilior*),' alluding to attempts at defining the *rigor* under the *lex Mamilia* and acknowledging that jurists are still arguing the matter.[27] Some of the difficulty, he says, results from the opaque archaic terminology of the law itself (*antiqui sermonis sensus*): it is ambiguous whether the 5-foot width of the boundary defines the space on each side, or the total width (so 2½ feet on each side). Urbicus leaves the matter with the current legal argument, which favors the latter. The 'theoretical' voice, however, here breaks in to enhance the precision and philosophical heft of the question. The author suggests that a boundary on the Earth cannot be treated the same way as a single line without substance: "whatever earthly thing is divided (*quidquid terreni est divisum*), it follows that it is agreed that in its entirety it has solidity."[28] The author argues that even a very finely traced line in the Earth inevitably acquires some physical bulk as it is drawn, because air is added in as the dirt is scraped and heaped up along a furrow (*in modum tamen sulci per supplementum aeris conspicitur*).[29] This is in itself a quite practical approach to the debate, but the author appeals to unnamed 'philosophers and geometricians' to support the stronger claim that the same would hold for an imaginary line traced (somehow) in thin air. Transferring the analysis from the surveyor's domain of the Earth, where *rigores* actually occur, into the air is characteristic of this author's tendency to extend any term's definition as far as logically possible, regardless of its practical applicability.

Even the 'practical' voice of the *De controversiis* is, in the final analysis, not especially practical. The primary aim of the text as a whole is categorizing and labeling different types of disputes. Urbicus bases his analysis on the 'progressions (*transcen-*

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25 On the surveyors' instruments, see Lewis 2012, 129–162.

26 Campbell 2000, 204. For these and other instruments used by surveyors, see Lewis 2001.

27 On the *lex Mamilia Roscia Peducaea Alliena Fabia*, see Fabricius 1924; Hardy 1925, 185–191. Fabricius attributes this law to C. Mamilius, tribune in 109 BCE, arguing that it was a response to the elitist *lex agraria* of 111 BCE, while Hardy argues that it was more likely part of Caesar's agrarian legislation, dating most likely to 59–52 BCE. None of the surviving three chapters offers any insight into the *rigor* question.

28 Campbell 2000, 24.

29 Campbell translates this section somewhat differently: "when it forms a boundary at the lower level with something earthy, even though it is very thinly traced, nevertheless, in the manner of a furrow, it is seen by its (imagined) extension through the air above." However, I think it is easier to comprehend without supplementing 'imagined': the earth dug up from a furrow is less compacted and literally easier to see since it is 'fluffed up' with air.

dentiae)' by which disputes may move from obscurity to clarity – *if* the correct statute is applied. The *transcendentiae* themselves are classified as "necessary, or possible, or impossible, and often ephemeral."[30] Urbicus gives a few examples to clarify what he means here. A dispute that changes from being about boundary markers to being about a *rigor* is impossible under the *status generalis assumptivus*, which just pertains to boundary markers, while a dispute about a boundary with no discernable demarcation is classified as both impossible and ephemeral. Disputes over boundary markers are not a class of their own, but rather "preliminary and a kind of threat of litigation, indicating that the dispute will be over either site or area."[31] Campbell notes of one of the principal passages defining these procedures that "Urbicus's theoretical approach in this section, which seems over-schematic and artificial, is divorced from the reality of land survey as it appears in Frontinus and other writers."[32] Indeed, Urbicus includes very few practical details on how they are to be resolved; the most detailed advice is "no one readily moves a boundary stone for just a small quantity of [land]. It will be part of the surveyor's skill to decide, according to the position of the neighboring angles, how far a marker has been moved and by what principle it should be restored to its proper place."[33] Urbicus's focus remains on his complex hierarchy of types of disputes and their associated statutes and conditions.

Contrast this typology of disputes with Frontinus's *De controversiis*, where disputes are classified topically and matched to observable features in the landscape: disputes over boundary markers (between two neighbors along a boundary, or three or more at the *trifinium* or *quadrifinium* that mark corners), disputes over *rigores* that stretch from one boundary marker to another (or similarly over the 5-foot breadth mentioned above), disputes over alluvial land, over sacred places, and so forth. Granted, the legal complexities governing land allocation had multiplied spectacularly between Frontinus's time and Urbicus's. Still, sensitive though the 'practical' voice associated with Urbicus is to the social and legal complexities of the surveyor's work, the text's aim to create a complete typology of disputes often seems to reflect an idealized, abstract view of that work rather than a system of practical knowledge derived from experience in the field.

Urbicus optimistically promises that "the angles at which boundaries meet one another (. . .) are never without some system. If we do not turn a blind eye, we shall through our skill easily restore to this system whatever unskilled people have disturbed."[34] Other texts of the *Corpus Agrimensorum*, however, indicate that restoring order to the landscape requires a wealth of experiential and local knowledge so that the surveyor can read the complex and shifting language of markers in the field. In-

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30 Campbell 2000, 26.

31 Campbell 2000, 28.12.

32 Campbell 2000, 337, n. 17. This passage (Campbell 2000, 24.32–26.15) is identified by Lachmann as an interpolation, but by Campbell as Urbicus's own work.

33 Campbell 2000, 26.32–28.2.

34 Campbell 2000, 28.6–9.

deed, the surveyors' unfolding experiences in the landscape spark the creation of new systems of taxonomy and terminology, which in some respects may match up to idealized abstractions like those Urbicus describes, and in others reflect an entirely different approach to meaning-making, as we will see in the next sections.

3 Stone and Bronze Language

The terminological system the surveyor engages with in the field is in fact a hybrid of verbal and material signifiers. The taxonomic and logical systems explicated in instructional texts like those collected in the *Corpus Agrimensorum*, plus the in-person verbal instruction fledgling surveyors surely received (though we know almost nothing about their education), represented only part of the picture.[35] The surveyor's work required him to leave books behind and head out into the field, to be confronted with an unpredictable assortment of material and visual signifiers that would complement (and sometimes conflict with) the verbal terminology that gave taxonomic structure to types of land and disputes over them. The stones themselves presented a terminological challenge of their own, even apart from the question of their significance as indicators of land types. One glossary of stone types in the *Corpus Agrimensorum* lists stones defined by shape (*isosceli* and *exagonus*), position or orientation (*terminus quadrifinius* and *terminus in inversum positus*), era of installation (*Augusteus*), and several other factors.[36] Terminology like *Augusteus* conceals a wealth of historical and cultural associations as well as communicating a host of technical details to the expert's eye. The text attributed to a certain Latinus and Mysrontius reports that round stones are called 'Augustan',

> because Augustus re-assessed this land, and where there were stones in existence, set up new ones, and had all the land surveyed again in his day and allocated to veterans. These stones of Gaius Caesar are round stones made from flint or volcanic rock, 1.5 feet underground and 2.5 feet above ground, or sometimes 4 feet; they are 2400 feet apart from one another.[37]

The text mentions as well 'Neronian, Vespasianic, and Traianic' stones, but gives no further details; nonetheless, it seems likely that these terms indicated a typology of stones at least as complex in the technical details of composition, shape, and situation in the landscape, even if the story behind their allocation was not so famous as the land grants of Augustus.

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35 While it remains very difficult to conjure up ancient contexts of imparting technical knowledge through non-textual means, an exemplary inroad into the possibilities of mining texts for clues to the tacit knowledge they entail is Cuomo 2016, 125–143.

36 Campbell 2000, 244–246.

37 Campbell 2000, 254.

The complexities multiply when these categories of stones are mapped on to categories of land. The *Corpus Agrimensorum* includes several lists of the meanings of these stones, which give a taste of the difficult definitional work the surveyor would have faced in the field. A text attributed to an unknown Latinus (whose relationship to the above-mentioned Latinus is equally unknown) notes a range of possible significations of stones, some more cut-and-dried than others. Lead on the top of a stone or attached to a tree signifies a cistern or pool; a hollow on top means that a nearby well marks a boundary; a hollow underneath indicates a washing area.[38] Meanwhile, a boundary stone laid on its side signifies a *limes* – but how is one to tell in the field whether the stone was placed on its side deliberately or just fell over? Another text, this one attributed to an equally mysterious Vitalis and Arcadius, notes that a washing area can itself be a boundary marker even without having the stone there, and that if it is marked by an *arca* (a chest-shaped marker with four sides and a hollow), it marks a *quadrifinium* (four-way intersection).[39] The latter case, however, applies only if the *arca* is encountered on the last of a chain of three hills (*monticelli*) along which a boundary extends from a *limes*. The stones' language is far from simple!

Moreover, stones are just one tool for surveyors to mark boundaries: ditches, trees, streams, walls, roads, and other manmade and natural objects may indicate them as well. Siculus Flaccus delves into the uses of trees as boundary markers, observing that practices vary regionally and depend on the owners of neighboring properties to abide by certain standards.[40] Almost any type of tree can indicate a boundary: pine, cypress, ash, olive, and many others are mentioned by authors in the *Corpus Agrimensorum*. Some property owners leave only trees of a single type standing to create a more distinctive boundary, while others plant distinctive new trees.

It is obviously convenient to use already grown trees as markers rather than waiting for new ones to grow, but how does one demarcate the 'marker' trees from others in the area? If the trees fade out on one side of the boundary, they can be left intact, but if similar trees grow on both sides of the boundary, the trees on the border must be scarred on both sides to differentiate them from their surroundings and indicate that they separate two different properties. These scars have a language of their own; for example, a 'decus (X)' or gamma indicates that the tree stands at a bend in the boundary. Trees, unlike rocks, have immediate commercial value of their own, and so boundary trees are subject to being cut down by unscrupulous neighbors not just to adjust the apparent property boundaries, but for their own wood.

The 'X' and other symbols carved on trees echo a more complex vocabulary of letters and other symbols that are found on boundary stones or label them in other ways. A few texts in the *Corpus Agrimensorum* use letters to link informational do-

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38 Campbell 2000, 226.

39 Campbell 2000, 248.30, 250.34–35.

40 Campbell 2000, 110.

mains ranging from signs in the landscape, to typologies of lands, to verbal and visual indicators in the texts themselves. The first, a brief anonymous text simply labeled *Item expositio terminorum*, is an abecedarium of facts that letters inscribed on boundary stones might signify.[41] For example, A indicates a nearby boundary or spring; B is the same but marks a boundary or spring branching in two. Some are iconic, for example G, which 'denotes a curving *limes* like its own letter' or L, which 'indicates a right angle, like its own shape'. K is for *kardo*: "you will find that this boundary stone is very carefully made and elegant, indeed beautiful" – though no such promise is made for D for *decumanus*. So far, so good: just an alphabet of indicators, many of them tied to their symbols with mnemonic devices like these.

But then again, in a text attributed to 'Latinus P. Togatus', the letters of the alphabet instead stand for distances between markers: A for 250 feet, B for 350, Z for 1900, etc. Yet another set of alphabetic associations is found in the text known as the *Casae litterarum*, which maps (literally) the letters of the alphabet onto a set of descriptions of prototypical property types. For example, B represents a farmstead (*casa*) with a large parcel of land in front of it that includes a brook to the south, while O signals a *casa* on a mountain surrounded by land extending radially from a spring. The descriptions of the *casae* are accompanied by small maps where a large letter stands in place of the *casa*, with the other important features of the estate depicted iconically; the alphabetic cues would thus have been acquired visually through the included images at least as much as through the verbal description. Hence, a surveyor encountering lettered stones in the landscape might activate any of these networks of associations, or indeed others that have not been passed on in the *Corpus Agrimensorum*. Assigning a meaning to the marked stone would require sorting through a polyvalent web of possible meanings, informed by the surveyor's foundational technical training and more recent lived experiences.

The marked stones and trees in the surveyor's landscape are only one part of the network of material supports defining patterns of the land's ordering and ownership. They were complemented by a host of separate technologies, like maps and tablets listing land allocations, that provided a check against the markers in the landscape by setting down the surveyor's terrestrial definitions in a centralized and abstract form. Hyginus Gromaticus reviews in his *Constitutio limitum* the range of material documentation surveyors and the imperial bureaucracy had at their disposal, recommending that:

> We shall write down all the mapping definitions (*aeris significationes*) on the maps and bronze tablets: given and allocated, granted, excepted, returned, exchanged for his own property, returned to the previous possessor, and whatever other abbreviated notations may have been in use and remain on the map. We shall place in the emperor's record office the mapping registers and a map of the entire territory.[42]

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41 Campbell 2000, 264–266.
42 Campbell 2000, 158.26–30.

The terminology in the surveyor's maps and tablets complements the language of the boundary markers by creating a dynamic record of ownership. The imperial records are meant to include the necessary information not only to record the current state of ownership, but to help the emperor make decisions about future allocations; so Hyginus recommends that they should include a list of all *subseciva* ('leftovers'), "so that whenever the emperor wishes he can find out how many men can be settled in that area."[43] The terminology defining types of land and its allocation comes alive in the imperial record office, as those terms become levers for further acts of land allocation made in the emperor's name.

Surveying maps were produced on a variety of materials, including wooden tablets, parchment, and monumental stone inscriptions like the cadastral map of Orange, but the bronze maps are mentioned most often in the agrimensorial texts.[44] Very few fragments survive of inscriptions that seem to correspond to the bronze maps. One maps three *centuriae* of the Roman settlement of Lacimurga in what is now Spain, including a section of the river Ana and a road, while another, discovered in the Capitoline complex at Verona also includes parts of three *centuriae*, which do not have distinctive topographical features.[45] The Verona map, like the Orange cadastral map, labels the positions of the *centuriae* with respect to the *decumanus maximus* and *kardo maximus* and includes information on how much territory was allocated to named owners. The Lacimurga map shares its inclusion of rivers and roads with the Orange map, and labels the area of the three *centuriae* (all 275 *iugera* versus the usual 200), but includes no information about their position (though this can be deduced since the fragment is a corner) or ownership.

The fragmentary material evidence seems in keeping with the textual descriptions in the *Corpus*, though these descriptions add considerable detail about information that is not well represented in the few surviving fragments. The tablets could include not only a visual representation of the mapped territory but also a wealth of information about its ownership and allocation, which could occur in various ways as land was given to veterans in the emperor's name, by a military commander to his friends or influential people, and so on. Annotations (*inscriptiones*) tracked the quantities of land granted, allocated, restored, or exchanged, as well as names of those to whom the land was given. Keeping strict records of the quantities of land thus allocated was important, among other things, for calculating the area of the irregular *subseciva*: the difference between the total quantity of allocated land and the total area of the *centuriae* covered by that territory gave the area of the *subseciva*. Siculus Flaccus argues that the evidence contained in the bronze map should be considered an authoritative tool to settle any

43 Campbell 2000, 158.22–23.

44 For detailed analysis and plates of the Orange cadastral map, see Piganiol 1962.

45 On these fragments see Sáez Fernández 1990, 205–228; Gorges 1993, 7–23; Cavalieri-Manasse 2000, 198–200.

disputes, but that if there is an objection to it, the surveyor can turn to the copy kept in the imperial record office (*sanctuarium*) for arbitration.[46]

Siculus Flaccus expands the terminology of the map to draw a parallel between map-making and the surveyor's work of gathering the information that the map itself represents:

> although the map is one element, some refer to the *pertica*, others *centuratio*, others *metatio*, others *limitatio*, others *cancellatio*, others *typon*, which, as I said above, constitutes one element, the map.[47]

The first four of these are measurement and division activities that happen in the field. The last two, although their meaning is less clear, seem to refer to record-keeping activities of stamping or crossing out writing, which might refer to the cumulative record of land passing through various owners.

The close connection between the surveyor's fieldwork and its representation in the bronze maps suggests a kind of translation process: the typology of land the surveyor's hands-on measurements create in the field is fused, in the map, both to its visual representation and to the legal realities behind it. The maps juxtapose a miniaturized, simplified visual representation of areas of land alongside annotations that bear information about the patterns of ownership that define the land in the legal domain. The legal situation defining a given piece of land can then be manipulated remotely by members of the imperial bureaucracy, as Hyginus mentions, so it is not merely a passive representation but an active site for adjusting the surveyor's definition of terrestrial space. The maps and other surveying records draw together several different experiential domains: the landscape itself, the overlay of meaning-bearing markers left on the landscape by the surveyors, and the matrix of legal information those markers signify. They translate into new media the terminological categories defining types of land and ownership, and their associated textual and visual explanations, carried within the texts of the *Corpus Agrimensorum* and other textual sources now lost to us.

Those media are themselves a crucial element of how the surveyors construct meaning out of the landscape. As we saw above, Siculus Flaccus identifies the bronze tablets, and in particular the versions held in the imperial *sanctuarium*, as the highest authority for resolving ambiguities and disputes over the allocation of land. The monumental size and stony permanence of maps like the cadastral map of Orange likewise convey a sense of immutable authority. The inscribed stones and trees in the landscape draw their own kind of power from their media: the intransigence of a row of marked trees, the cryptic inscriptions on stones decodable only by those trained to read them, and other stones marked with more broadly accessible inscriptions, all

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46 Campbell 2000, 120.30–32.

47 Campbell 2000, 120.24–26.

make claims to authority and permanence in their own right. Just like the varying 'linguistic power' Gärdenfors observes that certain kinds of people have to create and adjust systems of terminology, the *agrimensores'* inscriptions controlled flows of technical expertise and political power, thanks in part to the very media where they were inscribed. While terminology is usually considered from a media-agnostic perspective where the semantic content is all that is considered important, these inscriptions are an opportunity to reflect on how the material supports of systems of terminology can themselves invest the system with power.

4 Enactive Meaning-Making

The material supports – bronze maps, carved rock, and written book – upon which the surveyors' definitions in the landscape depend are of course closely bound up with the physical work of producing and reading them. The surveyor's *termini*, and their associated terminologies, cannot be determined purely on the basis of textual definitions; the surveyor's definitional work relies crucially on activities carried out in the world. Many of the texts in the *Corpus Agrimensorum* indeed feature an authorial voice that emphasizes the personal, experiential activity that links the surveyors' panoply of definitional terms to semantically active objects in the landscape. So, for example, the short text attributed to an unknown 'Gaius and Theodosius' is framed as personal experience:

> I buried squared boundary stones in the earth; they are used by surveyors in Italy to mark the hypotenuse. I put a vertical line on the leading boundary stone at a *trifinium*. I also established other four-sided stones as *cursorii*. Those who do not know their dimensions, do not understand whether they are placed at a *trifinium* or on the line of an internal boundary; and they make mistakes over many *limites*.[48]

Campbell suggests that 'Gaius' and 'Theodosius' may be names chosen to stand for a legal writer and an emperor. Indeed, the 'I' does all the fieldwork in this text, leaving 'you' only to 'discover' the system 'I' set up, which fits the relationship between a technical expert and an administrative authority. In other texts, however, the convention of representing surveying work as personal experience includes an 'I' and a 'you' who both do hands-on work in the field. The most common structure for these texts combines statements about what "I established (*constituere* or *ponere*)" and what "you discover (*invenire*)," suggesting roles of teacher and student.[49] The sense of collaboration is similar to the 'Gaius and Theodosius' text except that 'you' are explicitly situated

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48 Campbell 2000, 252.22–26.
49 Several examples of such texts are found at Campbell 2000, 260–266.

out in the field, not only observing boundary markers but performing other tasks of the surveyor as well, such as swearing an oath to ratify the boundary.

A few comments in the 'Gaius and Theodosius' text link the forms of boundary markers to a system of distance relationships; for example, "I dedicated a small star above stakes daubed with pitch. And so that you can discover the system followed, they are 411 feet apart from one another." In fact, in several texts the distance between certain types of boundary stones is itself an important part of their meaning (e.g., what kinds of intersections they sit between), as are other factors that must be observed on-site, like having pottery shards or other objects buried beneath them. While some of the texts in the *Corpus Agrimensorum*, as we have seen, contain 'dictionaries' of the meanings of stones of different kinds, the surveyor's array of terminological definitions can only be fully assessed by embodied interactions with the stones themselves. Important as these in-person, active observations are to the surveyor's definitional work, the texts do not discount the value of learning the definitions of markers from books. The 'Gaius and Theodosius' text begins with an instruction that if one discovers a series of same-colored boundary stones at a *quadrifinium*, there is no shame (*nec enim verecundum sit*) in referring to textual authorities to find their meanings – and indeed, promises that "you will become more skilled at establishing *termini* (*artificiosius terminabis*)" if you familiarize yourself with textual explications of features like the inscriptions on stones.[50]

The blend of formal textual definitions and experiential assessments that create meanings in the world for the surveyor's symbols is reminiscent of Zawada and Swanepoel's work on the terminology developed and used by mineralogists. Their study suggests some explanatory shortcomings of the classical terminology theory espoused by Wüster and others.[51] In their analysis of the mineralogists' work, classical terminology's emphasis on binary features in clearly demarcated categories was found particularly wanting. Instead, they found, mineralogists relied on fuzzier concept categories, structuring those concepts as prototype clusters with a sliding scale of similarities rather than binary inclusion or exclusion.

Crucially, membership of minerals in the categories was determined and adjusted primarily through experiential assessments. For example, the hardness test used to identify some minerals relies not on an 'objective' measurement yielding numbers on a display (problematic as claims for 'objectivity' are even for such parameters, I leave the issue aside), but on a very bodily activity performed by the mineralogist, who scrapes at the mineral with a file, assesses the amount of noise and powder produced in that process, compares them mentally to those of known minerals like diamond and talc, and finally assigns a number on the Mohs hardness scale. Even the other types of identifying test available for minerals, like tests for their chemical composi-

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50 Campbell 2000, 252.5–8.

51 Zawada & Swanepoel 1994, 254–257.

tion or crystal structure, are procedures established by routine and convention that rely on the mineralogist's experience of sensible properties like color, smell, or touch.[52] As Zawada and Swanepoel point out, the classical aim of developing 'necessary and sufficient conditions' for category membership hardly explains this process well.

Zawada and Swanepoel note several characteristics of mineral species' defining features which may seem familiar to readers of the *Corpus Agrimensorum*. Minerals vary widely along several axes (color, hardness, crystal structure, etc.), and those variations must themselves be evaluated according to functional and contextual considerations. These parameters are only defined according to conventional norms (i.e., they are not natural kinds 'out there' in the world), and assessing their features relies on the scientist's embodied observations. Finally, the features themselves depend on experts' interpretations of complex theories. The 'experiential' approach Zawada and Swanepoel suggest for analyzing the terminological work of mineralogists seems like a more realistic template for the context-rich, bodily experienced world of surveyors' markers than the clean-cut categories of 'classical' terminology, or the texts in the *Corpus Agrimensorum* that suggest a neatly manicured taxonomy of types of land and their material markers.

The surveyor's sensory, embodied experiences of identifying boundary markers in the landscape begin, like the mineralogist's identifications, with learning how to navigate an existing system of terminology for the stones and the different types of land that contain them. The basic process of placing markers at the intersections of *limites* mentioned by Frontinus among others quickly expands to include a wide range of possible variations. So, for example, the text attributed to 'Vitalis and Arcadius' introduces the *epetectalis*, denoting boundary stones grouped more than four together to set off a *quadrifinium*, separated from one another by 400 or 900 feet, and so called from its extra importance (these were the stones that marked the spot where a survey began or ended).[53] A *reprobus* stone is not, as its name might suggest, a false marker, but rather a stone featuring a 'non-equal' line which is placed on a boundary – but never at a *trifinium*, where only a stone with an obtuse angle on it should go.[54] Meanwhile, the type of stone shaped like a flask (*lagena* and *laguenaris*) or small cask (*orcula* and *orcularis*) may be separated from its neighbor by a wide range of distances: 53 feet, 150 feet, 355 feet, and perhaps other intervals as well, if the region has a variant practice of its own.

Regional variations, both in terrain and surveying practices, are indeed one of the principal reasons the surveyor's experience is so important in creating and interpreting *limites*. Hyginus Gromaticus spells out a relatively straightforward way of set-

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52 Zawada & Swanepoel, 265–266.

53 Campbell 2000, 250.7–9.

54 The *acies reproba* is so defined in the text of "Gaius" (Campbell 2000, 228.14; n.b. this is a different text from "Gaius and Theodosius").

ting out *limites* in his *Constitutio limitum*, but then concedes that one can stick to his method only if the nature of the region happens to permit it.[55] For example, a community located near the sea or a mountain cannot be laid out so as to expand equally from the central intersection of the *kardo maximus* and *decumanus maximus* since it will run into those intransigent natural boundaries. Hyginus is indeed quite sanguine about the possibility of local variations in terminology, observing that even in settlements where the *kardines* and *decumani* have been completely swapped, no harm (*iniuria*) is done. The colony is still marked out by lines at right angles to one another and no particular complaints arise either at the colony or the individual level. Even if everyone adopts their own personal set of measurement units, he says, "nothing will be missing from the work except a system (*ratio*), and it will still have credibility among *professores*." A far cry is indeed from the insistence on systematic consistency in Agennius Urbicus's *De controversiis*. But indeed, it is reasonable to expect that in at least some parts of the empire settlements would be laid out using non-standard terminology and procedures that reflected the peculiarities of the local terrain, and surveyors dispatched there must be prepared to deal with those variations more flexibly than the *De controversiis* might suggest.

The extremely local level of the individual boundary stone offers still more possibilities for variations that must be teased out by the surveyor in person, often through direct physical manipulation. Stones, intended to be immobile markers, can nevertheless be moved around in the landscape by unscrupulous landowners. The surveyor may, however, be able to verify the authenticity of a stone's placement by looking underneath to find objects placed there at the time of the stone's initial installation. Siculus Flaccus addresses the matter of signifying tokens buried under boundary stones at some length in his *De condicionibus agrorum*, commencing with the caution that the act is neither mandatory nor governed by a consistent set of rules, given that the same tokens are not found underneath all boundary stones.[56] As it is, stones may conceal deposits of potsherds, broken glass, low-value coins, lime, gypsum, ash, charcoal – or nothing at all.

Siculus Flaccus traces the practice back to a practice *apud antiquos* of performing a burnt sacrifice to Terminus before anointed and garlanded boundary stones, which were then placed atop the still-glowing embers. In those days, one could expect a kind of material univocity: a stone with charcoal and ashes underneath was a correctly situated boundary stone. In his own time, however, the range of possible signifiers has radically increased. He notes as well the possibility of local variations in how trees, ditches, and walls may be used to mark boundaries.[57] In some regions, trees are planted as boundary markers beyond ditches, so it cannot be assumed that the ditch

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55 Campbell 2000, 144.10–12.

56 Campbell 2000, 106.22–108.8.

57 Campbell 2000, 114.13–35.

itself signifies the boundary, and the surveyor must rely on an examination of local practices. Likewise, a stone wall might suggest a boundary, but it might also simply be an artifact of cleaning up stony ground, so "something can be deduced from the practice of the regions, and something from the nature of the site." The surveyor's investigation takes him far from any prescriptive universality of signifying objects, down to the level of regional practices and even the specific topographical features of a given site.

Hence, with markers of all kinds, the surveyor must remain sensitive to the signifying power of local variants in practice – a material *parole* rather than a *langue*, as it were. There are norms for boundaries, as Siculus Flaccus notes – stones, bushes, etc. established along a *rigor*, but non-standard practices should also be recognized: "those unusual examples that are done deliberately ought to have authority, inasmuch as it is recognized that they are done with a purpose and with the agreement of landholders."[58] These might include wooden stakes, heaps of stones (*scorpiones*), wall-like piles of stones, lids of wine jars, markings on rocks – no limit is set on the kinds of objects that could signify a boundary. The surveyor should accept the significance of whatever appears to have been set up as a boundary marker, based on similarities to other such indicators in the vicinity or broader region.

The unstable signifying power of stones and other potential markers set up in the landscape can ultimately be resolved only through embodied investigation into the particulars of each case. In order to discover whether a tomb signifies a boundary, for example, the reader of the compilation *Ex libris Dolabellae* is instructed that

> You can recognize in the following way boundaries associated with tombs or receptacles for ashes, where straight lines run between holdings, since you should find near the tomb either box-trees, or also ashes, or cooking-pots, or broken earthenware vessels, or indeed intact ones. In order to discover if a tomb marks a boundary, look five feet away from it or turn the earth over with a plough. If you find the signs mentioned, then the tomb marks a boundary. If you do not, go round to the other side.[59]

The textual definition of the tomb's significance can only take the reader so far: in order to certify its meaning, the surveyor must get out there with his tools and dig for meaning in the earth. Similarly, shrines may mark the intersection of different properties' boundaries; according to the same text, the sign of such an intersection will be the presence of multiple altars and entrances corresponding to the different properties. But even this apparently straightforward indicator may break down, since shrines may be abandoned. If that happens, the surveyor will once again have to scrutinize the site for himself, searching for 'anything that resembles foundations' about 15 feet away from the shrine.

Like the mineralogists Zawada and Swanepoel study, the *agrimensores* work with a complex cluster of terminological categories that strongly resist attempts to define

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58 Campbell 2000, 108.21–23.

59 Campbell 2000, 222.26–30.

some items' membership in a clear-cut, binary way. The prototype theory Zawada and Swanepoel observe as a classification strategy for the mineralogists appears to be an important component of the surveyors' toolbox as well. A boundary stone with a deposit of charcoal and ash underneath is prototypical of a properly placed and ratified marker, but for every such stone the surveyor uncovers, he will also confront many more stones with other indicators underneath, and many more still with no buried tokens at all. A stone with a vertical line marked on it could be the primary marker of a *trifinium* – unless it is in fact the 'unequal line' of a *reprobus*, or the obtuse angle that could still mark a *trifinium*, only with part of the inscription scuffed off. A ditch with a row of nearby trees may likewise be a prototypical boundary, unless local practices make the trees themselves the typical signifier of a boundary – to say nothing of cases where the trees have simply grown up along the ditch because it carries water.

Like the mineralogists estimating the effort required to shear shavings off a stone or assessing whether a specimen falls within tourmaline's dazzling spectrum of colors from green to pink, the surveyors must appeal to their past training experience as well as more recent experiential encounters with local practices to assess the meaning of markers in the landscape. The 'experiential realism' that Zawada and Swanepoel (drawing on past work by Lakoff and Geeraerts) identify as a crucial component of the mineralogists' mapping of specimens to a terminological system suggests that concepts emerge in large part from bodily experience, and that new experiences are interpreted by means of those existing concepts. Experience and epistemology are intimately entangled. The conceptual mappings the surveyors use to interpret the landscape (and to categorize it anew) are likewise, crucially, products of gradually acquired experience. The theoretical taxonomies imposed upon potential signifiers in the landscape may apply only to the most prototypical elements; beyond that, the surveyor's interpretation, local knowledge, and embodied experience are absolute necessities.

The surveyor's boundary-defining work is extremely *active*: he must follow traces of boundaries throughout the landscape, skillfully deploy instruments like the *groma* to read and write *limites* on the land, and use his expertise to resolve cases where those boundaries have been tampered with. But even the parts of the surveyor's work that might seem purely observational, like scrutinizing the remains of pottery or ashes below a boundary stone to verify its reliability, can themselves be viewed as skilled bodily activities that shape the surveyor's conceptual analysis. The surveyor's embodied work to extract definition from objects in the world recalls Hutchins' argument that from the perspective of embodied cognition, "bodily practices including gesture are part of the activity in which concepts are formed."[60] The surveyor's fieldwork is not merely a stepping stone toward establishing a permanent, unmistakable material and verbal signifier for each type of land which can be written down somewhere to obviate

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60 Hutchins 2011, 428–429.

future investigations. Instead, it is a vital part of an ongoing terminological negotiation that must remain sensitive to local variations in naming conventions as well as terrain.

As such, the surveyor's terminological work in the world in fact corresponds well to Hutchins' description of 'enacted representations':

> Enacted representations are dynamic, integrating memory for the immediate past, experience of the present, and anticipation of the future. They are multi-modal, in the sense that they may involve the simultaneous coordination of any or all of the senses and any modes of action. They are saturated with affect.[61]

Hutchins focuses on the dynamic *act* of apprehending material representations, as "to apprehend a material pattern as a representation of something is to engage in specific culturally shaped perceptual processes."[62]

Particularly notable in Hutchins' characterization of enacted representations is his assertion that they are 'saturated with affect'. To be sure, the surveyor's landscape is itself far from neutral emotional ground, given that arbitrating disputes over boundary placement and land use was a central part of the surveyor's work. But an additional dimension of affect, more closely bound to questions about terminology, emerges from recent work by Faber on the neural manifestations of specialized terminologies and the conceptual domains of specialized knowledge they refer to. Faber et al. performed an fMRI study on a group of geologists and a group of laymen, who were monitored as they performed the task of associating a word with a target terminological stimulus. The terms used as stimuli were names for tools both specialized and common, so a successful association might mean linking 'angle' with the prompt 'goniometer' or 'cut' with 'scissors'.[63]

There were considerable differences between the activated regions of the laymen's brains and those of the expert geologists. The most striking feature of the experts' response was the activation of the amygdala and the parahippocampal gyrus leading to it, which are linked respectively to emotional processing, and to the creation and recall of autobiographical memory using contextual associations.[64] Faber et al. note that "even though terms for scientific instruments are not typically regarded as having emotional valence," in this case, the terms may have been processed affectively because of their resonance with the experts' layers of past experience with the instruments the terms refer to. For the experts whose very professional lives are built upon lived experiences manipulating these tools and concepts, the technical terminology itself sparks a meaningful cognitive event. It seems likely that the complex webs of terminology the Roman *agrimensores* internalized, learning not merely from books but from lived experience, would have generated similar patterns of neural ac-

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61 Hutchins 2011, 434.

62 Hutchins 2011, 429–430.

63 Benítez et al. 2014, 15–32. The prompts and responses were in fact in Spanish, the native language of the participants.

64 Benítez et al. 2014, 27.

tivity. Far from remaining inert signifiers of abstruse information, invoking technical vocabularies, in the minds of experts, reignites networks of concepts inextricably bound to lived experience.

5 Conclusion

The *Corpus Agrimensorum* is an extraordinarily valuable set of texts, providing insights into the complex legalities and physical practicalities that guided the surveyors' peripatetic work in the Roman landscape. Both the legal and practical sides of the surveyor's work demanded the development of extensive specialized technical terminologies. As we have seen, however, those terminologies were developed and deployed in quite different ways as they were subjected to various pressures, like philosophical demands for precision and uniformity, or sociological needs for flexible terminologies that could account for differences in surveying practices across the empire. Complicating the picture still further is the integration of purely verbal terminologies with other semantic systems, from the images in the texts of the *Corpus Agrimensorum* to the images found on boundary stones, scarred trees, and the maps that connected surveyed land to the imperial record-keeping apparatus. Indicators in the landscape and the *tabularium* formed terminological systems of their own, calling into question the relationship between such systems and the affordances of the media in which they are embedded.

Ultimately, in the case of the surveyors it appears useful to stray from the rigid boundaries of the discipline of 'classical terminology' established by Wüster and others, to explore the situational flexibility afforded by approaches inspired by cognitive linguistics. We may acknowledge the difficulty, even impossibility, of developing precise and univocal terminological categories for a complex system like the surveyors dealt with, infused throughout with human variation and emotion. To be sure, some of the surveyors themselves appear to aim for univocity and precision in much the same way Wüster advocated. However, much more often we see the terminological systems in the *Corpus Agrimensorum* devised with flexibility and polyvalency in mind, often built on prototypes but allowing for far-ranging excursions from the prototypical. The ambiguities in these working systems were not a fatal flaw – far from it, as they granted to surveyors steeped in practical, embodied knowledge the flexibility needed to account for regional and diachronic variations in terminological practice, as well as the pathological variations sparked by human error and mischief. Ultimately, the surveyors' terminological structures were largely created through practice out in the landscape, and re-created as that practice developed, a compelling example of Hutchins' enactive 'cognition in the wild'. Like the expert navigators Hutchins describes, or Zawada and Swanepoel's experienced mineralogists, the Roman surveyors were empowered by their embodied experience to navigate not only the irregularities of the landscape, but the complexities and ambiguities of their own polyvalent terminologies.

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Markus Asper

Rich Names: Implications of Terminology in Ancient Greek Rhetoric, Medicine, and Siege Lore

Abstract: This chapter discusses 'rich' terminologies, that is, terms that are coined with a view toward connotations, and some of their implications in four different fields of theoretical Greek knowledge (mathematics, rhetoric, medicine, and belopoeics). In each case, 'rich' terminologies exceed the purely functional ones, which I call 'lean':[1] e.g., they can tell us something about the field and the actors involved. In addition, the chapter argues that certain aesthetical aspects, connotations perhaps, of the terms adopted add to their significance. These aspects are fragmentary self-descriptions of the activities they are meant to designate and, in some cases, even contribute toward reconstructing the perspective of the actors onto their own practices. To some extent, a notion of field memory emerges. In short, rich terminologies can present additional aspects and perhaps do always imply certain associations that go beyond purely functional concepts of terminology.

By way of introduction, let me begin with geometrical terminology. It is well known that the ancient Greek mathematician's lexicon contains many elements from practical mathematics, e.g., *teinō* for the positioning of lines, *gnōmōn* for the perpendicular, or *epharmozein* for the notion of congruency.[2] The first must have been a surveyor's term, the second was originally a tool used in construction, and the third designates in general the concept of fitting something to something else. Thus, Greek theoretical mathematics reveals in some of its terms a past that has more to do with measurement or even the constructing crafts than with abstract contemplation, let alone timeless proofs.[3] It seems that the master narrative of how philosophers saw theoretical mathematics slowly emerge from measuring and the crafts utilize and even stress the gap between such terms' connotations and their elitist, abstract practice.[4] This holds certainly for Athenian mainstream mathematics in the Euclidian tradition which at some point came under

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1 "Descriptive" is the term adopted by Schironi 2019, 239. See, however, Fleck 1979 [1935], 132f. for how descriptive terms can take on symbolic dimensions.
2 Ubiquitous in Euclid and Hellenistic mathematics, see Mugler 1958, esp. p. 13 on γνώμων.
3 Among others, pointed out by Burkert 1982.
4 See, e.g., Aristotle, *Metaph.* A 1, 981 b13–25 and Proclus, *In Eucl.* prol. II, pp. 64.3–68.23 Fr. (based upon Eudemus' lost history of geometry, on which cf. Zhmud 2002).

Platonic spell. There is, however, a different kind of Hellenistic mathematics, to which Reviel Netz has attached the label of 'ludic'. Netz has shown that, apart from busying themselves with ludic problems and proofs arranged with a view to suspense, these mathematicians have a certain propensity toward 'ludic' naming, that is, they use colorful, metaphorical expressions from everyday life to designate abstract constructs.[5] These terms I call 'rich' because they carry a load of connotations that are foreign to the mathematical objects they designate. For example,[6] Eratosthenes calls his method of finding prime numbers the 'sieve' (*koskinon*), Nicomedes a new curve 'shell-like' (*konchoeidēs*), some other mathematician, perhaps Diocles, according to Proclus, called another curve 'ivy-like' (*kissoeidēs*),[7] and Archimedes seems to have named a certain mathematical object *arbēlos* (the word designates a cobbler's knife), another one *salinon* (probably 'salt cask').[8] We can compare terms in the Euclidean tradition; I choose some from the ones defined in the beginnings of the respective books: e.g., *eutheia* (*Elem.* I, Def. 2), *tmēma kuklou* (*Elem.* III, Def. 6), *euthugrammon* (*Elem.* IV, Def. 1), *hupsos* (*Elem.* VI, Def. 4), or *summetra megethē* (*Elem.* X, Def. 1). These terms attempt to be accurate and free from any notion foreign to mathematics (in opposition to 'rich', we could thus call them 'lean'). The 'rich' terms Netz discovered in ludic mathematics, however, exhibit a certain playfulness: First, they are all metaphorical. Second, while these terms usually describe humble objects of everyday life or unremarkable objects in nature (shells, ivy, and ordinary tools),[9] the mathematical discourse they take a part in, in this case, could not be farther removed from the humble and the everyday. Ludic mathematics and its hybrid aesthetics are part of the games social elites play and, in Hellenistic times especially, of the courts.[10] Therefore, these terms actually draw attention to the elitism of the practice precisely by choosing names drawn from lowly life. One is tempted to compare certain kinds of Hellenistic poetry of the time that stages the simple life for elite audiences in an extremely stylized way.[11] In Archimedes' case, a certain practical joke is played upon the recipient, because the rich term designating a certain mathematical object is, at the same time, a very rare word, philologically recherché (as far as we can say). Therefore, unlike 'lean' Euclidian terms, the rich terms of ludic mathematics hint at a certain way these mathematicians wanted to be conceived of by their readers.

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5 On metaphors in ancient Greek lexica, see Schironi 2019, 234.

6 The following examples I take from Netz 2009, 149–157 ("a vignette: the scientific name").

7 On these two see, in a morphological context, Schironi 2019, 232, 237.

8 See Netz 2009, 156, quoting Dijksterhuis, E.J. 1987. *Archimedes*. Princeton, 404. Archimedes used both terms in a treatise called *Lēmmata* which is lost in Greek but transmitted in Arabic. While *arbēlos* is used in Pappus twice, *salinon* is a *hapax*.

9 One might object that ivy was associated with symposia. While this is true, the symposiac does not fit in with these other terms listed by Netz.

10 See Berrey 2017, e.g., 134–137.

11 One may think of Callimachus' *Hecale* or Theocritus' poems on herdsmen and their inner life. This is certainly not just *bathos* (*pace* Netz 2009, 159).

To be sure, it is not always possible to explore terminology's inner life in such a way. However, we can at least gather some cases in which terminology goes beyond the purely functional and thus becomes 'rich'. In what follows, I intend to illustrate this approach's productivity by presenting three examples culled from different fields and contexts: fourth-century theory of rhetoric, Roman imperial medicine, i.e., anatomy and pulse lore, and Hellenistic siege engines.

1 Rhetorical Branches: Licymnius, Aristotle, and Ambivalent Taxonomies

It is well known that in some realms of ancient Greek theoretical discourse, an agonistic climate was part of the culture, most notably in rhetoric and in medicine. Part of the competition of which many texts bear witness was terminology, as contested as almost anything else. Suffice it to briefly hint at two cases, both tiny if remarkable details in a large canvas.

In his *Rhetoric*, Aristotle presents himself as an innovator who is coming late to an already well-developed field. His discourse teems with criticism of technical, perhaps to a large extent 'sophistic', literature that was apparently already available and circulating. In a well-known passage (*Rhet.* III 13, 1414[b]15–18),[12] Aristotle takes issue with some of Licymnius' (whose date and place are uncertain) more daring terminological choices:

> δεῖ δὲ εἶδός τι λέγοντα καὶ διαφορὰν ὄνομα τίθεσθαι· εἰ δὲ μή, γίνεται κενὸν καὶ ληρῶδες, οἷον Λικύμνιος ποιεῖ ἐν τῇ τέχνῃ, ἐπούρωσιν ὀνομάζων καὶ ἀποπλάνησιν καὶ ὄζους.

> One needs to make genus and differentia explicit when coining a term. Otherwise, the discussion becomes pointless and loquacious, as does Licymnius in his *tekhnē* who coins the term 'gust of favorable wind' and 'divagation' and 'branches'.

Although Aristotle's criticism is not entirely clear to me, it appears that he is concerned here with a recommendation of how to coin terms for parts of dihaereses (εἶδος καὶ διαφορά). Thus, when he, a little above the quote, criticizes Theodorus for introducing too many and Licymnius for coining either too metaphorical terms or more than one term per definable entity, he implicitly talks about his own methodological standards. At stake are terminologies for parts of oratorical discourses, certainly in the context of *tekhnē.* Unfortunately, Aristotle does not present a glossary of Licymnius so that we cannot know exactly what part of discourse Licymnius called 'gust of favorable wind' or 'branch'. However, with respect to Licymnius' unusual choices, two points merit acknowledgment: first, Licymnius probably does not coin these risky terms out of the

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12 One of the main 'fragments' of Licymnius, *Artium Scriptores* B XVI 4, p. 118 Radermacher.

blue. There were terminologies around that were already well-established. Presumably, Licymnius wanted to present his terms as a stark contrast to established terminological coinages. His metaphorical extravagance serves a need for distinction in a contested field, in which terminology becomes a means among others. Second, if this is correct, Licymnius must have carefully chosen these striking terms. (I admit that we do not know whether all these terms were pulled from the same context.) What did he have in mind? Licymnius might have thought of movement in space, perhaps travel (the first two remind us vaguely of Odyssey-like narratives), the third perhaps of horticulture (or Dodona?). Although this becomes somewhat speculative in light of the scarce evidence, one might suggest that Licymnius wanted us to think about his terminology, provided he did not explain his striking choices. Apart from 'wandering astray' (ἀποπλάνησις) which is clear enough, due to the conventional metaphor 'an argument is a way', 'branches' and 'favorable winds' are rather puzzling. In addition, the latter is a *hapax legomenon*. It is remarkable that the terms introduced by Licymnius who is said to have composed dithyrambs, too,[13] reminds us remotely of Aristophanes' playful criticism of the dithyrambic poet Kinesias in *Birds* and elsewhere.[14] Whatever connotations Licymnius aimed for, they seem deliberately taken from realms remote from rhetoric and sophistic practice for which metaphors culled from the crafts recommended themselves.[15] Aristotle meant to say that one needs to give a definition of any term introduced (εἶδός τι λέγειν καὶ διαφορὰν) and then gives an extreme example: we should avoid the practice of Licymnius who not only does not define his terms by genus and difference but adopts terms of which one cannot even guess where they belong in his taxonomic system. While Aristotle elsewhere in the *Rhetoric* duly criticizes the taxonomic practice of technical authors to go for ever more detailed divisions,[16] here the terms themselves appear to be at stake. With Aristotle and Licymnius, we see two actors employing different terminological strategies, the first what one might call a 'systematic' one,[17] the second a metaphorical one that leaves more room to the reader's imagination, perhaps to the degree of violating genre conventions by exuberant metaphor. Licymnius, it seems, wished for some visual component to add some color to his terms: While 'wind' and 'divagation' carry some associations that lead toward images of travel and change, perhaps innovation, perhaps ship-wreck, 'branch' on the other hand, leads us toward associations of horticultural growth, accumulation, and harvest. It seems that Licymnius has inscribed into his terminologies the ambivalence of rhetoric itself – which does not sit well with our Platonically informed picture of sophistic actors.

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13 See ibid. p. 117.

14 Aristophanes, *Ran*. 1373ff. and Dunbar, N. 1995. *Aristophanes: Birds*. Oxford, 660–670.

15 As is, again, perhaps best illustrated by Aristophanes' derision (see my 1997, 176 and index s.v. 'Handwerksmetaphorik').

16 Rapp 2002 ad loc. takes this to be the point of critique here.

17 On 'systematicity' see my 2016.

2 Competition, Colorful Terms, and Consensus: Medical Terminology

For the success of theories, in social-historical as in epistemic respects, coining terms and naming them cleverly play an important role. While Aristotle had famously criticized Empedocles' terminological practice for using metaphors, albeit in passing, Galen directs strong criticism against competitors who, according to him, do not handle terms the right way. He often attributes naming practices to non-epistemic motives, most explicitly in *On Medical Terms* 85r-v (pp. 9.5–8 Meyerhof & Schacht 1931).[18] In this treatise, Galen understands terminology exclusively as a means of knowledge transmission. Thus, he judges those harshly who care more for terms than the scientific or therapeutic task demands.[19] Galen makes a point of distinguishing between heated and fruitless discussion over terminologies and arguments over the medical facts themselves (86r, pp. 10.31–33 M&S). He even clearly states that the polemics concerning terms differs from the polemics concerning medical facts and arguments (87r, 12.1–3 M&S). Nonetheless, he engages in the former, too, and with apparent gusto. Tellingly, he denies any substantial connection between name and named thing; the example of how slave-holders name their slaves makes, to modern readers, a striking case (88r, pp. 13.10–16 M&S). Thus, for Galen, names of facts seem to be both unrelated to the named fact and to belong exclusively to the naming individual. Thus, only in the case that established names fall short, the medical writer should invent new ones (90v, p. 16 M&S), which is what Galen himself has usually done (he describes his method of naming in detail on p. 16 f. M&S, 91rv). In a vivid scene of dispute, prognosis is the means to go beyond fruitless discussion about terminology in which the competing physicians indulge (92v, p. 18 M&S). Only in passing does Galen mention the possibility to name a medical phenomenon, e.g., a disease such as the semitertian fever, after the physician who has discovered or described it (95v, p. 22 M&S). Differences in naming diseases do not imply differences in therapy which is why the competitive search for the right terms is fruitless (97v, p. 24 f. M&S). A consensus about names is the foundation for any discussion of medical entities (101r, p. 29 M&S). Therefore, any participant in the game who introduces new terms must appear as a saboteur of collective knowledge and thus of medical progress. At least, this is what Galen wants us to believe. For example, in the course of a discussion about the notion of 'fever' and its willful connection with various symptoms by some medical theorists, mostly pulse and complexion, Galen remarks (106r, p. 35 M&S):

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18 Meyerhof and Schacht translated the title as 'On medical names'. Apparently, in the lost Greek original what led to Arabic *ismal'u* was the Greek *onomata*, which in the grammatical tradition usually means 'nouns'.

19 See, e.g., the Zenon joke (85v, p. 10.10f. Meyerhof & Schacht); cf. *Anat. admin.* VI 13, vol. 2, p. 581 Kühn.

> Whenever complexion or pulse change due to one of these factors, anybody can call this 'fever'. Doing this, however, he would do what Erasistratus did who has remarkable habits and newly introduces remarkable terms without explaining or accounting [*logismos*, according to the editors] for any of them, neither from the term itself or from how it is being used among men.[20]

According to Galen, this is an instance of bad practice because it puts medical communication at risk. Erasistratus, however, triggered Galen's discourse by postulating a new connection between pulse and fever, understanding the latter as a certain quality of the former (p. 35, 106v M&S). Galen does not waste a moment on reflecting upon Erasistratus' motives in re-coining the long-established term 'fever'. In his derisive use of the term 'sophist' for physicians who indulge in such coinages (p. 36 f., 107rv M&S), he probably hints at the terminological choice's purely strategic character. However, Erasistratus may have had systematic aims in mind, such as coherence and clarity of 'lean' terminology.[21]

While it seems that Galen usually describes situations that emerge from contexts of discoveries that require new terms, or engages in disputes that result from the clash of formerly unreconciled terminological traditions, there are also medical realms where terms appear to be firmly established and are unanimously shared: For example, the well-known treatise of Rufus of Ephesus on anatomical terminology (*Peri onomasias tōn tou anthrōpou moriōn*; late first century CE) hardly registers any terminological dissent. That is why the list of terms given, *a capite ad calcem*, almost maps a description of the human body. In the rare cases where there are alternatives for anatomical terms, Rufus treats them like a lexicographer rather than a physician-philosopher, that is, he does not decide between them. Take, for example, the anatomy of the nose (*Nom. part. hom.* §31–34, pp. 137.7–11 Daremberg & Ruelle):

> Ἀπὸ δὲ τοῦ μεσοφρύου τέταται ἡ ῥίς. Ταύτης δὲ τὰ μὲν τρήματα, μυκτῆρες καὶ ῥώθωνες· Ἀθηναῖοι δὲ καὶ μύξας ὀνομάζουσιν. Ἱπποκράτης δὲ τὸ δι' αὐτῶν φλεγματῶδες περίσσωμα ἰὸν μύξαν καλεῖ· Ἀθηναῖοι δὲ τὸ περίσσωμα τοῦτο κόρυζαν καλοῦσιν.

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20 Translated from the German of Meyerhof and Schacht (not from the Arabic, as would be more desirable): "Der Mensch kann, wenn wegen eines dieser Dinge in der natürlichen Farbe oder dem Arterienpuls eine Veränderung eintritt, es Fieber nennen; dann aber ähnelt er in diesem seinen Tun dem Erasistratos, der erstaunliche Gewohnheiten hat und erstaunliche Namen neu einführt, ohne für irgendetwas davon eine Erklärung und einen λογισμός beizubringen, weder aus dem Hinweis des Wortes selbst noch aus dem Sprachgebrauch des Menschen." Apparently, Galen distinguishes between an etymological explanation of terminology ("aus dem Hinweis des Wortes selbst"; in p. 36, 106v/107r Galen mentions Prodicus as a positive instance) and one that relies on its denotations in its actual use. Remarkably, Galen does not seem to miss a definition in Erasistratus' introduction of new terms.
21 See my 2015, 53f.

From the space between the eyebrows the nose extends. It has hollows, the nostrils and *rhō-thōnes*.[22] The Athenians, however, call them *muxai*. Hippocrates calls the phlegm-like secretion that runs through them *muxa*; and the Athenians call this secretion *koruza*.

For the front part of the nasal cavity, we get three terms, one of them regional. In addition, Rufus regales us with a linguistic remark about geographically differentiated usage and two terms for nasal secretion, one of them merely philological, observing Hippocratic language, and the other one, again, on Athenian usage. He does not offer any discussion of which of the competing terms would be preferable and for what reasons. It is, however, interesting that Rufus who does not write in Athens (and probably not in Rome, either) provides Athenian terms as implicitly opposed to non-Athenian terminological practices and probably as competing with Hippocratic usage. The latter turns out to be an argument against the Athenian use of certain terms. In cases where there are no established terms, terminological discussion becomes more poignant (e.g., §133–135, pp. 150.13–151.6 D&R on cranial sutures, i.e., the anatomy of the skull):

> Δύο δὲ ἄλλαι τοῖς ὀστοῖς τῶν κροτάφων, ὥσπερ λεπίδες ἐπιπεφύκασιν. Ὀνόματα δὲ αὐτῶν παλαιὰ οὐκ ἔστιν, ἀλλὰ νῦν ἐτέθη ὑπό τινων Αἰγυπτίων ἰατρῶν φαύλως ἑλληνιζόντων· στεφανιαία μὲν τῇ πρὸς τὸ βρέγμα, λαμβδοειδὴς δὲ, τῇ περὶ τὸ ἰνίον, ἐπιζευγνύουσα δὲ, τῇ μέσῃ· λεπιδοειδεῖς δὲ, ταῖς τῶν κροτάφων. Οὗτοι δὲ καὶ τῶν ἄλλων ὀστῶν μόρια ὀνομάζουσιν ἀνώνυμα τοῖς πάλαι, ἃ ἐγὼ οὐ παραλείψω διὰ τὴν εἰς τὰ νῦν τῶν ἰατρῶν δήλωσιν.

> There are two others [cranial sutures = *rhaphai*] at the bones of the temples; like scales they are grown together. They do not have ancient designations, but have just now been named, by some Egyptian physicians who know their Greek badly: ‚coronal' (is the name for the suture) towards the front part of the head, ‚lambda-like' (the one for the suture) around the occiput that joins at the middle (of the head). And then, the 'scale-like (sutures)', at the temples. These physicians assign names also to the parts of other bones that have been left unnamed by the physicians of old, which I will not pass over in silence because of the explanation with respect to contemporary medicine.

Anatomical discoveries present terminological challenges. 'Ancient', which I take to mean 'Hippocratic', terminology is somehow sanctioned by time and thus canonical. Recent naming decisions, however, provoke some criticism. Here, Rufus criticizes these Egyptian physicians for their lack of linguistic competence in Greek. Paradoxically, he reports the terms themselves, without indicating where precisely he sees any linguistic problem, but leaves the names of the physicians themselves to oblivion. Since Rufus mentions several, actually 10, physicians by name in his treatise, with a total of 22 mentions, we must understand his passing over of the names of the Egyptians as a sanction, as if there was, for him, a competition between Greek and Egyptian medical practitioners. As to the notion of 'Egyptian', it is difficult to think of

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22 My translation is tentative. There does not seem to be a difference between μυκτῆρες and ῥώθωνες, except for the latter to be more technical.

something more Greek than the letters of the Greek alphabet, such as lambda, or the utensils of the symposium or civic rewards, such as crowns (*stephanoi*).[23] Perhaps Rufus constructs an opposition between fifth- and fourth-century mainland medicine and near-contemporary Alexandrian physicians such as Marinus whom Galen often quotes with respect to anatomical knowledge?[24] In imperial Roman Alexandrian culture, however, one would expect the ethnic borders between Greek and Egyptian to have been blurred long ago. Perhaps, Rufus saw the activities of these 'Egyptian' scientists as an intrusion into a purely Greek game of discovery and naming, the latter being taboo to non-native speakers of Greek or intruders from outside. Or did he see a problem in the admittedly rare use of *stephaniaios* as opposed to the more commonly used *stephanikos*? While it remains unclear what Rufus meant to say precisely, we can grasp here some competition for the reputation that comes with medical discovery and the establishment of terms, oddly, I think, conceived of as being positioned between old and new, Greek and 'Egyptian'.

With respect to pulse lore, the situation was different. While in anatomy undisputable discoveries simply needed a name within an already established epistemological and terminological frame, in pulse lore the phenomena themselves[25] and their interpretation as a diagnostic tool were under debate. In the context of historical terminologies, medical discussion of pulse terms is especially interesting because there are no visual or technological analogies one could proceed from, as, e.g., 'lambda-like'. Even more, the empirical basis of ancient pulse lore is quite questionable.[26] In addition, following Praxagoras' of Cos distinction between arteries and veins, pulse phenomena have been systematically observed and described for the first time by Praxagoras' follower Herophilus in third-century Alexandria which means that these concepts were subjected to the full-blown controversial culture of theoretical medicine right from the start. We read them in Galen's ample treatises covering pulse lore, themselves being situated in an agonistic position toward past and present competitors. Among the qualities of the pulse, according to Herophilus and Galen, there is, besides size, vehemence, and speed, 'rhythm', i.e., the time of the dilation as compared to the time of the contraction. As is well known, in order to conceptualize and classify 'rhythm' in pulse, Herophilus borrowed from Aristoxenus' theories, especially with respect to a basic unit of time, called the *prōtos khronos* in Aristoxenic rhythm lore and applied to

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23 Perhaps Rufus plays of 'ethnic' Egyptian medicine against Alexandrian anatomy (see Gersh 2012, 73). However, why would these 'Egyptian doctors' use Greek names at all? Gersh sees here a little nostalgia for the great past of Alexandrian dissection.

24 Marinus has been pointed out to me by Orly Lewis to whom I am very grateful. On Marinus as mentioned by Galen, see Rocca 2002.

25 For an introduction, see Berrey 2017, 191–196. on Herophilus' discovery of pulses and his theories about them.

26 On this point, see Berrey 2017, 193.

the infant's pulse by Herophilus.[27] It seems to me that such an appropriation implies the statement, whether Herophilus actually made it or not, that there is some kind of over-arching unity in scientific concepts of music and medical research.[28] Another possible implication would be the claim that Herophilean pulse lore has some affinity with the Peripatetic system of knowledge.

Greek pulse theorists classify pulses according to specific combinations of several criteria. Thus, the emerging taxonomy turns out a large number of kinds of pulses in need of names. However, since the discovery of pulse has been a post-Hippocratic achievement, in this field there is no canonized tradition of names. In addition, there are no visual analogies that could make the naming act obvious; yet, one needs names for these complexes of several criteria. The terminological situation becomes even more interesting as pulses, being one of the most prominent diagnostic tools and thus a central element of contacts between patients and physicians, must have been one of the important issues of agonistic debate. It is interesting that in this situation, the established names of pulse kinds come from different areas and follow different logical methods of naming. Accordingly, naming practices and failed attempts at finding suitable terms constitute important points in Galen's targeting of predecessors and competitors throughout the greater part of his book *On Distinct Types of Pulse* (*Diff. puls.* II–IV).[29] Most of the terms for the taxonomy are rather straightforward, that is, 'lean', such as *takhus* (quick), *iskhnos* (weak), or *puknos* (frequent), and thus, most pulses do not have their own names, but have to be described by three or four categories ('the quick, weak, and frequent pulse'). Toward the end of Galen's own complex taxonomy in *Diff. puls.* I, however, we come across three more colorful, i.e., 'rich', terms, this time used as proper terms for single kinds of pulse. Among the uneven pulses, there is the 'wave-like' (*kumatōdēs*, I 25, 8.549 f. K.), discussed in some detail: With this pulse, the physician feels the artery distending in wave-like dimensions and patterns. In the same class follow the 'one that moves like worms' (*skōlēkizōn*) and the 'one that moves like ants' (*murmēkizōn*). On these, Galen says (*Diff. puls.* I 26, 8.553 K.):

Ὥσπερ δὲ τὸν κυματώδη σφυγμὸν ὁ σκωληκίζων διαδέχεται μικρότερον γενόμενον, οὕτω τὸν σκωληκίζοντα ὁ μυρμηκίζων, ὅταν ἀπολλυμένων τῶν κινήσεων τῶν πολλῶν εἰς μίαν, καὶ ταύτην παντελῶς μικρὰν τελευτήσῃ, καὶ διὰ τοῦτο οὐδ' ἀνώμαλος παντελῶς φαίνεται, καίτοι πιθανὸν ἐστιν ἐκ τοῦ γένους αὐτῶν εἶναι τῶν ἀνωμάλων, ἀλλὰ διὰ τὴν μικρότητα λανθάνει ἡ ἀνωμαλία. κέκληται δ' οὗτος ὁ μυρμηκίζων ἀπὸ τῆς πρὸς τὸ ζῷον τὸν μύρμηκα ὁμοιότητος, ὡς μέν τινές φασι κατὰ σμικρότητα, ὡς ἕτεροι δὲ διὰ τὸν τρόπον τῆς κινήσεως, ἵν' ὁμοίως τῷ σκωληκίζοντι καὶ δορκαδίζοντι, καὶ οὗτος ᾖ κεκλημένος. ἐκεῖνοί τε γὰρ ὁμοιότητι κινήσεως τῆς πρὸς τὰ ζῷα ὧν

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27 See, e.g., Herophilus fr. 183.1–11. v. Staden; Berrey 2017, 196–202.

28 Unlike Berrey 2017, 208, who understands the Herophilean appropriation along the lines of 'hybridization' and thus as partaking in the aesthetic discourse of court science.

29 See the recent study of these passages by Lewis 2022 who gives a concise overview of Galen's eight treatises on pulse lore.

τὴν ἐπωνυμίαν ἔχουσιν ἐκλήθησαν, οὗτός τε αὐτὸς ὁ μυρμηκίζων οὕτως. τινὲς δὲ καὶ δι' ἄμφω φασὶν αὐτὸν οὕτως ὀνομάζεσθαι, διά τε τὴν μικρότητα καὶ τῆς κινήσεως τὸ εἶδος.

> Just as the moves-like-worms pulse follows upon the wave-like one when it (the wave-like pulse) becomes weaker, so the moves-like-ants pulse follows upon the moves-like-worms pulse when the many movements diminish into one and this becomes very small in the end. And thus, it does not even seem to be uneven (although it is plausible that it belongs to the class of the uneven ones), but due to its being small the unevenness goes unnoticed. This pulse is named 'moves-like-ants' after the similarity to the animal ant – some say after its tinyness, but others because of the way it moves – in order that it be similarly named to the moves-like-worms and the moves-like-deer ones. For these pulses are named according to the similarity to the ways the animals which they carry the names of, move, and this very one, the moves-like-ants, in the same way. And some say that this pulse is called this way due to two (analogies), because of its tinyness and the kind of movement.

The moves-like-deer pulse ("galloping," according to Montanari's dictionary) had been termed that way already by Herophilus, Galen says a little later (ch. 28, 8.556 K.). There, Galen accurately describes how this pulse is, in its being uneven, singularly analogous to the jumping movements of deer which, Galen/Herophilus say, exhibit a certain double movement (*diplēn tina kinēsin*) of which the second is faster and fiercer (*ōkutera te kai sphodrotera tēs proteras*). Beyond all anatomical and zoological problems, Galen's remarks hint at a discussion of terms among pulse theorists who were interested not only in meaningful terms but also in a certain coherence of naming principles.[30] One might speculate that the moves-like-deer pulse was termed by Herophilus as the first of the pulses named after animals that might be indicated by Galen's rather detailed discussion of that pulse and quote, and then others followed in his vein.[31] Clearly, in the struggle for patients and reputation it meant a great deal to have appropriate and even catchy names for diagnostic phenomena and to be able to account for them in a convincing way.

The pulses in these diagnostic systems do not carry names that follow a coherent system. Many single pulses apparently do not have names (even classes go without name, such as in Archigenes' taxonomy), or bear the rather nondescript designation of *meson* between two named extremes.[32] Thus, it is remarkable that in the class of 'unevenness', these pulses bear colorful names. Perhaps they were more prominent

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30 See also his polemical remarks in *Diff. puls*. I 2, 8.498, on pulse theorists who are spending too much time and effort on logical-taxonomical questions. At the same time, one sees Greek theorists devoting their energies to the systematicity effect, not only for epistemic reasons, but also in order to enhance their authority.

31 See Lewis 2022, 205, for a similar conclusion with regard to Archigenes quoting Herophilus. Netz 2009 discusses two instances of Herophilean naming in the field of anatomy and hints at G.E.R. Lloyd's idea of Alexandria as "the main site for Hellenistic naming."

32 For μέσον, see Lewis 2022, 201f. In Galen's system of pulse classifications, three classes remain 'nameless' (ἀνώνυμα). Archigenes himself states that two classes (regularity/irregularity and evenness/unevenness) better be left without names (ἀκατονόμαστα, *Diff. puls*. II 6, 8.592f. K.). Galen's criti-

than others in diagnostic practice. Vivid, 'rich' terms might have proved advantageous for various reasons: first, since these names are all metaphoric, they are not open to polemics about taxonomy and logical classes. Second, they refer patients to sign-systems beyond medicine: The 'wave-like' pulse indicates the sea, that is, a certain menace, certainly an area of the imagination not easily associated with the human body. Similarly, deer point to nature, the non-human, and non-domesticated. Deer are known for their being elusive: health is an unstable status that can be gone quickly. Provided the mentioning of 'deer' evokes a notion of hunting among the elite, physician and patient will find themselves in a new metaphorical frame to think about pulses, disease, and medicine. With worms and ants one will associate not imminent danger, but decay. When it comes to tactile sensation, it is clear in both cases that the associations are unpleasant,[33] but not leading to expectations of imminent death or severe suffering. In all three cases, the terminology, due to its being 'rich', directly speaks to the experiences of lay patients who can relate to the pulse names without having any knowledge of the taxonomical system itself. It seems that these terms even protect the system against patient insight, because they do not give away anything about the logical structure of the taxonomy.[34] As far as I can see, the terms *kumatōdēs*, *murmēkizōn*, *skōlēkizōn*, and *dorkadizōn* enjoyed a certain success: Since the days of Herophilus, they were accepted and transmitted despite their metaphorical unclarity. We have seen that in the lines given above Galen refers to long-standing discussions about the precise meaning of these terms. It is quite surprising that all the participants of this discourse, over hundreds of years, have preferred to discuss the precise meaning of these terms rather than doing away with them. Thus, one might understand the specific metaphorical quality of these terms, their 'richness', as a means of aiming at consensus despite fundamental disagreement.

3 Names, Terms, and Field Memory: The Case of Siege Technology

Inventions need a name, because without names one could not even communicate about them; the more so, since inventors strive for recognition which leads to public reputation or patronage. As is well known, artillery and siege technology saw a signif-

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cism of Archigenes and his established terminology is similarly with respect to pain: see Roby 2016, 307–312, and her great discussion of Galen's ideas on terminology.

33 In poetic-polemical debates on 'new music' ant-based metaphors are attested since Aristophanes and Pherecrates (Aristophanes, *Thesm.* 100 and fr. 155.23 PCG, resp., see my 1997, 42–45, where I maintain that the two fields, pulse lore and music criticism, and these terms have a connection. Now, I am less confident).

34 See Lewis 2022, 216.

icant increment of inventorial activity all through the fourth century, but especially in the decades after Alexander's death.[35] At the same time, probably first in Alexandria, a genre of writing emerged, the *belopoïka* ('construction of artillery'), that preserved and transmitted abstract knowledge and certain machines. To us, this genre is represented by extant writings of Philo of Byzantium (third century BCE), one Biton (uncertain, perhaps second century BCE),[36] some chapters in Vitruvius, an Athenaeus (perhaps first century BCE), and Heron of Alexandria (first century CE) who all refer to further authorities on siege engines. It is far from clear whom these writings, many of which invoke patrons ranging from Attalus to Augustus, are actually addressing.[37] Due to the knowledge at stake, it is interesting to look at the naming practices in these treatises.

In all of them, large stretches of text, brimming with numbers, seem to be written for the fellow technician. We are led to the same conclusion as these texts teem with technical terms that make them quite difficult to follow (which is why those modern readers who have attempted to actually rebuild those machines, such as Schramm and Marsden, have often had to practically figure out the precise meaning of terms). To give an example, since torsion engines are in the focus of many of these texts, there is a lot of discussion about 'washers' (*khoinikides*) and springs (*tonoi*), the central unit of many of the engines in question. Authors have much to say about their dimensions, location, construction, maintenance, etc. These two terms, however, and so many more besides them, are never explained. In other words, authors expect their readers to know them and thus their ways in the field of siege engines and general construction lore.

On the other hand, some of our treatises single out a handful of terms for careful designation. Heron who comes latest in the series but who had actually promised that he would mention nomenclature (p. 18 Marsden = 73.11-3 Wescher) has the fullest series of terms explained, but still not more than about 12.[38] As far as I can see, most of these terms are what we call 'lean', such as *katokheis*, the 'holders', or *anapaustēria*,

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35 As discussed by Cuomo 2007, 41–57.

36 See now Keyser 2022, 153–155.

37 I have tried to discuss this in my 2017.

38 Heron, *Belop.* p. 20 M.: = 78.2 W.: τὰ δὲ εἰρημέα στημάτια κατοχεῖς ("what I called stanchions, the holders"). P. 24 M. = 83.11 W. τὰς καλουμένας χοινικίδας ("washers, as we call them"). P. 26 M. = 89.5 W.: καλεῖται δὲ ἀναπαυστηρία ("It is called the rest."). P. 28 M. = 91.8f. W.: Τῶν οὖν ὀρθίων τοίχων ὁ μὲν καλεῖται παραστάτης, ᾧ προσαναπίπτει ὁ ἀγκών ὁ δὲ ἕτερος ἀντιστάτης . . . ("Of the vertical walls, the one against which the arm recoils is called the side-stanchion; the other, against which the heel of the arm rests, is the counter-stanchion."). P. 28 M. = 93.7 W. καλεῖται δὲ ὑποπτερνίς ("this is called the heel-pad"). P. 30 = 97.10 W.: καλεῖται δὲ ἡ καταλειφθεῖσα ἐντορία τριϐεύς ("into which what is called the lever is lowered"). P. 32 M. = 99.1 W.: διὰ τοῦ καλουμένου ἐντονίου ("what is called the stretcher"). P. 32 M. = 99.10f. W.: καλεῖται δὲ τὸ πῆγμα . . . τράπεζα ("The framework . . . is called the table."). P. 32 M.: = 100.5 W.: ἡ δὲ σῦριγξ . . . ἐπὶ μὲν τῶν εὐθυτόνων σῦριγξ κέκληται, ἐπὶ δὲ τῶν παλιντόνων κλιμακίς ("the case . . . is called the case in straight-spring engines, but ladder in V-springs . . ."). P. 32 M. = 101.7 W.: καλεῖται δὲ πτέρυξ αὐτὸ τὸ ὄργανον ὅλον. ("The whole engine is called when complete a Protector."). P. 36. M. = 107.1 W. τὸ δὲ καλούμενα ἐντόνια ("The stretcher, so-called, . . ."). (All translations from Marsden 1971.)

the 'rest'. Herons *Cheiroballistra* provides the same picture.[39] Philo, who uses partly the same terms that Heron explained, uses all terms without ever explaining any but one pair of levers (*zugides*) which he calls differently from what he perceives to be common.[40] Biton, in more than one respect the most enigmatic of our siege lore authors, never bothers to explain his terms. Vitruvius, however, who obviously makes much use of the Greek authors in his field, occasionally points out Greek-Latin equivalences, for example, in phrases such as *cuneoli ferrei quos ἐπιζυγίδας Graeci vocant* (*Arch.* X 12.1).[41] As far as I can see, these explanations do not follow any pattern. Vitruvius certainly acknowledges the Greek background of his lore and thus, probably, builds up his own authority as having read up on siege lore. Heron, who overlooks a long history of catapult-building and writes with a view to an encompassing, canonical corpus of mechanics, might be interested in ironing out terminological differences between schools, that is, different local traditions of that lore,[42] in order to come up with a unified exposition. At the same time, the more space any approach allots to terminological questions, the more clearly it differs from the purely practical and thus transcends toward a discourse within a court context.

There is another group of remarkable terms in these treatises, the names of the actual machines. Some of them are clearly 'lean' terms, e.g., *gastraphetēs* or *petrobolos* ('belly-launcher' and 'stone-thrower', respectively), which are either transparent with respect to their construction or to their virtues. Some are truly idiolectal, such as *sambukē*[43] which due to its metaphorical structure (a *sambukē* is a triangular, harp-like musical instrument) may allow for a 'rich' interplay between the poliorcetic *sambukē*'s grim purpose and its namesake's symposiastic associations. Some are clearly programmatic, such as the *helepolis* ('city-destroyer'), a name chosen as if to convince clients to purchase it.

It is remarkable that in the treatises of Biton, Vitruvius, Athenaeus, and Heron, the names of the machines usually come with those of their inventors and sometimes

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39 Heron, *Cheirob.* 214 M. = 128.3 W.: κατεσκευάσθευσαν δὲ καὶ τὰ καλούμενα καμβέστρια τρόπωι τοιῷδε. ("Prepare what are called the field-frames in the following way."). 131.1 W. "Τὸ δὲ καλούμενον κλιμάκιον ἔστω ("Let what is called the little ladder . . .")."

40 Philo, *Belop.* 122 M. = 60.3 f. W. (conj. R. Schöne): . . . μέσαι δ' ἐπ' αὐταῖς αἱ καλούμεναι τίθενται ἐπιζυγίδες, ἡμῖν δὲ κληθησόμεναι καταζυγίδες . . . ("over these, in the middle, are placed what are called upper-levers, but what I shall call under-levers . . .") Schironi 2019, 237, draws attention to Philo's metaphorical terms for his engine parts, terms that indicate that these engines are seen as living beings.

41 Similarly *Arch.* X 10.3 *Canaliculi qui Graece σῦριγξ dicitur . . . regularum, quas nonnulli bucculas appellant . . . quae . . . vocitatur scamillum seu, quemadmodum nonnulli, loculamentum . . . . 4 σχαστηρία sive manucla dicitur . . . 5 Posterior minor columna, quae Graece dicitur ἀντίβασις.* 11.7 . . . *ei membro quod Graeci χελώνιον vocant . . . basis quae appellatur eschara.* 14.1 *arbusculae quae Graece ἁμαξοπόδες dicuntur.* 15.1 ὄρυγγες Graece dicuntur.

42 See Marsden 1971, 157, n. 8, reacting to Schramm 1918, 16 f. who regarded these terminological differences as 'arbitrary' ("willkürlich.").

43 See Keyser 2022, 166–169, for its shape and development.

even some remarks about the historical-geographical context in which or for which it was designed. Here are three typical examples: Biton introduces his stone-thrower with the remark, "This stone-thrower was designed in Rhodes by Charon of Magnesia";[44] Philon an 'automatic catapult' with "A certain Dionysius of Alexandria constructed in Rhodes what is called a repeating catapult, which has a unique and very intricate arrangement";[45] and Athenaeus introduces the *helepolis* with "The city-destroyer made by Epimachus the Athenian, which Demetrius the besieger of the Rhodians deployed against their walls, is like this."[46] Sometimes, the name of the engine designates a class rather than an individual machine which is then individuated by inventor's name (Biton, *Constr.* p. 72 M. = 57.1–58.1 W.):

> Ἐχομένως δὲ τῶν προγεγραμμένων ὑπογράψομέν σαμβύκης κατασκευήν. φέρει γὰρ καὶ τοῦτο τὸ ὄργανον ἐν τοῖς πολεμικοῖς ἀγῶσι μεγάλων πραγμάτων κινήσεις. ὑπογράψω δέ σοι ὃ ἠρχιτεκτόνευσε Δᾶμις ὁ Κολοφώνιος.

> Following upon what has been already written, we shall describe the construction of a sambuca. This instrument, in martial engagements, offers opportunities for great exploits. I shall describe for you the one which Damis of Colophon designed.

When a place is added to the inventor's name, a certain siege seems to be in the writer's mind. Apparently, the machine had been successful in that context. Again, this is an example taken from Biton (Constr. p. 76 M = 65.1–3 W.):

> Τούτου δ' ἐχόμενόν σοι τὸν ὀρεινοβάτην γαστραφέτην ὑπογράψομεν· ἔχει γὰρ τόνδε τὸν τρόπον. ἐκθήσω δέ σοι, οἷον ἠρχιτεκτόνευσε Ζώπυρος ὁ Ταραντῖνος ἐν Κύμῃ τῇ κατ' Ἰταλίαν.

> Following this, we shall describe for you the mountain belly-bow. It has the following form. I shall explain for you the one which Zopyrus of Tarentum designed at Cumae in Italy.

Biton gives this kind of information at the outset of all the engines that he describes, four non-torsion catapults, a *helepolis*, and a *sambukē*.[47] Other treatises, however, use the same convention, even if less coherently: For example, Vitruvius and Athenaeus, in their discussion of 'turtles' (*khelōnai*) pay homage to 'the turtle of Hegetor'.[48] Conceivably, to the competent mechanic, the name of the machine gave general hints as

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44 Biton, *Constr.* p. 66 M. = 45.1f. W.: ἔστι δὲ τοῦτο τὸ πετροβόλον ἐν Ῥόδῳ ἠρχιτεκτονευμένον ὑπὸ Χάρωνος τοῦ Μαγνησίου.
45 Philo, *Belop.* 146 M. = 73.21f. W.: Διονύσιος δέ τις Ἀλεξανδρεὺς κατεσκεύασεν < ἐν > Ῥόδῳ τὸν καλούμενον πολυβόλον καταπάλτην ἰδίαν τινὰ καὶ πάνυ ποικίλην ἔχοντα κατασκευήν.
46 Athenaeus, *Mech.* 27 (p. 56 W.-B.): Ἡ δὲ ὑπὸ Ἐπιμάχου τοῦ Ἀθηναίου γενομένη ἐλέπολις, ἣν Δημήτριος ὁ Ῥοδίους πολιορκῶν προσήγαγε τοῖς τείχεσιν αὐτῶν, ἔστι τοιάδε.
47 Except for the ones already mentioned these are: the *lithobolos* of Isidorus of Abydos, designed in Thessalonica (p. 68 M. = 49.1f. W.); the *helepolis* constructed by Posidonius the Macedonian for Alexander, son of Philip (p. 70 M. = 52.1 f. W.) and the *gastraphetēs* (belly-bow) designed at Miletus by Zopyrus of Tarentum (p. 74 M. = p. 61.2–62.1 W.).
48 Vitruvius, *Arch*. X 15.2, Athenaeus, *Mech*. 21 p. 52 W.-B.

to its construction,[49] whereas the one of its inventor and of the place of its first construction and, presumably, successful use triggered the technicians' collective memory as to more specific and more complex information (the kind of siege, specific problems overcome by certain inventions, etc.). While usually the name of the inventor is mentioned in a clearly acknowledging manner, Philo shows how it can rather be used to induce some skepticism as to whether two rather extravagant engines really work: On the *khalkotonon* and the *aērotonon*, both invented by Ctesibius, Philo mentions in the first case that he has rebuilt the machine without Ctesibius' plans and takes pain to ascertain by eye witnesses that his machine differed greatly from Ctesibius' one.[50] In the second case, he makes an effort to convince his addressee Aristo of the fact that the machine actually works (which modern experts have doubted).[51]

Thus, the terminological system of two or three names (class of engine, inventor, place) allowed for an efficient way to transmit complex mechanical information and was even able to negotiate the author's own stance vis-à-vis the mentioned inventor's one. As we might gather from vague modern parallels,[52] the inventors' names alone would exert a certain zeal in the readers of these treatises. *In nuce,* authors and readers work, by using these names for these machines, on a fragmentary history of that field, a kind of shared disciplinary memory. We can only speculate that the addressees, powerful players in the Hellenistic or Roman worlds such as Attalus or Augustus, who were just planning their own campaigns, were meant by the authors to relate to the historical situations conjured up by the place names mentioned in connection to certain siege engines, which means that in the background of even these treatises there is a paradigmatic view of history at work, certainly sketchy, but comparable to what we see in Plutarch's parallel lives. In some cases, the terminological system even opens up to narrative: Vitruvius can come up with a Peripatos-inspired history of knowledge that eventually led to the siege engine called *aries*/*krios* (*Arch.* X 13.1–3) or turns the situational knowledge contained in these terms and names into anecdotic narratives of paradigms for intelligent stratagems or cautionary tales (*Arch.* X 16ff.) and thus, to a certain extent, into frame-tales of his own project.[53] To add another modern parallel: Present-day mathematicians exhibit a certain tendency toward creating terminology based on personal names, such as 'Gauss-Bonnet theorem', 'Hardy-Littlewood maximal inequality', 'Mandelbrot set', or 'Riemannian manifolds'.[54] It is evident that such terminology adopts

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49 See, e.g., Vitruvius, *Arch.* X 13.3 who quotes Diades with four machines that carry five names (*turres ambulatoriae, terebra, ascendens machina, corvus demolitor = grues*). In 13.6, there follows the *testudo* of Diades.

50 Philo, *Belop.* 134f. M. = 67.28–68.3 W.

51 Philo, *Belop.* 152 M. = 77.9–12 W. See Schramm 1917, 62f.; Marsden 1971, p. 184. For such machines, see the remark in Athenaeus 15, p. 50, 10–13 W.-B. (on 'machines on paper').

52 Traweek 1999, 525, 531.

53 For the term and its meaning, see my 2011, 92.

54 I take these from the index of Gowers 2005.

an ideology of monumentalization, while at the same time expressing the idea that mathematics is a group effort. There is a certain tension between the famous discovery encapsulated in the coinage of the term, and its (potentially) epigonal user in the present. The same might be true of the one who puts 'Hegetor's turtle' to use after having read up on it in siege engine literature.[55]

<p style="text-align:center">✳ ✳ ✳</p>

To sum up: Unfortunately, when the history of ancient Greek knowledge is concerned, we cannot follow the process and struggles of how terminologies emerged and either prevailed or disappeared. However, we do get some glimpses of such constellations: Apparently, Aristotle criticized the inappropriate richness of Licymnius' terms and theirs, according to his own standards, being improperly introduced. While it would be rash to conclude that this is the reason of why Licymnius' treatise and rhetorical system have vanished, it affords an impression of less sober terminologies than Aristotle's. Why Licymnius opted for rich terms instead of lean ones, we cannot tell. However, considerations of the competitive structure of theoretical rhetoric might have been part of the story.

For Galen, caught up in constant struggle with competitors past and present, terminologies can easily turn into moral questions that allow for judgments of fellow medical writers' character. Whoever does not play according to the harsh rules laid down by Galen risks medical communication altogether and, according to Galen, acts irresponsibly. As Rufus shows, however, there exist less confrontational ways to deal with terminological differences: different anatomical terms can simply coexist in local traditions, e.g., Athenian versus Hippocratic. However, even Rufus lets himself get carried away when 'Egyptian' doctors name new discoveries, namely cranial sutures, badly. Unlike and more efficiently than Galen, however, Rufus helps forgetting them by not even mentioning their names or contexts of discovery (on the other hand, his criticism remains unclear). I have briefly discussed pulse lore because the field quickly emerged, needed many new terms, and ended up with an interesting terminological mix. It seems that the diagnostic performances Galen and his medical competitors engaged in could have profited from 'lean' just as well as from 'rich' terms. The curious fact that 'rich' pulse terms as fuzzy as *murmēkizōn* established themselves hints at the fact that they offered ways of consensus precisely due to their being fuzzy.

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55 I cannot help wondering about the different ways modern soldiers, admittedly not technicians, call their guns, cannons, and engines. As it seems, their names attempt to create intimacy, sometimes vaguely sexual, and certainly carry an air of quasi-human relationships. See Bergmann 1916, 6–12, who, among others, lists: "dicke Bertha," "schlanke Emma," "kurzer Gustav," "langer Schorsch," "Wauwau," "schwarze Säue," "Marie auf Socken," "Gurgel-August," and many more. With all due respect for different circumstances of class and media, I find the differences quite striking.

Turning to ancient siege technology, I have looked at the treatises of the belopoeic tradition and the large number of technical terms they offered. While the vast majority of terms is simply being taken for granted by the authors, some are explained, perhaps motivated by the consideration that their texts might transcend local technical communities (which is most clearly the case in Vitruvius who occasionally equates Latin with Greek terms). The more often this is the case, the more probable it is, in my view, that authors saw technicians among their readers. I believe that we can say, for example, that Biton is probably rather targeting audiences who decide about machines, while Heron apparently thought that at least a portion of his readership would actually build machines.[56] Besides terminological details, these siege lore experts developed a naming system for machines that strikingly combined technological with historical information about the machine's invention. The latter transcends my provisional divide between 'lean' and 'rich' terms and allows for a, albeit fragmentary, glimpse at how these technicians saw themselves: caught up not only between powerful clients and technical, economical or even military constraints, but also in a competition with great inventors past.

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Sabine Föllinger

The Problem of Biological Terminology in Aristotle's *De generatione animalium* (*On Generation of Animals*)

Abstract: In his late work *De generatione animalium*, Aristotle develops a complex theory in order to explain all processes of generation and (anachronistically termed) inheritance as well as the development of the embryo of all kinds of animals, including humans. In his attempts to come up with one unified theory which is able to explain all phenomena, he uses his doctrine of four causes, his general understanding of processes of generation and corruption, and the role of movement. Biological research had already existed before Aristotle, but he was the first to systematize it and to integrate it into a complex theoretical approach. In doing so, he could not rely on preexisting technical terminology to express his research. Such lack created even more problems, because he faced the problem of having to explain very complicated processes. In order to cope with the variety of difficulties in explaining diverse phenomena, Aristotle forged different paths to meet this challenge: He uses theoretical terminology, which he has already introduced in other contexts such as *eidos*, which experiences shifts in meaning depending on the context. He uses terminology introduced by other authors. He explicitly coins new terminology by the addition "*legō*" and he implicitly coins new terminology by using common language in a specific way. He uses preexisting scientific metaphors and uses a concept of "*analogon*" in a certain sense. A very important feature of Aristotle's technical terminology is the use of comparisons by way of analogy. Using these comparisons, he tries to express such complex processes as the development of the embryo, which according to his explanation is (in modern parlance) epigenetic, and processes of inheritance which modern biology explains by means of genetics.

Aristotle's role as the founder of biology is undisputed[1] not only because he carried out large-scale individual zoological research, but legitimized biology theoretically as well. Thus, his interest was in the systematic-theoretical classification of facts.[2] His far-reaching influence is demonstrated not least in the fact that basic biological categories of systematization, such as 'species' and 'genus', can be traced back to him. Basic concepts that are still valid in modern biology, such as 'nutrition', 'growth', 'reproduction', 'perception', and 'thinking', likewise point back to Aristotle.

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1 On the importance of Aristotelian research for modern biology see Kullmann 2003; Toepfer 2010, esp. 316. This does not mean that there was no biological research before him (cf. Harig & Kollesch 1998), but that he systematized it and gave it a methodological basis.
2 See Kullmann 2007, 130, on this.

In terms of theory, the *De generatione animalium* (*GA*), which belongs to Aristotle's later works (and is perhaps his final work),[3] is particularly fascinating, not least because of its complex subject matter, for Aristotle offers in it explanations for the way in which male and female reproductive partners contribute to conception, how the embryo develops, and why the offspring becomes male or female and why it is similar to its parents and previous generations. In the course of this, Aristotle examines all kinds of animals, including humans.[4] His goal was quite ambitious, because neither the function of the testicles nor the female egg were known at the time, and human dissections were not permitted. The speculative character of the writing is therefore not surprising, though one must nevertheless emphasize that Aristotle integrates numerous empirical observations. Indeed, his writing is based on the methodological principle that a theory must be able to explain the phenomena it examines – and indeed all phenomena. He sees the theoretical key to explaining the manifold phenomena of procreation and heredity in his doctrine of four causes, his general understanding of processes of generation and corruption, and the role of *kinēsis* (movement). Aristotle also draws on the opinions of his predecessors and contemporaries and takes a critical look at them – sometimes in a highly polemic manner. His main points of criticism are that they (a) have made too few empirical observations or have evaluated empirical observations prematurely or insufficiently, (b) that their respective theory cannot explain all phenomena, or (c) that they draw conclusions from incorrect assumptions. He himself sees – as he proudly notes – the advantage of his own approach in being able to explain everything with one unified theory.[5] In doing so, his research objective also integrates reasoning as to why there even are two sexes in general. But his explanation becomes even more speculative – necessarily – when he explains why the embryo develops epigenetically, why the heart is the beginning of this development – that this was the case, he was able to empirically establish on the basis of his observations of chicken eggs – how the sexes come into being, why children resemble their parents and grandparents, and why there may be similarities between the daughter and her male ancestors and between the son and his female ancestors.

Aristotle entered highly complex terrain with these explanatory approaches, and we can note that *GA* itself is not always a didactically perfect implementation of problems that have previously been solved elsewhere, but sometimes it proceeds in a problem-solving manner so that the work combines the gaining of knowledge and its

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3 The biological writings are subject to an overall concept, see Kullmann 2007, 141.

4 *De generatione animalium* offers in books I–IV explanations on the reproductive organs and the processes of reproduction, sex differentiation, and embryology as well as Aristotle's theories on inheritance. It is controversial whether Book V, on the body characteristics that develop after birth, originally belonged to it or was an independent work. See Liatsi 2000, 13–25, and Corcilius 2022.

5 See Föllinger & Busch 2022b.

presentation.[6] This can be seen in the fact that Aristotle repeatedly works with ad hoc, non-valent, and dialectical premises. Sometimes, he suggests an argumentation that is not compelling, evidenced by the use of expressions of necessity or of stylistic devices that might provide coherence and persuasive power of argument. Also the fact that he uses analogies which, according to his own philosophy of science, actually provide no strict proofs is telling. The impression that one is watching a scientist break new ground arises from the observation that Aristotle often has no technical terminology to fall back on, such as the term 'epigenetic'. It is precisely these circumstances that make the reading a challenge because Aristotle likes to use well-known – though sometimes imprecise – general terms to describe what he means, or uses analogies that supplement or replace the general description. As such, he is not only faced with the problem of how knowledge can be conveyed didactically but also with how it can be expressed at all. This difficulty mainly concerns the explanation of the complex processes already mentioned, but it does not mean that Aristotle completely lacked technical terminology. On that note, I would like to show in what follows the different ways in which Aristotle uses technical terminology in *GA* or replaces it with something else, and in doing so I will specifically address examples of the complex cases mentioned. But the issue of Aristotelian nomenclatures of animal species will not play a role in my analysis; to them, a separate contribution by Marcel Humar is dedicated in this volume (183–204).

Roelcke's considerations are suitable as an initial heuristic approach to the question of how technical terms are actually created.[7] He differentiates four groups within a technical vocabulary, for each of which he provides examples from biology:[8] "the intra-disciplinary technical vocabulary, which consists of those technical terms that belong exclusively to the relevant technical language,"[9] e.g., '*genom*' or '*zooplankton*' (A); the "interdisciplinary technical vocabulary" with "technical terms that appear both in the relevant and in other technical language systems,"[10] e.g., '*structure*' or '*classification*' (B); the "extra-disciplinary technical vocabulary" with technical terms "that belong to other specialist language systems but are nevertheless expressed in specialist texts in the relevant subject,"[11] e.g., 'species protection' or 'global warming' (C); and the "non-disciplinary technical vocabulary," i.e., "general and technically not further developed words"[12] such as 'human' or 'goal' (D).

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6 Cf. the two studies by Föllinger & Busch 2022a, 2022b.

7 Roelcke 2020.

8 The following quotations can be found in Roelcke 2020, 71, the examples from biology ibid., 72.

9 "intrafachliche(n) Fachwortschatz, der aus denjenigen Fachsprachwörtern besteht, die ausschließlich der betreffenden Fachsprache angehören" (Roelcke 2020, 71).

10 "interfachliche(n) Fachsprachwortschatz" mit "Fachwörtern(n), die sowohl in dem betreffenden als auch in anderen fachsprachlichen Systemen erscheinen" (Roelcke 2020, 71).

11 "extrafachlichen Fachsprachwortschatz" mit "Fachwörtern, die anderen fachsprachlichen Systemen angehören, dennoch in Fachtexten des betreffenden Faches geäußert werden" (Roelcke 2020, 71).

12 "nichtfachlichen Fachsprachwortschatz," d. h. "allgemeinen und fachlich nicht weiter geprägten Wörtern" (Roelcke 2020, 71).

As a trial, I would like to apply this differentiation to *GA*, though an important difference must first be made aware of: unlike in modern times and ancient medicine and mathematics, there was no clearly defined disciplinary group of biologists who would have contributed to establishing terminology or who would have been the addressees for the establishment of certain specialist terms.[13] Biology did not yet exist as a discipline; 'biological research' was part of the *philosophia phusikē*. Aristotle was the first to map it out as a separate area of investigation and legitimize it methodically; later in antiquity the scope of his research together with his abstract approach remained unrivalled.[14] Biology, as an area of research, is, in his time, so to speak, only just being discovered. This may also be the reason why Aristotle likes to use his philosophical vocabulary and adjust it accordingly, especially since his general philosophemes form the basis for his theory.[15] An example of this is the word *eidos*. To make matters worse, we know nothing about the audience for *GA*; to this end, we can only speculate. Wolfgang Kullmann suspected that the zoological writings were intended for an expert primary audience and simultaneously for an additional secondary audience.[16] With regard to *GA*, this thesis seems plausible to me due to the heterogeneity of this writing: on the one hand it is full of implicit assumptions that actually would need further explanation; on the other hand, it offers up didactically styled passages.[17] In addition, the areas distinguished by Roelcke (A)–(D) cannot be easily delimited from one another, precisely because we are living in a time when the single areas of science are emerging. Nevertheless, for heuristic reasons, a subdivision seems to be helpful: if one wishes to speak of an "intra-disciplinary" technical vocabulary (A), one can first refer to the naming of species.[18] The "interdisciplinary" technical terms (B) make up a fairly large group. On the one hand, this includes the technical terminology with words such as *hulē*, *eidos*, *genos*, *kinēsis*, *telos*, and *psukhē*. However, sometimes only through context does it become clear what meaning they have. On the other hand, we also find medical terminology such as *kratein*.[19] An "extra-disciplinary" tech-

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13 On the importance of institutions in the development of technical terms in the modern age, see Felber & Budin 1989, 221–233; Roelcke 2020, 155–176.
14 See Lennox 1995.
15 For a discussion on the well-known problem that Aristotle even uses vocabulary in different contexts with different meanings, see the introduction by Markus Asper in this volume (1–9).
16 "Intended for an additional abstract audience and for posterity" (Kullmann 2007, 137). We are not well informed about the lessons in the Lyceum and the context of Aristotelian text production, cf. Van der Eijk 2017, 187 with reference to Lynch 1972 and further literature. The view, long held by researchers, that the Aristotelian *pragmateiai* are 'lecture notes' in a more or less revised state, has rightly been questioned or discussed and modified in recent years, see Föllinger 1993; van der Eijk 1997; Lengen 2002; Föllinger 2012; and the volume by Wians & Polanski 2017.
17 See the studies by Föllinger & Busch 2022a, 2022b.
18 See Marcel Humar's contribution in this volume (p. 91–93).
19 About this term, see below, p. 91–92.

nical vocabulary (C) could include more specific medical expressions such as *katamē-nia* as well as mathematical expressions.

If one examines the use of 'technical terminology' in *GA* in more detail, the following paths that Aristotle takes can, in my opinion, be distinguished:

(1) Aristotle uses specialist terminology that he has already introduced and coined in theoretical contexts, such as *eidos, hulē, arkhē, kinēsis, poioun* vs. *paskhōn*, which, however, experiences shifts in meaning depending on the context. Such a shift in meaning occurs when he secretly turns the – singularly used – principle *kinēsis* into the plural *kinēseis* (767b35–a2) in Book IV, such that the movement, the origin of which is the male contribution to procreation, now becomes impulses, possessing the 'hereditary information'.

An illustrative example for the narrowing of a semantically broad term is the use of *logos* in II 1. By using an analogy here to replace an explanation, Aristotle limits the meaning of this word and thus replaces a missing technical term.[20]

(2) Aristotle uses terms introduced elsewhere. So it is probably a sign of missing specialist terminology that he occasionally makes to do with the term 'participation' (*meth-exis*), a Platonic expression that he otherwise actually rejects: In I 19. 719a5–8, he phrases it in such a way that the ovoviviparous animals "take part" in both genera (live-bearing as well as egg-layers) (719a6 f.: διὰ τὸ ἀμφοτέρων μετέχειν τῶν εἰδῶν). Obviously, there are no other terminological possibilities available to him to express that animals can combine characteristics of different genera. This is probably why the expression is so vague, and it is not for nothing that Aristotle exactly here refers to the need to obtain further knowledge from images of sections (*Anatomai*) and the writing *Historia animalium* (719a8–10: δεῖ . . . τεθεωρηκέναι καὶ τῶν ἱστοριῶν).[21]

(3) With *kaloumena*, Aristotle signals that certain terms have already been introduced, but by whom they were introduced or which group accepts them as introduced remains unclear. The identification with *kaloumena* can then also serve as a starting point for a criticism of an introduced technical term. This is the case in *GA* I 23. 730b33–731a9. Here Aristotle speaks of the so-called "seeds" (*ta kaloumena spermata*) of the plants and, as the context makes clear, distances himself from this term because, in his opinion, the male and female principles are mixed in the plant, and plants can therefore 'procreate from themselves'. He calls the product a κύημα (*kuēma*), using a term that describes the "embryo"[22] in zoology. The traditional term σπέρματα – according to Aristotle – is not appropriate because the σπέρματα of plants

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[20] See my comments below, p. 98.

[21] For the references to *anatomaí*, see Lennox 2018.

[22] Peck translates as "fetation" in contrast to the term γονή, which he translates as "semen." Lefèbvre 2014 translates κύημα as "embryon."

are more than just σπέρματα, so to speak, insofar as they incorporate the functions of an egg.

(4) Aristotle explicitly coined new technical terminology by redefining a word with the phrase "I mean" (*legō*[23]) in the form of a technical definition or by restricting its meaning.[24] And so with *legō* he introduces the word *perittōma* in a very specific meaning as 'remnant of food' (λέγω δὲ περίττωμα μὲν τὸ τῆς τροφῆς ὑπόλειμμα, GA I 18. 724b26f.) and defines *kuēma* as the "first mixture of female and male" (λέγω δὲ κύημα τὸ πρῶτον μίγμα ἐκ θήλεος καὶ ἄρρενος I 20. 728b34). In the modern age, definitions play an important role in the development or establishment of specialist terms.[25]

The usage is somewhat different when Aristotle refers in the first person plural (*legomen*) to a terminology that he would like to identify as one that has already been introduced and is obviously already generally recognized within a certain group. In this way he speaks of *telos* ("goal") as that "for whose sake other things happen" and uses the phrase *hou heneka* (οὗ ἕνεκα), which was coined and introduced for his philosophy (II 6. 742a28f.). The fact that he speaks in the first person plural could indicate that the target group he is addressing or, at least, the group of primary addressees is one of his fellow researchers and students who are familiar with this terminology. However, the emphasis on this terminology may also be an indication that he already has an additional group of addressees in mind that does not consist of experts and for whom he has to explain this expression.[26]

(5) Aristotle implicitly coined a specialist terminology by using common language terms in a specific way. Two important technical terms are *existasthai* (ἐξίστασθαι) ("to step out") for the formation of the sex and the similarity to the mother and father, and *luesthai* (λύεσθαι) ("to *relapse*")[27] for the similarity with the ancestors (*GA* IV 3. 768a9–21).

(6) A special case is the use of metaphors: In *Rhetoric* (III 10–11), Aristotle explains that the metaphor is not just an ornament, but has a learning effect, i.e., a didactic function. This learning effect is generated by the pleasure that the recipient feels when deciphering the metaphor:[28] for the recipient has to partake in translations of a sort, and pleasure is associated with this cognitive process. For the field of science, however, according to Aristotle, somewhat different conditions apply, because in sci-

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23 On this use of λέγω see Asper 2007, 132 with note 270 and Brink 1933, 56f.

24 According to Roelcke 2020, 72–83, the definition is the most important way of creating new specialist terms. He distinguishes between the "explicative definition" (77) and the "exemplary definition" (78) from the classic definition of Aristotelian provenance.

25 See Roelcke 2020, 72–83.

26 On the possible addressees of *GA* see above, p. 88.

27 This is the translation by Peck.

28 See Rapp 1992, 542.

ence there exist demands for clarity and explicitness. This is why clarifications of terms and definitions are necessary. The charm of metaphors and comparisons, on the other hand, lies precisely in the fact that they are not explicit, but that one has to make inferences. Therefore metaphors, even if they have a certain didactic value, are not suitable for science.[29] In the natural sciences, Aristotle himself repeatedly criticizes the pre-Socratic philosopher Empedocles for the metaphors he used in his poem *Peri phuseōs* (*Meteorologica.* II 3. 357a24–28).

In *GA,* Aristotle likes to quote Empedocles verbatim because, given the nature of his criticism, he can express the inadequacy of the language of poets for scientific contexts. In his criticism of Empedocles' view that milk is a product of putrefaction, he clearly states that a poetic expression can have an obscuring effect. Here he uses the word-for-word quote (*GA* IV 8. 777a7–12):[30]

> τὸ γὰρ γάλα πεπεμμένον αἷμά ἐστιν ἀλλ' οὐ διεφθαρμένον. Ἐμπεδοκλῆς δ' ἢ οὐκ ὀρθῶς ὑπελάμβα- νεν ἢ οὐκ εὖ μετήνεγκε ποιήσας ὡς τὸ γάλα "μηνὸς ἐν ὀγδοάτου δεκάτῃ πύον ἔπλετο λευκόν". σαπρότης γὰρ καὶ πέψις ἐναντίον, τὸ δὲ πύον σαπρότης τίς ἐστιν, τὸ δὲ γάλα τῶν πεπεμμένων.

> since milk is *concocted*, not *decomposed*, blood. As for Empedocles, either he was mistaken, or else his metaphor was a bad one, when he wrote how the milk is formed "on the eighth moon's tenth day, a whitish pus." No; putrefaction and concoction are opposites, and pus is a putrefaction, whereas milk is to be classed as something concocted.

The criticism does not only apply to the content (milk is a putrefactive product), but Aristotle criticizes the metaphorical expression in general.[31] So it is not suitable for the scientific field.

Yet, Aristotle himself makes use of metaphors in the scientific realm. For example, in *GA* he uses the verb *kratein* (= to win, get the upper hand) to denote that when a child is conceived, a child looks more like its father than its mother, if the paternal part has become stronger.[32] He obviously takes this expression from the Hippocratic writings,[33] where it is likewise used in the area of procreation doctrines; it is therefore an established term that describes a process for which no word is yet available. The verb *kratein* comes from the military-political field and denotes physical strength. But in Aristotelian reproductive biology, it describes the dominance of the paternal or maternal 'inheritance'. The Hippocratic writings, from which Aristotle accesses this metaphor, actually represent a 'symmetrical' doctrine of procreation, according to which male and female seeds fight for dominance. Aristotle, on the other hand, uses the

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29 See Rapp 2013.

30 This and the following translations of *GA* are from Peck 1942.

31 For this, as for the criticism of Empedocles in *GA* in general, see Föllinger 2022b.

32 Modern biology uses similar metaphors.

33 See Föllinger 1996, 170–179.

word in the context of his 'asymmetrical' doctrine of procreation to explain the emergence of individual properties in ontogenesis: if the male contribution to procreation is 'stronger', i.e., prevails, certain individual properties are based on the father; if not, then on the mother.

Insofar as Aristotle reflects on the use of the metaphor to name things that have not yet been named[34] in *Rhetoric* (III 2. 1405a34–1406b6) and in *Poetics* (21.1457b25–30), one can say that he himself here provides clues for how one can arrive at a 'technical terminology'. However, these metaphors, which name something that has not yet been given a name[35] must not be too far-fetched – in contrast to metaphors used by rhetors and poets – but rather they have to be taken from the field of the same *genus* and of the same type (*ek tōn suggenōn kai tōn homoeidōn*, *Rhetoric* III 2. 1405a34–35). In so far as "strength" is the type of metaphor for *kratein* and the power struggle between male semen and female menstrual blood is one about a balance of power, one can say that the metaphor is not too far-fetched. For, modern biology also speaks of 'dominance' when it comes to inheritance. Another metaphor is that of cooking (*pepsis*) for physiological processes (which we also know: we 'burn' calories).

(7) Another, somewhat more specific way of dealing with specialist terminology or the lack of specialist terminology is to use the term *analogon*. In *GA*, Aristotle uses *analogon* with regard to parts of the body such as the heart, brain, and lungs.[36] He often speaks of an analogue of menstrual blood in female animals of other genera and species, without it being clear which substance this is supposed to be. For Fiedler,[37] the reason is that Aristotle could dispose of the problem of having to create a new *terminus technicus*. This could very well be a reason. But then the question arises of why he wanted to avoid this act of creation. Would it have been too ambitious an undertaking, or would the new creation no longer have been understandable for a wider audience? In any case, one has to go beyond the reason assumed by Fiedler as to why Aristotle avoids a specific naming of terms. Aristotle's aim in *GA* is to offer a *unified* theory for all generation and inheritance phenomena throughout the entire animal kingdom. Due to this, he needs a single explanatory approach. He sees this single explanatory attempt in his hylemorphic approach. Accordingly, he must assume that

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34 This use was later called catachresis. Cf. Rapp 2002, second half volume, 843, on *Rhetoric* 1405a35–1405b6.

35 See also *Poetics* 21. 1457b25–30.

36 See the passages cited in Fiedler 1978, 27 note 3.

37 Aristotle offers no systematic reflections on analogies, though they play an important part in his practice. Fiedler has systematically examined Aristotle's "occasional theoretical utterances in the various writings, (. . .) commentary remarks on individual comparisons by analogies and . . . his practical approach" (Fiedler 1978, 21: "gelegentliche(n) theoretische(n) Äußerungen in den verschiedenen Schriften, (. . .) kommentierende Bemerkungen zu einzelnen Analogievergleichen und (. . .) sein praktisches Vorgehen") in order to explain Aristotle's conception of analogy. On Aristotle's use of analogy, see also Sier 2022.

there is something in every female sexual partner in the entire animal kingdom that is 'analogous' to menstrual blood in that it offers the matter. By simply speaking of the fact that there is an analogy to menstrual blood and/or by taking its existence for granted, he can give his theory the general character that he would like to give it without actually having to empirically prove the existence of a corresponding body part or component.

(8) Comparisons that use analogies can serve to replace missing technical terms. I would now like to turn to this particular procedure in more detail:

In *GA*, Aristotle offers a surprising number of comparisons. At first glance, this is astonishing, for the comparison is, according to the explanations of Aristotle's *Rhetoric*, a metaphor that is made more precise by inserting a comparative word. But metaphors are actually not suitable for the field of science because metaphors are ambiguous,[38] and in the field of science, a claim to clarity and explicitness has been made. But the fact that, nevertheless, Aristotle often uses comparisons in *GA* can be justified by the fact that these comparisons work with analogies.[39] Aristotle himself defines analogies in *Poetics* (21. 1457b16–33) as a relation of 'units' in which the second is related to the first as the fourth is to the third. With such comparisons based on analogies, Aristotle can now illustrate in *GA* complex scientific connections that are on the theoretical level difficult and not immediately understandable; as such, they can be a didactic tool. But Aristotle uses such comparisons to serve also heuristic purposes because they can serve to clarify difficult facts in the cognitive process – also for the scientist/author himself – by functioning as models. Indeed, Aristotle partially substitutes them for explanations so that they have an evidentiary function.[40] When reading *GA*, one even gets the impression that analogies provide a means for the scientist himself in order to understand coherences and to gain knowledge, with which he then simultaneously allows the reader to participate in his own knowledge process. This corresponds to the character of the entire writing.[41]

Now I would like to address comparisons that Aristotle, by analogizing abstract processes with concrete phenomena taken from everyday life, uses as heuristic aid for explanation, comparisons which at the same time help to 'find words' for that which he desires to express. This applies in particular to his theory that the male's contribution is immaterial in nature, consisting rather in initiating the procreation process by way of movement. From this movement, a process is set in motion whereby the 'dispositions'

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38 Christof Rapp has shown this on the basis of Aristotle's explanations in *Topics and Metaphysics*. According to the *Topics*, a metaphor is not suitable for a definition because it is not explicit (*asaphēs*) (Rapp 2013).

39 That the analogy is a subgroup of the metaphor becomes clear from the *Poetics* passage mentioned. Aristotle deals extensively with metaphor and comparison as its sub-form in *Rhetoric* III.

40 A separate study is being prepared to categorize different types of comparisons.

41 See my remarks on the character of writing, above, p. 86–87.

of the offspring are successively transformed through the 'transmission of information' such that the formation of body parts and certain physical characteristics can be realized. With the terms 'dispositions' and 'transmission of information' I use modern terminology and ideas.[42] Aristotle, on the other hand, expresses himself generally through circumscriptions – such as (general) relative clauses – and general philosophical vocabulary such as *dunamis* (potentiality), *energeia* (actuality/realization), *eidos* (form), *kinēsis* (movement), and *logos*.

In order to explain his rather abstract view that the male's actual contribution to the process of procreation does not consist of anything material, Aristotle uses a comparison that analogizes the procreation process with everyday handiwork activity. He starts from his basic philosophical view[43] that between that which is acted upon (*pathētikon*) and that which acts (*poioun*) there is no unity in which that acts would be a component. He transfers the distinction between that which acts and that which is acted upon to the two sexes, where what is being acted upon is the female partner. Aristotle does not justify this statement nor does he explain the process of acting upon on a theoretical level, but instead illustrates with two comparisons what, according to his theory, happens. One comparison cites as an analogy the bed as a 'product' made by carpenter and wood, whereby the analogy does not illustrate but actually replaces an explanation (I 22. 730b5–23):

> καὶ γὰρ πρὸς τῷ ξύλῳ ὁ τέκτων καὶ πρὸς τῷ πηλῷ ὁ κεραμεύς, καὶ ὅλως πᾶσα ἡ ἐργασία καὶ ἡ κίνησις ἡ ἐσχάτη πρὸς τῇ ὕλῃ οἷον ἡ οἰκοδόμησις ἐν τοῖς οἰκοδομουμένοις. λάβοι δ' ἄν τις ἐκ τούτων καὶ τὸ ἄρρεν πῶς συμβάλλεται πρὸς τὴν γένεσιν· οὐδὲ γὰρ τὸ ἄρρεν ἅπαν προΐεται σπέρμα, ὅσα τε προΐεται τῶν ἀρρένων, οὐθὲν μόριον τοῦτ' ἔστι τοῦ γιγνομένου κυήματος, ὥσπερ οὐδ' ἀπὸ τοῦ τέκτονος πρὸς τὴν τῶν ξύλων ὕλην οὔτ' ἀπέρχεται οὐθέν, οὔτε μόριον οὐθέν ἐστιν ἐν τῷ γιγνομένῳ τῆς τεκτονικῆς, ἀλλ' ἡ μορφὴ καὶ τὸ εἶδος ἀπ' ἐκείνου ἐγγίγνεται διὰ τῆς κινήσεως ἐν τῇ ὕλῃ, καὶ ἡ μὲν ψυχὴ ἐν ᾗ τὸ εἶδος καὶ ἡ ἐπιστήμη κινοῦσι τὰς χεῖρας (. . .) ποιάν τινα κίνησιν (. . .) αἱ δὲ χεῖρες τὰ ὄργανα, τὰ δ' ὄργανα τὴν ὕλην. ὁμοίως δὲ καὶ ἡ φύσις ἡ ἐν τῷ ἄρρενι τῶν σπέρμα προϊεμένων χρῆται τῷ σπέρματι ὡς ὀργάνῳ καὶ ἔχοντι κίνησιν ἐνεργείᾳ, ὥσπερ ἐν τοῖς κατὰ τέχνην γιγνομένοις τὰ ὄργανα κινεῖται· ἐν ἐκείνοις γάρ πως ἡ κίνησις τῆς τέχνης.

> After all, the carpenter is close by his timber, and the potter close by his clay; and to put it in general terms, the working or treatment of any material, and the ultimate movement which acts upon it, is in all cases close by the material, *e.g.*, the location of the activity of house-building is in the houses which are being built. These instances may help us to understand how the male makes its contribution to generation; for not every male emits semen, and in the case of those which do, this semen is not a part of the fetation as it develops. In the same way, nothing passes from the carpenter into the pieces of timber, which are *his* material, and there is no part of the art of carpentry present in the object which is being fashioned: it is the shape and the form which pass from the carpenter, and they come into being by means of the movement in the material. It is his soul, wherein is the "form", and his knowledge, which cause his hands (. . .) to move

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in a particular way (. . .) his hands move his tools and his tools move the material. In a similar way to this, nature[44] acting in the male of semen-emitting animals uses the semen as a tool, as something that has movement in actuality; just as when objects are being produced by any art the tools are in movement, because the movement which belongs to the art is, in a way, situated in them.

The analogy consists in the fact that the 'forming' of the wood is brought about by the movement but without that moving part actually providing anything material. It is the 'form' that brings about the shape of the bed, the originator of which is the carpenter or his idea of the product. His hands are the tools that use movement to impart the shape to the wood. Correspondingly, according to Aristotle, the seed itself is not part of the resulting embryo, but rather imparts form to the matter – the menstrual blood – through its movement. So, one can make out the following equivalents:

Hands – seeds = tools
Wood – catamenial material = matter
Movement – movement = movement
Carpenter – nature = 'mover'

Even if this comparison is problematic in that the carpenter is an external agent who is not quite equivalent to 'nature',[45] it can clarify what is important in Aristotle's explanation: the essential thing is not the physical nature of the seed, but the transference of the 'form', a process that we would in modern times call 'information' – which itself is also a metaphor.

So, this comparison – as a substitute for theoretical explanation – conveys a theory by contrasting the general philosophical vocabulary on the theoretical level with the concrete equivalents on the level of metaphor. But it also serves as a substitute for specialist terminology. This means: the general philosophical terminology + the analogization with concrete things and known processes from the everyday world replace the technical terminology.

Another theoretical and speculative element of Aristotelian theory puts forth the idea that the development of the embryo takes place successively or, as one would put it in modern terms, proceeds 'epigenetically'. For this demanding thesis – whose empirical starting point was obviously the observation made through experiments with chicken eggs that the heart develops first – Aristotle uses a comparison with 'automatic puppets' (*automata*) (II 1. 734b4–19).[46] In order to better understand the way in which the comparison based on analogy replaces a (as yet) non-existent technical terminology, this text should also be cited in full (II 1. 734b9–19):

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44 Peck: "Nature."

45 Elsewhere, even Aristotle himself points out this problem.

46 See below, p. 97.

ἐνδέχεται δὲ τόδε μὲν τόδε κινῆσαι, τόδε δὲ τόδε, καὶ εἶναι οἷον τὰ αὐτόματα τῶν θαυμάτων. ἔχοντα γάρ πως ὑπάρχει δύναμιν τὰ μόρια ἠρεμοῦντα· ὧν τὸ πρῶτον ὅταν τι κινήσῃ τῶν ἔξωθεν εὐθὺς τὸ ἐχόμενον γίγνεται ἐνεργείᾳ. ὥσπερ οὖν ἐν τοῖς αὐτομάτοις τρόπον μέν τινα ἐκεῖνο κινεῖ οὐχ ἁπτόμενον νῦν οὐθενός, ἁψάμενον μέντοι· ὁμοίως δὲ καὶ ἀφ' οὗ τὸ σπέρμα ἢ τὸ ποιῆσαν τὸ σπέρμα, ἁψάμενον μέν τινος, οὐχ ἁπτόμενον δ' ἔτι· τρόπον δέ τινα ἡ ἐνοῦσα κίνησις ὥσπερ ἡ οἰκοδόμησις τὴν οἰκίαν. Ὅτι μὲν οὖν ἔστι τι ὃ ποιεῖ, οὐχ οὕτως δὲ ὡς τόδε τι οὐδ' ἐνυπάρχον ὡς τετελεσμένον τὸ πρῶτον, δῆλον.

And it is possible that A should move B, and B move C,[47] and that the process should be like that of the "miraculous" automatic puppets: the parts of these automatons, even while at rest, have in them somehow or other a *potentiality*, and when some external agency sets the first part in movement, then immediately the adjacent part comes to be *in actuality*. The cases then are parallel: just as with the automaton (1) in one way it is the external agency which is causing the thing's movement – viz., not by being in contact with it anywhere now, but by having at one time been in contact with it, so too that from which the semen originally came, or that which fashioned the semen, <causes the embryo's movement[48]> – viz., not by being in contact with it still, but by having once been in contact with it at some point; (2) in another way, it is the movement resident within <which causes it to move[49]>, just as the activity of building causes the house to get built. It is clear by now that there is something which fashions the parts of the embryo, but that this agent is not by way of being a definite individual thing, nor is it present in the semen as something already perfected to begin with.

Here, Aristotle's comparison, which works with an analogy, clearly serves as a model by means of which Aristotle can make it possible to explain how the effect of the seed is to be imagined.[50] The comparison is intended to make it clear that the successive development of the offspring from the seed is based on an initial impulse that develops gradually. It is important for Aristotle to explain how it can be that the parts of the newly emerging living being developed successively from the seed without having to make the (absurd) claim that one part of the body is always potentially contained in the previous one. Rather, his explanation points to the fact that a process is set in motion during procreation, in which the body parts gradually arise, starting from the initial impulse.[51] Aristotle could not yet find any technical terminology for that, and his philosophical terminology, which forms the framework for the theoretical explanation (*energeia*, *dunamis*, *tode ti*), is too unspecific, as is particularly clear in the following:

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47 Here, the Greek text actually has: "this moves this, and this moves this . . . ."

48 "Causes the embryo's movement" is an addition by Peck.

49 "Which causes it to move" is an addition by Peck.

50 The analogization of the blood vessels with a system of irrigation channels in *De partibus animalium* (*PA*) IV 10. 688a11ff and 24ff has a comparable heuristic function. This analogy, according to Fiedler, is no conclusive proof, but it also illustrates not only because Aristotle could not observe the processes concerning the blood vessels: "The irrigation system offers a model from which Aristotle can understand, i.e. justify, all the manifestations that can be determined in connection"(Fiedler 1978, 32).

51 Quarantotto 2022 seeks an explanation.

> It is clear by now that there is something which fashions the parts of the embryo, but that this agent is not by way of being a definite individual thing, nor is it present in the semen as something already perfected to begin with. *(end of passage quoted above)*.

The lack of precision in the existing terminology is probably the reason why Aristotle's explanation is initially set on a very theoretical level that is too general to really express what happens, in order to then replace the missing technical terminology by comparing it with the specific 'automatic puppets' that the recipients were familiar with. In these 'automatic puppets' an impulse that was not visible from the outside, viz., from the viewer's perspective, triggered a process that we would call a 'chain reaction'.[52] This analogy, which likewise creates a mental image of the *automata* in the recipient, makes it clearer how one should imagine the process. Here also a movement starts from the first element, the seed, which in turn sets something else in motion so that the movement reaches all subsequent parts, even if they are not in direct contact with the original mover. Another comparison with building a house, already introduced above, serves to illustrate that the movement emanating from the seed is nothing external. The formulation chosen by Aristotle "because the movement (. . .) is, in a way, situated in them" makes it clear that he can only express what he means very vaguely. The comparison with the building of a house even replaces a scientific argument or a proof, and Aristotle concludes with the aforementioned reference to the obviousness of the fact (734b17–19) that what triggers the movement is neither individual nor anything like a finished product present in the seed.

The situation is similar with the comparison which Aristotle uses after the comparison with the *automata*. In order to explain how the individual parts of the body are formed during embryonic development, he starts from his theoretical premise that what initializes the development of the embryonic parts is neither a specific individual entity nor some completed product in the semen.[53] His own approach consists in explaining that there is potentially something in the male semen that is the cause for the individual body parts to develop, i.e., becoming actual, in the course of embryonic genesis. Again one notices clearly how Aristotle can use his philosophical terminology (potentiality: *dunamis* – actuality: *energeia*), but he lacks a more specific form of expression, i.e., technical terminology. So he takes the opportunity to explain what he meant by using a comparison. He analogizes the development of body parts with a process of artificial production (*GA* II 1. 734b28–735a4):

> καὶ ὥσπερ οὐδ' ἂν πέλεκυν οὐδ' ἄλλο ὄργανον φήσαιμεν ἂν ποιῆσαι τὸ πῦρ μόνον οὕτως οὐδὲ πόδα οὐδὲ χεῖρα. τὸν αὐτὸν δὲ τρόπον οὐδὲ σάρκα· καὶ γὰρ ταύτης ἔργον τί ἐστιν. σκληρὰ μὲν οὖν καὶ μαλακὰ καὶ γλίσχρα καὶ κραῦρα καὶ ὅσα ἄλλα τοιαῦτα πάθη ὑπάρχει τοῖς ἐμψύχοις μορίοις θερμότης καὶ ψυχρότης ποιήσειεν ἄν, τὸν δὲ λόγον ᾧ ἤδη τὸ μὲν σὰρξ τὸ δ' ὀστοῦν οὐκέτι,

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52 Primavesi 2018, CX–CXXVI, explains how the *automata* functioned.
53 This is probably an allusion to theoretical approaches that attempted to explain the development of an embryo with a kind of preformation theory.

ἀλλ' ἡ κίνησις ἡ ἀπὸ τοῦ γεννήσαντος τοῦ ἐντελεχείᾳ ὄντος ὅ ἐστι δυνάμει ἐξ οὗ γίγνεται, ὥσπερ καὶ ἐπὶ τῶν γιγνομένων κατὰ τέχνην· σκληρὸν μὲν γὰρ καὶ μαλακὸν τὸν σίδηρον ποιεῖ τὸ θερμὸν καὶ τὸ ψυχρόν, ἀλλὰ ξίφος ἡ κίνησις ἡ τῶν ὀργάνων ἔχουσα λόγον τὸν τῆς τέχνης. ἡ γὰρ τέχνη ἀρχὴ καὶ εἶδος τοῦ γιγνομένου, ἀλλ' ἐν ἑτέρῳ· ἡ δὲ τῆς φύσεως κίνησις ἐν αὐτῷ ἀφ' ἑτέρας οὖσα φύσεως τῆς ἐχούσης τὸ εἶδος ἐνεργείᾳ.

And as in speaking of an axe or any other instrument, we should not say that it was made solely by fire, so we should not say this about a foot or a hand <in the embryo>, nor similarly of flesh either, because this too is an instrument with a function to perform. As for hardness, softness, toughness, brittleness and the rest of such qualities which belong to the parts that have soul[54] in them – heat and cold may very well produce these, but they certainly do not produce the *logos* in direct consequence of which one thing is flesh and another bone; this is done by the movement which derives from the generating parent, who is in *actuality* what the material out of which the offspring is formed is *potentially.* Exactly the same happens with things formed by the processes of the arts. Heat and cold soften and harden the iron, but they do not produce the sword; this is done by the movement of the instruments employed, which contains the *logos* of the art; since the art[55] is both the principle and form[56] of the thing which is produced; but it is located elsewhere than in that thing, whereas nature's[57] movement is located in the thing itself which is produced, and it is derived from another natural organism which possesses the form[58] *in actuality.*

The key point is that it is not the material influences that make a becoming thing what it is. Rather, it is what Aristotle calls here both with regard to the artificial production and with regard to the natural process *logos* (λόγος). This *logos* is transmitted through the movement of the tool in the artificial process and through the movement of the male parent in the natural process and conveys the 'form', i.e., that which is the essence of the respective product. It is difficult to translate the term *logos*, which occurs twice in this passage (734b33 and 735a2), even if it is factually clear what it means in each case. So, Peck leaves it untranslated in both places; Balme translates as "definition" in both places, Lefebvre translates it as "raison." If one wanted to use a more specific vocabulary, one could translate it in the first passage (734b33) using a modern concept like 'information', while the second passage (735a2) deals with the 'designation' of a tool. At this point it becomes very clear how Aristotle uses, in a particular context, comparison via analogy to give a semantically diverse term, for which he himself has no word, a certain meaning.

The variety of paths that Aristotle takes to find suitable terms, and also the way in which he uses comparisons working with analogies didactically, heuristically, and additionally as a substitute for missing technical terminology, demonstrate well the status of biology in the fourth century and the creative achievement that is due to Aristotle.

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54 Peck: "Soul."

55 Peck: "Art."

56 Peck: "Form."

57 Peck: "Nature's."

58 Peck: "Form."

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Coming to Terms with Aristotle: Technical Terminology in the *Poetics* and Beyond

Abstract: Aristotle uses a number of common Greek words in the *Poetics* as technical terms with specific meanings unique to literary criticism. I argue that the key term *mimēsis*, though typically considered a philosophical term, may be a technical term referring to a particular kind of organization or arrangement of individual imitations within an artistic work. This technical definition is only indirectly related to the word's colloquial meaning of 'imitation', and would exclude it from being understood as a philosophical or aesthetic concept. I conclude that this wider consideration of technical terms and reconsideration of philosophical terms in the *Poetics* could help explain some terminological confusion in Aristotle's other texts.

1 Introduction

Aristotle's thought is practically inseparable from his terminology. Aristotle defined and applied more terms than any other philosopher before him, and many of the terms that he coined are still in use by philosophers today. But paradoxically, Aristotle himself made little effort to adhere to a terminological system. Since the Stoics, readers of Aristotle have complained of his imprecise use of terminology, faulting him for applying words and concepts differently than he himself defines them, or reverting to their colloquial meaning without warning.[1]

These two problems are related, because Aristotle typically uses everyday words as terms without clearly indicating when they are philosophical terms and when they are not. Bonitz, who produced the first lexicon of Aristotle's terms in the nineteenth century, alluded to this practice when he noted that Aristotle 'novavit'[2] many philosophical terms by appropriating common words in Greek. At about the same time, Teichmüller commented in detail on the problem posed by Aristotle's use of terms in a section called "Die Terminologie ist bei Aristoteles nicht von stricter Observanz." Teichmüller concluded "dass man den Aristoteles zwar gar nicht verstehen kann, wenn man seine Terminologie nicht kennt, dass man ihn aber auch notwendig missverstehen muss, wenn man überall *termini* wittert."[3] Most scholarship since Teichmüller has taken a similar approach to Aristotle's terminological practice. While

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1 On the Stoics and later periods, see for example Tzamalikos 2016, 72–75 and 129–133.

2 Bonitz 1870, iii.

3 Teichmüller 1867, 7.

acknowledging that Aristotle is inconsistent in his use of terminology, the assumption is that an intelligent and informed reader can correctly determine from the context the meaning of a term, or whether a common word is being used as a philosophical term. Still, there are numerous critical instances where inconsistencies in Aristotle's usage cannot be adequately resolved from the context.

This pattern of terminological ambiguity is particularly remarkable since Aristotle himself goes to great lengths to precisely define his terminology. For example, he frequently uses the formula "πολλαχῶς λέγεται" (*pollakhōs legetai*) to introduce the disambiguation of several different senses of a term, and Book 5 (Delta) of the *Metaphysics* presents definitions of 30 crucial philosophical terms focused on differentiating the various meanings each term can have. Aristotle also sometimes warns of the grave risks of imprecisely defined terms, for example in *Topics* I 18.108a18–37, or shows he is keenly aware of terminological ambiguity, for example, in *On Sophistical Refutations* 4.166a14–21. And as the founder of formal logic, he emphasized the importance of terminological clarity, for example, in *Posterior Analytics* II 13.97b13–27. So in spite of being the first philosopher to stress the theoretical importance of consistent terminological practice, Aristotle still was quite loose with his terminology. This paradox is one of the most peculiar aspects of Aristotle's works.

But over the last 40 years, several scholars have also considered whether Aristotle's apparently inconsistent terminological practice may in fact adhere to a coherent theoretical principle itself. Edel argued that Aristotle's philosophical terminology can be sorted into conceptual networks, groups "of basic concepts associated in such a way that starting with any one . . . leads to others."[4] For Edel, Aristotle is neither a formalist aiming at (but sometimes falling short of) a strictly consistent terminology, nor an informalist who chooses to avoid the restrictions of philosophical terminology. Instead, Edel believes each term "reaches over to the others and only gradually becomes intelligible as its relations to the others . . . are revealed."[5] This explains why terms may be used inconsistently in Aristotle without revealing a flaw in his thought. The use of terms would naturally change not only depending on the context (i.e., in which 'conceptual network' they appear), but also over the course of a work as the relations between terms develop or the terms shift slightly in meaning. This approach was also applied by Ricœur, who argued that mimesis in Aristotle's *Poetics* relies on a 'conceptual network of action' that includes 'terms such as agent, goal, means, circumstance, help, hostility, cooperation, conflict, success, failure, etc.' in which 'all the members of the set are in a relation of intersignification'.[6] As with Edel's understanding of basic concepts in Aristotle, Ricœur is suggesting that the key term *praxis* in the

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4 Edel 1982, 41. See also Horowitz and Thayer 1987, in particular 189–216.

5 Edel 1982, 38.

6 See Ricœur 1984, 54–57.

Poetics and its related terms could be relational, flexible, and unfixed, but still conform to a consistent terminological method.

So studying terms as part of a conceptual network is essentially a more systematic and deliberate way of defining terms in their context. The conventional approach uses the local context of the passage or sentence where the term appears to deduce what it means in that instance. The conceptual network approach takes into account the use of terms in the same network in and around that passage or sentence to determine what the term means in that instance. The network approach is more precise and methodical, but its decisive advantage is that it can explain local shifts in terminology, or even predict them.

Applying this more systematic approach to context in the *Poetics* following Ricœur could be particularly useful, because of all of Aristotle's works, terminological problems are perhaps most prominent in this text. As the first surviving work of literary criticism, it relies heavily on terms that rarely or never reappear in Aristotle's other works or those of previous philosophers. For centuries, the *Poetics* has been criticized chiefly for its "lack of terminological clarity"[7] and resulting obscurity. Aristotle introduces key terms in his theory of poetry without explaining them or defining them, and often uses them in ways that are thought to be inconsistent in various parts of the text. As a result, scholars regularly comment that important terminology "shifts in meaning without warning" or "develops as he writes,"[8] for example, or that Aristotle's "loose terminology" makes the *Poetics* "notoriously difficult to understand."[9] These confusions and inconsistencies apply to a greater or lesser extent to practically all the important terms in the text.

But Aristotle's terminological practice in this particular text can be explained in another way. Halliwell has suggested that "the central ideas of the treatise had been at least partially elaborated elsewhere"[10] by Aristotle in lost works. As a result, Halliwell believes that in the *Poetics* Aristotle uses some "terms and concepts before he has explained or defined them" because they would be already familiar to his audience. Similarly, Bywater[11] speculated that some of the terminology used in the *Poetics* actually belongs to a specific technical vocabulary already established by other critics even before Aristotle. Perhaps substantiating this claim, at *Metaphysics* XIV 3.1090b19 Aristotle argues that nature is not like an "episodic tragedy," suggesting that "episode"

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7 Schmitt 2008, 46.

8 Janko 1984, 229.

9 Craik 1970, 95. See also Vahlen 1865, 70 for the more moderate complaint that "neben einer festen Terminologie einiges Abweichende herläuft."

10 Halliwell 1986, 35.

11 Bywater 1902 (see also Bywater 1909, xiv–xv). Without citing Bywater, Gudeman 1934, 19 (with note 17) also argued that many terms in the *Poetics* must come from a "Fachwortschatz literarischer Kritik," and Rees 1972, 1, assumes that *peripeteia* ("reversal"), *anagnōrisis* ("recognition") and *pathos* ("suffering") belonged to the "technical vocabulary of the contemporary theater."

or "episodic" were technical terms from the theater his audience was aware of.[12] Whether developed by Aristotle or by others in addition to Aristotle, the notion here is that key terms in the *Poetics* have special, technical meanings not always entirely derived from their colloquial meanings.

But there is an important methodological consequence of viewing some terms in the *Poetics* as previously defined technical terminology. If it is true that these terms have consistent definitions potentially quite distinct from their dictionary definitions but known to Aristotle's audience, then variously interpreting such terms by relying on the specific context could make less sense than in other cases. This is because the problem here is not necessarily Aristotle's varying uses of a term depending on the context. Instead, the problem may be that since the technical definition is lost, we do not see how the term is consistently applied. This technical definition could then only be recovered by first assuming that the term is used consistently in every instance, and then looking for a definition that matches all the various usages. In other words, *given there may be an entirely consistent definition that works for all the uses of a particular technical term, the only way to determine that definition is to extrapolate it from these uses themselves.*

Without explicitly formulating the methodology in this way, I previously took essentially the same approach to defining the ambiguous terms *megethos* (μέγεθος) and *mēkos* (μῆκος) in the *Poetics*, determining that the word μέγεθος only refers to relative size (meaning proportional size independent of absolute size measured in units), and μῆκος only to absolute size (meaning size quantified and measured in a concrete number of units).[13] Although both definitions still relate in some way to their respective colloquial meanings of 'magnitude' and 'length', obviously the technical meanings are extremely specialized and cryptic. The results also pointed towards a technical redefinition of the key term *muthos* (typically translated as 'plot') in the *Poetics.*[14]

So this approach requires deliberately disregarding the lexical definition, and then carefully analyzing the different applications of the term in question to deduce what its lost technical definition appears to be. It also requires keeping an open mind to surprising technical definitions that cannot be intuited from the lexical definition, and that may even be only tangentially related to it. This approach of course assumes that the lost technical definitions themselves were consistently applied by Aristotle. But that assumption seems more plausible if Aristotle borrowed this terminology from a technical vocabulary already accepted by contemporary critics.

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12 See Webster 1954, 307. On the definition of "episode" see Köhnken 1990.

13 Marsh 2015.

14 See now in further depth Marsh 2021.

One fundamental term in the *Poetics* that has never been considered as a potential technical term is *mimēsis*.[15] Especially because of its extensive previous use by Plato in his discussions of art, it seems obvious that in the *Poetics mimēsis* would be, as in Plato, a philosophical term that is part of the conceptual network of imitation including other terms such as *metaphora, logos, phusis, phonē, sēmainein*, and *onoma*.[16] But Aristotle's concept of *mimēsis* has little in common with Plato's. Plato defines *mimēsis* in several contexts explicitly in relation to literal imitation, while Aristotle never offers any explicit definition at all.[17] In addition, Plato's use of the term in general aligns with meanings that place it in the conceptual network of imitation. But the problems with understanding mimesis in relation to imitation in the *Poetics* are notoriously complex.[18]

To name just a few of these problems, at 1447a20 Aristotle mentions "*mimēsis* with the voice" together with the other prominent *mimēsis* forms listed such as tragedy, comedy, dithyramb, music, the visual arts, and dance. If this refers to vocal imitations (mimicry and so on) as most critics conclude, why would such an obscure "parlor-trick"[19] be included in this selection of major arts? Similarly at 1448b7–9, he says that we first learn by *mimēsis*, presumably referring to children imitating those around them. But then he completes the sentence by noting everyone likes mimetic objects, apparently referring to artistic works. Again within this one sentence *mimēsis* has shifted from meaning simple mimicry to sophisticated artistic activity. Then a few lines later at 1448b13–19, Aristotle seems to say that visual imitations (in painting, for example) give us pleasure because we learn something by recognizing things or people such as we have seen before. But later at 1461b28–32 Aristotle specifically criticizes arts that imitate "everything," for example when an aulos player mimics the flight of a discus with his body. Don't we also "learn" from recognizing the player's movements as a flying discus just as we do from recognizing a figure in a painting? Why is this sort of imitation then so undesirable? Lastly, Aristotle may explicitly contradict

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15 Woodruff 1992, 74 begins his investigation of the term by stating that "*mimesis* seems to be a technical term in the *Poetics*, and so ought to be used with reference to one focal meaning." But since he assumes the "focal meaning" must be derived from the dictionary definition of "imitation," his conclusions do not stray far from previous attempts to define the term. My point here is that a technical term's definition cannot be assumed to be derived from the dictionary definition. Similarly Söffing 1981, calls mimesis a *terminus technicus* at 46, n. 22. But he still relates *mimēsis* to its dictionary meaning, glossing it as the "Umsetzung von Realität," and therefore assumes its definition is quite broad and abstract.
16 For an innovative and detailed analysis of this conceptual network, see Derrida 1974, 30–46.
17 For a comparison of *mimēsis* in Plato and Aristotle, see Woodruff 1992, 74: "What Aristotle has to say on mimesis is almost entirely free of Platonic influence." He also reviews Plato's various definitions of *mimēsis* and summarizes the different meanings of *mimēsis* in Aristotle. On *mimēsis* in Plato see also Else 1958; Golden 1975; Belfiore 1984; Halliwell 2002, 37–71; and now Pfefferkorn and Spinelli 2021.
18 Besides my list here, see also Belfiore 2014, 63–64.
19 Lucas 1968, 57.

his own initial description of *mimēsis* when discussing epic. At 1448a21–22 Aristotle includes Homer's combination of narrative and direct speech as a category of art that is also a *mimēsis*. But then much later at 1460a7–11 Aristotle criticizes epic poets who unlike Homer "speak in person" throughout the poem, and only infrequently engage in *mimēsis*. The context seems to indicate Aristotle means Homer uses more direct speech than the other epic poets, and as a result that plain narration apparently now no longer qualifies as *mimēsis*, and the epic is no longer viewed in its entirety as a *mimēsis*.

The accepted explanation for these difficulties is that *mimēsis* is a remarkably malleable and multifaceted philosophical term straddling an enormous scope of meanings ranging from literal imitation to representation to expression.[20] Many of these varying uses of the term can be explained by studying the context, or analyzing local shifts in the conceptual network of imitation. But still we must accept that in some cases, Aristotle is either inconsistent or that we cannot know what he means. As a result, the definition of *mimēsis* defies any simple or static formulation. Some even praise Aristotle's "sagacious reticence,"[21] arguing that the term's profound philosophical subtlety justifies his refusal to define it. Yet the fact remains we do not really know what *mimēsis* means in this text and are just guessing at definitions that relate it to concepts of imitation, no matter how vaguely.

Here I would like to explore the opposite notion: that Aristotle's use of *mimēsis* seems confusing or inconsistent because it is actually a technical term with a precise meaning unknown to us, but familiar to him and his audience. Instead of assuming the term refers to a large family of philosophical concepts related to its lexical definition of imitation that must somehow apply in each of these very different contexts, I examine whether it may have a narrower, more precise definition. I show that in the single case where Aristotle appears to define *mimēsis* in relation to imitation or representation at 1448b9–19, this understanding of that crucial passage relies on a misinterpretation of a single Greek word, one almost entirely overlooked or dismissed by commentators until now. I then demonstrate that the passage may instead point to a consistent definition of *mimēsis* not necessarily derived from the one found in the dictionary. Finally, I apply that definition to the problems with the use of the term listed above. I conclude that mimesis may be a narrow technical term that refers to a particular artistic practice or procedure that only indirectly integrates the concept of imitation.

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20 See for example Janko 1987, xv: "The Greeks drew no distinction between imitation, copying, impersonation and representation – all these concepts were included in the word mimēsis." Hubbard 1972, 89 comments, "*mimesis*, the central concept of the *Poetics* . . . is never defined and the range of ideas Aristotle uses it to cover is a shifting one."
21 Halliwell 1995, 8.

2 *Mimēsis* and Scope

Aristotle launches his discussion of poetry at 1447a13–16 with a list of arts that he defines as kinds of *mimēsis*. But even with this first mention of the term, he narrows its scope. He first specifies that "most" but not all music for the aulos or lyre is *mimēsis*. He also adds that the arts listed are *mimēsis* "as a whole" (*to sunholon*, τὸ σύνολον). There are three possible interpretations of these limits. The first is that only some specimens of aulos or lyre music, for example, are *mimēsis* and some not. The second is that only some parts of these works of art are *mimēsis*, and some not. The third is that *mimēsis* is present in various degrees in different parts of a work, and perhaps entirely absent in some parts. As I will show, all three of these possibilities are confirmed by Aristotle's other statements indicating the scope of *mimēsis*.

Since the focus in the *Poetics* is on narrative works such as tragedy, comedy, and epic, which Aristotle appears to assume always require *mimēsis*, there is little further discussion of works of art that exclude *mimēsis* entirely besides some music for the aulos and lyre. But following this passage at 1447a27–8 he mentions that dance is also a kind of *mimēsis*. He explains this is because dance also can translate rhythms into movements that are a *mimēsis* of *ēthē kai pathē kai praxeis* (ἤθη καὶ πάθη καὶ πράξεις). Since Aristotle goes out of his way to list the objects of *mimēsis* for this particular art, it seems likely that the inclusion of such 'characters, emotions and actions' qualifies a dance as a *mimēsis*. A reasonable assumption then is that not all dances included such elements at all, and as a result some dances fall outside the scope of *mimēsis* entirely. The statement also suggests that it was not immediately obvious how dance could be a kind of *mimēsis*, or at least that Aristotle felt obligated to specify which category of dances he believed qualify as *mimēsis*.

In addition, in the *Politics* Aristotle indicates that musical *mimēsis* may be a special category of music in general. At VIII 5.1340a8 he states that many melodies and particularly those of a musician named Olympus make our souls "enthusiastic." He then goes on at 1340a12–14 to add: ἔτι δὲ ἀκροώμενοι τῶν μιμήσεων γίγνονται πάντες συμπαθεῖς ("besides everyone is emotionally affected when listening to *mimēseis*.") Since Aristotle writes "besides" (*eti de*, ἔτι δὲ), one logical interpretation of this passage is that a musical *mimēsis* is a particular type of musical composition that makes its listeners emotionally "sympathetic" (the literal translation of *sumpatheis* (συμπαθεῖς)). He first describes an effect of music in general, and then the effect of a particular group of works within it, the musical *mimēsis*. Many melodies such as those of Olympus can make our souls 'enthusiastic', but only musical *mimēsis* can make us 'sympathetic'. So by this reading of the passage a piece of music is not automatically a *mimēsis*, but music can be composed in such a way that it is a *mimēsis*. If this is correct, it would also explain why in the *Poetics* Aristotle immediately signals that not all music for the aulos or lyre can be called *mimēsis*. Regardless of the instrument or instruments used, it appears that some pieces of music can be examples of *mimēsis* and some not.

But it also seems that within a work that can be called a *mimēsis*, *mimēsis* may be more pronounced in some parts than in others. In the case of tragedy, there are several instances when Aristotle suggests that the poet engages in *mimēsis* to a greater degree when composing the *muthos* than in other parts of the play. At 1449b24 tragedy is described as a *mimēsis* of an action, a formula that is repeated many times throughout the rest of the text. The *muthos* is then defined at 1450a4 as the *mimēsis* of the action in the play. Among the parts of tragedy, Aristotle specifies that the *muthos* is primary, and the other parts such as character are secondary. For example, at 1450b2 he writes: ἔστιν τε μίμησις πράξεως καὶ διὰ ταύτην μάλιστα τῶν πραττόντων ("tragedy is a *mimēsis* of an action, and primarily because of the action *a mimēsis* of agents.") Aristotle also notes at 1450a23–5 that a tragedy can be written without character, but not without *muthos*. If tragedy is *a mimēsis* of character primarily because it is a *mimesis* of an action, it seems that character here depends on action.

One interpretation of this ranking is that *mimēsis* of character is secondary only because it is less necessary to a tragedy. It would still then be *mimēsis* in every sense, just not essential for the purposes of tragedy. But it could also indicate that since *mimēsis* of character is secondary, it requires less *mimēsis*. There is a primary *mimēsis*, *muthos*, which lays the foundation that supports a secondary *mimēsis*, character. This secondary *mimēsis* is weaker, and therefore unable to stand on its own. It may be missing a degree of mimesis that it must borrow from the *muthos*. As a result, it could be that the parts of the tragedy that establish character contain less *mimesis* than the parts that compose the action.

If true, this would parallel the *muthos*' relationship with the other events in a narrative work. Some scholars argue that not all events are included in the *muthos*, and the rest are what Aristotle describes as "episodes."[22] The *muthos* events must be linked by probability or necessity, but the "episode" events are only plausible or appropriate.[23] In this case the difference cannot be a matter of what is essential or not, because Aristotle never suggests the "episodes" are inessential or could be left out like character. But Aristotle does indicate that the "episode" events are supported by the *muthos* events, and rely on their stronger structure of causality. That is why at 1455b1–2 Aristotle instructs the poet to first lay out the *muthos*, and then "fill it out" with "episodes" that relate to it. In addition, he says at 1451b33–52a1 if the *muthos* events are not linked by probability or necessity, the result is a flawed "episodic" *muthos*. This shows the "episodes" can only serve their proper function when they appear in relation to a *muthos*, and, regardless of their content, cannot replace the *muthos*. So as with *muthos* and character, it appears that the *muthos* events lay the foundation for the 'episode' events. Here again there is a primary *mimēsis*, the *muthos*, with a secondary *mimēsis*, the "episodes," which cannot stand on its own.

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22 For summary of the evidence here, see Marsh 2015, 581–582.

23 See Belfiore 1992, 364–366.

That conclusion may be confirmed by another comment Aristotle makes about the events in a tragedy. Discussing the proper effect of tragedy, at 1453b11–4 he writes:

> ἐπεὶ δὲ τὴν ἀπὸ ἐλέου καὶ φόβου διὰ μιμήσεως δεῖ ἡδονὴν παρασκευάζειν τὸν ποιητήν, φανερὸν ὡς τοῦτο ἐν τοῖς πράγμασιν ἐμποιητέον.

> And since the poet should produce the pleasure of pity and fear through *mimēsis*, it is clear that it should be produced in the events.

Since just before at 1453b2 he states that fear and pity should be a result of the "structure of events" and this formula often appears in the *Poetics* as a gloss for the *muthos*, it can be assumed that in this sentence *tois pragmasin* (τοῖς πράγμασιν) refers to the events in the *muthos*, not the "episodes." So Aristotle here asserts that this effect of tragedy should be produced by *mimēsis*, and as a result 'it is clear' (*phaneron*, φανερὸν) by the *muthos*. It appears that *mimēsis* covers a number of parts of tragedy, but it is most obvious and 'clearest' in the *muthos*. *Mimēsis* is more pronounced in the *muthos* than in these other parts, and the other parts participate in *mimēsis* to a lesser degree.

Lastly, there are two passages showing that *mimēsis* may be entirely absent in some parts of a work. As mentioned in the introduction, at 1460a7–11 Aristotle gives this advice to epic poets:

> αὐτὸν γὰρ δεῖ τὸν ποιητὴν ἐλάχιστα λέγειν: οὐ γάρ ἐστι κατὰ ταῦτα μιμητής. οἱ μὲν οὖν ἄλλοι αὐτοὶ μὲν δι᾽ ὅλου ἀγωνίζονται, μιμοῦνται δὲ ὀλίγα καὶ ὀλιγάκις: ὁ δὲ ὀλίγα φροιμιασάμενος εὐθὺς εἰσάγει ἄνδρα ἢ γυναῖκα ἢ ἄλλο τι ἦθος . . ..

> The poet should speak as little as possible in person, since that is not what makes the poet a *mimētic* artist. Other poets perform in person throughout, making a *mimēsis* rarely and just in a few parts. But Homer after a short introduction immediately brings on a man or a woman or some other character . . ..

I will return below to what Aristotle might mean by the poet speaking "as themselves" or "in person" as the phrase could also be translated. But whatever it means he explicitly states that the poet is not acting as a "mimetic artist" in these parts of the poem where the poet performs "in person", and that other poets (besides Homer who Aristotle praises for avoiding this mistake) only are "mimetic artists" in small parts of the poem. So the passage not only establishes that it may be possible for some parts of the poem to lack *mimēsis* entirely, it even suggests that in some cases *mimēsis* may appear in only small sections of a long epic poem.

Then when discussing problems in poetry such as the pursuit of Hector in the *Iliad*, which Aristotle finds implausible, at 1460b31–2 he minimizes these kinds of errors by comparing them to a similar kind of mistake in painting: ἔλαττον γὰρ εἰ μὴ ᾔδει ὅτι ἔλαφος θήλεια κέρατα οὐκ ἔχει ἢ εἰ ἀμιμήτως ἔγραψεν. ("It is a smaller error if the artist did not know that a female deer has no antlers than if he painted it unmimetically.") The word *amimētōs* (ἀμιμήτως) here is typically understood to mean imi-

tate 'poorly' or unconvincingly, so that the sentence highlights the difference between slavishly copying reality and creating a successful work of art. According to this reading, Aristotle means that painting a female deer inaccurately – in other words failing to imitate in every detail the physical characteristics it has in life – is better than painting a poor artistic *mimēsis* of the deer that is less effective for other reasons. But then it would make more sense for Aristotle to use a phrase that means "apply *mimēsis* incorrectly" or inadequately, so that the contrast between narrow imitation as copying and much broader imitation as an artistic activity is clear. Instead, he uses a word whose literal translation is simply 'non-mimetically' or entirely without *mimēsis*. It seems at least possible then that *amimētōs* does not mean imitating poorly, it means the deer is not part of the *mimēsis*. In that case, the larger painting (which would then presumably include other subjects) could qualify as a *mimēsis*, but this one figure of the deer within it would not. Aristotle means that an inaccurately depicted female deer that is part of the *mimēsis* is still better than an accurate depiction that makes no contribution to the *mimēsis*. If true, the passage indicates that a deer appearing in a painting can be 'non-mimetic' in every sense, and as a result that certain parts of a painting may not contain any *mimēsis* at all.

3 *Mimēsis* for the Structure, *Mimēma* for the Part

If Aristotle limits the scope of *mimēsis* within the artistic work, it could also be that the definition of *mimēsis* itself has a narrower scope. The only instance where Aristotle comes close to defining what *mimēsis* is, or explicitly describing how *mimēsis* functions in a work of art is at 1448b7–19. This makes the use of the term *mimēsis* in this passage unique in the *Poetics*. I do not have space here to go through each and every use of *mimēsis* and its cognates in the text, but they all fall into three general categories.

In the first category, the term is used without any object. For example, as mentioned at the beginning of the last section, Aristotle launches his discussion of poetry at 1447a13–16 with a list of arts ranging from literature to music to dance that he defines as kinds of *mimēsis*. He also uses *mimēsis* as a synonym for the artistic work, for example when referring to epic as the *dihēgēmatikēn mimēsin* (διηγηματικὴν μίμησιν) or 'narrative *mimēsis*' (1459b33).

In the second category, *mimēsis* or the verb *mimeisthai* (μιμεῖσθαι, 'to imitate') is used in the sense of 'to make an artistic *mimēsis*' about certain objects, such as in the passage at 1447a28 also discussed above where Aristotle specifies that dance can make a *mimēsis* about 'characters, emotions and actions', or in the definition of comedy at 1449a32–3 where he says it is a *mimēsis* of inferior people. It is also used with an object, though much more rarely, to indicate literal imitation, such as at 1454b9 where it refers to copying a good painter's approach to character.

In the third category, Aristotle occasionally calls the artist a *mimētēs* (μιμητὴς) or 'mimetic artist', such as in the passage about Homer at 1460a7–11 cited at the end of the last section.

Since the term is used absolutely in both the first and third categories, these uses function basically like a label, and give no explicit indication of Aristotle's criteria for classifying an art or artwork as a *mimēsis*, or an artist as mimetic. The uses in the second category show that an artistic *mimēsis* has objects such as people or actions and that these objects can be real or made up. For example, Aristotle specifies that the *muthos* can take either real historical events or events that never happened as its object.[24] But Aristotle leaves unsaid what a *mimēsis must do* with these objects to produce a work of mimetic art, or what precisely makes the *muthos* events – whether real or invented – a *mimēsis* of an action.

So Aristotle's uses of the term and its cognates in all three categories appear to rely on an assumption that his audience is already familiar with its meaning when applied to works of art. Yet at the same time, although context may indicate how Aristotle intended the term to be variously understood in each of these passages, no single consistent definition emerges from them. As Woodruff concludes, in Aristotle "the texts do not determine a single account of *mimēsis*. We shall have to speculate."[25]

That is why the passage at 1448b7–19 is such an important exception. The passage stands apart in two ways: it is the only passage where literal imitation and artistic *mimēsis* are directly linked; and it is the only passage where the process of understanding an artistic *mimēsis* is explained. That means it is the only evidence we have of how Aristotle himself may have defined *mimēsis*.

Aristotle begins the passage by stating that people "learn their first lessons" through *mimēsis*, and that everyone enjoys "*mimetic* objects" (μιμήμασι). He further explains how this pleasure is produced, which it turns out is also linked to learning:

σημεῖον δὲ τούτου τὸ συμβαῖνον ἐπὶ τῶν ἔργων: ἃ γὰρ αὐτὰ λυπηρῶς ὁρῶμεν, τούτων τὰς εἰκόνας τὰς μάλιστα ἠκριβωμένας χαίρομεν θεωροῦντες, οἷον θηρίων τε μορφὰς τῶν ἀτιμοτάτων καὶ νεκρῶν. αἴτιον δὲ καὶ τούτου, ὅτι μανθάνειν οὐ μόνον τοῖς φιλοσόφοις ἥδιστον ἀλλὰ καὶ τοῖς ἄλλοις ὁμοίως, ἀλλ᾽ ἐπὶ βραχὺ κοινωνοῦσιν αὐτοῦ. διὰ γὰρ τοῦτο χαίρουσι τὰς εἰκόνας ὁρῶντες, ὅτι συμβαίνει θεωροῦντας μανθάνειν καὶ συλλογίζεσθαι τί ἕκαστον, οἷον ὅτι οὗτος ἐκεῖνος: ἐπεὶ ἐὰν μὴ τύχῃ προεωρακώς, οὐχ ᾗ μίμημα ποιήσει τὴν ἡδονὴν ἀλλὰ διὰ τὴν ἀπεργασίαν ἢ τὴν χροιὰν ἢ διὰ τοιαύτην τινὰ ἄλλην αἰτίαν.

The proof is what happens in practice: we enjoy viewing the most precise images of objects, which themselves are unpleasant to look at, for example, the shapes of the most unattractive animals or corpses. The reason is that learning is intensely pleasurable, not only for philosophers but likewise for others as well, although they derive less pleasure from it. That is why people

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24 On Aristotle's comments on the relationship between the events of history and the events in the poetic muthos, see in particular Butcher 1902, 163–165; Lucas 1968, 123–124; Gallavotti 1974, 144; Dupont-Roc and Lallot 1980, 222; Croix 1992; Nussbaum 2001, 386–387.
25 Woodruff 1992, 89.

enjoy seeing images. What happens is that they learn by looking at the images, working out what each thing is (for example 'this is a particular person'). If the viewer happens not to have seen it in advance, it will not give pleasure as a mimetic object, but because of the technique or color, or for some other reason.

Aristotle observes that *mimēmata* (μιμήματα) give us pleasure so reliably that we even enjoy seeing *eikonas* (εἰκόνας) or images of unpleasant objects. But not all images are in this category. At the end of the passage he concludes that depending on the context, we may not be able to enjoy an image *hēi mimēma* (ᾗ μίμημα) but only for other reasons unrelated to its function as a μίμημα. So the topic in this passage is images functioning in a particular way as μιμήματα that produce the specific pleasure appropriate to them.[26]

Aristotle then goes on to argue that such μιμήματα produce this pleasure through learning of a certain type. These images require the viewer to *sullogizesthai* (συλλογί-ζεσθαι, besides 'work out' translations include 'conclude' or 'infer') what each thing is, for example that a person depicted is 'so-and-so', a particular individual or perhaps kind of individual. But this at first seems to be a form of recognition, not learning or even inference. Initially at least then, it is unclear how recognition of this sort could produce any notable pleasure.[27]

Apparently aware of this, Aristotle lays out the conditions of such learning. He states that the viewer must *proheōrakōs* (προεωρακώς) the object, or else the image cannot give pleasure as a μίμημα. If this word προεωρακώς means 'to have seen the object previously' as it is usually translated and generally understood, then he must be describing an interpretive process that resembles the recognition of an imitation. He would then be saying that such recognition is only possible when the viewer is in some sense familiar with what is imitated, and this is where the learning and pleasure lies. For some interpreters, this leads to an understanding of *mimēsis* as a nuanced form of imitation relating 'the world within the work and the world of the artist or audience'.[28] This would then be in fact the only passage in all of Aristotle where the term *mimēsis* applied to artistic works is explicitly linked with imitation in the literal sense.

But the verb *prooraō* (προοράω) does not in any other instance during this period mean 'see before' in the sense of having seen something previously. Everywhere else and in the rest of Aristotle's works it means 'see what is before one' in the sense of see what is ahead, see in advance, or to foresee. This problem with the passage has

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26 For the debate on how or if this pleasure through learning may apply to the pleasures of poetry as well, see Lear 1988, 307–314, Ferrari 1999, 84–86, Heath 2012, 68–72; Destrée 2012, 98–103.

27 See Tsitsiridis 2005, 437–440 for a convenient overview of how scholars have interpreted this reference to learning, understanding and inference in the passage.

28 Halliwell 2002, 155.

been almost universally ignored.[29] That approach was inaugurated by Bonitz himself, who tries to explain the phrase *ean mē tukhē proeōrakōs* (ἐὰν μὴ τύχη προεωρακώς, "if the viewer happens not to have seen it in advance") by adding in parentheses "i.q. πρότερον ἑωρακώς" ("the same as having seen previously"). But I cannot see why this single usage should have such a different meaning, except because scholars believe the context requires it if *mimēsis* is about imitation.

Given this crucial ambiguity, it may be worthwhile to consider what the passage would mean otherwise. If this word προεωρακώς does not refer to any form of recognition or directly to the world outside the work of art, then what the passage might say about *mimēsis* and how it functions can have only an indirect relation to imitation. In that case, a parallel passage at *Rhetoric* II 23.1400b28–33 may help explain what Aristotle means when he writes the viewer can συλλογίζεσθαι what each thing is, and in the process 'foresee' an image:

> πάντων δὲ καὶ τῶν ἐλεγκτικῶν καὶ τῶν δεικτικῶν συλλογισμῶν θορυβεῖται μάλιστα τὰ τοιαῦτα ὅσα ἀρχόμενα προορῶσι μὴ τῷ ἐπιπολῆς εἶναι (ἅμα γὰρ καὶ αὐτοὶ ἐφ᾽ αὑτοῖς χαίρουσι προαισθανόμενοι), καὶ ὅσων τοσοῦτον ὑστερίζουσιν ὥσθ᾽ ἅμα εἰρημένων γνωρίζειν.

> Of all refutative and demonstrative syllogisms, the most celebrated are those where the listeners foresee the conclusion from the start, though not because they are superficial (since at the same time they congratulate themselves on figuring them out in advance); and also those where the hearers lag behind to some extant so that they understand them at the same time as they are said.

Here the listeners see in advance the conclusion of a rhetorical syllogism, or an argument with premises and a conclusion. As the listeners hear the first premise, the rest of the argument or simply the conclusion itself comes into view before they are spoken. It appears that the listeners infer what the next steps in the syllogism are, or in a sense compose the syllogism themselves before the orator lays it out. They 'congratulate themselves' because they not only can understand a syllogism just after it is delivered by the orator, they can even think 'syllogistically' like the orator in anticipating the argument. In other words, like the orator they can also συλλογίζεσθαι, and when they use that facility to accurately infer what will come next, it gives them pleasure. This could also be described as a form of learning, since the audience learns how to apply their 'syllogistical' thinking to the argument at hand.

If a similar mechanism applies in the *Poetics* passage, then the image only qualifies as a 'mimetic object' if the viewer has in some way foreseen it or expected it from other parts of the artistic work. As with the conclusion of a syllogism and its premises,

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29 The sole exceptions I am aware of are Martineau 1976, 452–453; Halliwell 2001, 90; Veloso 2018, 193–194. Martineau makes a tortured and unsuccessful attempt to gloss the word as a kind of intellectual intention, Halliwell without evidence simply denies the dictionary definition applies, and Veloso argues the word can mean "recognize" or "guess" by misreading Thucydides 7.44.2 where it more likely refers to seeing a figure just ahead.

foreseeing what image will come next here would mean inferring it from the other images in the painting. This would suggest that a visual *mimēsis* would be a structure of μιμήματα linked in such a way that they permit the viewer to syllogistically anticipate them from the others. Such 'mimetic objects' would always be single images in a larger *mimēsis* structure including other images that can be understand as part of a sequence, or that relate to each other according to a specific logic. So when viewers of a painting infer who someone is as Aristotle describes, it would mean that they see who they already expected to see or could have guessed they would see, not that they recognize who they see because they have in some sense seen that figure before.[30] The identification process described is only secondarily about who the particular person is. Primarily, it is about identifying the person's place in the syllogistic structure.[31]

To the objection that Aristotle may seem to speak in this passage of only one person that is 'syllogistically' recognized as a μίμημα, I would answer that the wording of the text in fact indicates precisely the opposite. Before citing the individual image of a person as a specific example (*hoion hoti houtos ekeinos*, οἶον ὅτι οὗτος ἐκεῖνος), Aristotle speaks in general of the viewer inferring *ti hekaston* (τί ἕκαστον), or 'what each thing' is. He would only speak of 'each thing' if the viewer sees a number of images considered as a group. This clearly demonstrates that for Aristotle the μίμημα here is part of a whole or a sequence. So although the object of 'syllogize' is singular and Aristotle's example that follows is of a single figure, the formulation 'each thing' strongly suggests that thinking syllogistically about a single thing means considering it as one among several others.[32]

By this reading each *mimēsis* part would produce the pleasure particular to *mimēsis* by how it relates to the other images in the *mimēsis* structure, and only indirectly by how it may function as an imitation that relates to the world outside the artwork. This explains why this pleasure would still be produced even if the thing itself is unpleasant to see, because the pleasure does not come from the thing itself alone. On the other hand if the viewer cannot understand those relationships adequately and so

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30 For a complete discussion of how the Greek text ὅτι οὗτος ἐκεῖνος could have this different force indicating something that is expected or previously known including extensive examples, see Sifakis 2001, 47–49.

31 By this interpretation, a passage at *Rhetoric* I 11.1371b4–10 that contains similar phrasing to 1448b9–19 basically restates what the passage in the *Poetics* suggests about *mimēsis* requiring an understanding of its parts for learning. But the *Rhetoric* passage does not focus on individual images or *mimēsis* parts. Instead, that passage indicates that even if all parts of the *mimēsis* are unpleasant, it can still produce this pleasure.

32 This reading of the passage might also rehabilitate the now rare but still plausible translation of ἐπὶ τῶν ἔργων at 1448b10 as "in the case of artistic works" (for example the translation by Schmitt 2008, 6 "unser Umgang mit Kunstwerken") instead of the more common 'in practice' as I have translated it above. Since my interpretation presupposes Aristotle is talking here about a μίμημα functioning together with a number of others in an artistic work, it would make more sense for him to introduce the explanation with a reference to entire artworks.

predict what will come next in the structure, then as Aristotle observes the image is not a *mimēsis* part, and only its execution or color could please the viewer. In addition, this pleasure comes from a form of learning just like Aristotle describes in the passage from the *Rhetoric*, because the viewer learns how to think syllogistically about this particular *mimēsis* structure.[33] So besides altering how Aristotle's concept of *mimēsis* should be understood, a corollary of this interpretation of the passage is that μίμημα would also be redefined in this context as a technical term meaning '*mimēsis* part'.

4 *Mimēsis* and Imitation

Even if *mimēsis* is a technical term for Aristotle, it would still also have its colloquial meaning of 'imitation' in other contexts. In the *Poetics*, as already mentioned at the beginning of the last section there are a number of occasions where Aristotle uses the word in this way, sometimes even immediately after using it to refer to an artistic work. For example, in the passage at 1454b8–10 cited above he writes:

> ἐπεὶ δὲ μίμησίς ἐστιν ἡ τραγῳδία βελτιόνων ἢ ἡμεῖς, δεῖ μιμεῖσθαι τοὺς ἀγαθοὺς εἰκονογράφους.

> Since tragedy is a *mimēsis* of people better than us, the poet should imitate good painters.

The first *mimēsis* refers to a complex artistic work, but the second clearly means simply to copy or emulate. He also at 1459a12 notes that the iambic poetic meter 'imitates' everyday speech, showing that this usage of the term can even apply to things that resemble other things. And as already mentioned in the introduction, at 1461b28–32 Aristotle refers to musicians who imitate what they are singing about with gestures or body movements.

These passages again demonstrate that there is no simple link between imitation and artistic *mimēsis*. One is a kind of reproduction and the other a complex cultural product. Since Aristotle himself offers no explanations, the conventional definition of *mimēsis* as a philosophical term covering both kinds of imitation must always remain speculative. But if it is true that *mimēsis* is in fact a technical term, there is one instance that may explicitly establish a precise relationship between imitation in this literal sense and *mimēsis* as an artistic work. Just before the passage describing the pleasure produced by μιμήματα discussed in the previous section, at 1448b4–9 Aristotle identifies the natural causes of poetry:

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33 If this interpretation is correct, then the "καὶ" in μανθάνειν καὶ συλλογίζεσθαι at 1448b16 in the *Poetics* passage should probably be understood as explanatory or epexegetical. The translation then would be, "they learn, namely work out what each thing is . . .."

ἐοίκασι δὲ γεννῆσαι μὲν ὅλως τὴν ποιητικὴν αἰτίαι δύο τινὲς καὶ αὖται φυσικαί. τό τε γὰρ μιμεῖσθαι σύμφυτον τοῖς ἀνθρώποις ἐκ παίδων ἐστὶ καὶ τούτῳ διαφέρουσι τῶν ἄλλων ζῴων ὅτι μιμητικώτατόν ἐστι καὶ τὰς μαθήσεις ποιεῖται διὰ μιμήσεως τὰς πρώτας, καὶ τὸ χαίρειν τοῖς μιμήμασι πάντας.

There seem to be two causes of poetry in general, both natural. Imitation comes naturally to people starting from childhood (people differ from the other animals in that they are the most mimetic, and they also learn their first lessons through imitation); and everyone naturally enjoys mimetic objects.

The first μιμεῖσθαι in the sentence must refer to imitation in the sense of copying or mimicking behavior, because activities such as writing poetry or composing music do not come naturally to people as children; these skills must be learned. Similarly, if people are the 'the most mimetic' (*mimētikōtaton*, μιμητικώτατόν) of animals, this means that animals are also capable of this kind of *mimēsis* to a lesser degree, and so the reference again must be to imitation and not artistic production. The last observation that children learn their first lessons through *mimēsis* could in principle also refer to artistic works. But since the first two uses of the term in the same clause apply only to literal imitation, it seems highly likely that Aristotle here again means that children learn from imitating their parents or others around them.[34]

Then Aristotle suddenly shifts his focus at the end of the sentence from imitation to μιμήματα, going on to use painting as an example as discussed in the last section. This is one of the problems listed in the introduction, that the transition between the discussion of *mimēsis* as imitation and the following explanation of the pleasures of artistic *mimēsis* is confusingly abrupt. The basic problem is that the passage moves from the first general category focused on imitation in the literal sense, to the other general category, imitation as artistic activity, without any explanation or comment concerning what they have in common. Aristotle apparently feels no need to clarify that the topic has shifted so radically in the space of a few words and within the same sentence. As a result, the passage can be read as proof that *mimēsis* is an abstract philosophical concept characterized by this extraordinarily wide scope.

But the transition could also be a shift from the general to the specific. As I have argued above, the rest of this passage may establish that μίμημα is a technical term meaning '*mimēsis* part'. If true, then the passage would first establish that imitation in general is natural, and then that *mimēsis* parts are always pleasing. Still, this would not explain how imitation in general is linked to these specific parts of an artistic work.

If there is any direct link at all, then somehow imitation itself must be divided into parts. This would be the only way that μιμήματα – since the word clearly refers to a collection of discrete things – could also be considered imitations. Viewed in this light, there is one speculative explanation that could adequately clarify the transition

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34 Here Halliwell 2002, 178–179 (see further references in note 5) would also include children's "make-believe or playacting."

from imitation to *mimēsis* parts. It may be that such parts are simply the specific re-sults of the general activity of imitation discussed in the first several lines of the pas-sage. This would mean that Aristotle is still talking about imitation in the literal sense, but now discussing individual imitative acts or products. The explanation of the tran-sition would be that he moves from talking about imitation in general to particular *mimēsis* parts because these *mimēsis* parts are discrete imitations.

For example, when he says that children learn 'from imitation', an individual imi-tation in this general category could be a child imitating a parent pouring a libation. This specific action of pouring a libation could also be performed by an actor on stage. If this same individual imitative action is arranged syllogistically in a drama together with other imitative action parts, then it would become a μίμημα in a *mimē-sis*. So the full definition of μιμήματα would be individual imitations in an artistic work functioning as parts of an artistic *mimēsis*. This would establish a clear connec-tion between imitation in the literal sense and artistic *mimēsis*.

If this is true, then Aristotle would be saying that there are two causes of poetry:[35] one is that producing imitations is natural, and the other is that when individual imi-tations are arranged syllogistically in artistic works, they are naturally enjoyable. The first is a general capacity for imitation, and the second the specific pleasure of syllo-gistically understanding imitations, or learning from them when they are syllogisti-cally arranged. This means that for the mimetic artist, the imitations all of us are capable of producing are the basic material of *mimēsis*. They are the parts used by the artist to build a syllogistic *mimēsis* structure. In the example from the visual arts that follows in the passage, Aristotle then explains exactly how an individual imitation (in this case an image of an unpleasant animal or corpse) can be used as a μίμημα in a painting. A corollary of this interpretation is that the skill required to arrange these imitations in a work of art so they can be syllogistically enjoyed is not a natural cause of poetry. Like syllogistic thinking itself, it must be learned.

5 What Does 'Syllogize' Mean?

Mimēsis understood in this way places as much emphasis on the structure of the imi-tative parts as on the imitations themselves. Given the structure's new importance, un-derstanding its specific requirements is central to determining how *mimēsis* functions in individual works of art. But Aristotle's use of συλλογίζεσθαι to describe the structure of

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35 It is unclear from the text whether the two natural causes are the capacity for imitation and plea-sure in mimetic objects, or if the first natural cause is imitation together with enjoyment of mimetic objects, and the second cause the natural instinct for rhythm and melody mentioned at 1448b20–1. I have chosen here the first interpretation because it seems to me otherwise the second reason is intro-duced too late, but see Vahlen 1865, 10–11; Montmollin 1951, 32–34; Else 1957, 127–130; Lucas 1968, 74.

mimēsis leaves open a number of possibilities. The word applies to range of procedures from strict logical deduction to casual inference. This key term must now be further investigated as well so that its meaning can be more narrowly defined in this context.

In reference to the arts, the meaning of συλλογίζεσθαι probably cannot be directly derived from its meaning in reference to speeches in the *Rhetoric*.[36] If an artistic *mimēsis* is an intelligible structure of individual imitation parts, inferring the connections between the parts cannot be limited to or even primarily about deductive thinking. Instead, syllogizing here must have a broader scope to accommodate the many ways that parts of an artwork can be followed or anticipated.

In the *Poetics*, Aristotle goes into great detail about how the events in the *muthos* should be arranged. Since the tragic *mimēsis* clearly includes the play's plot, the *muthos* is also part of the *mimēsis,* and its constituent events can be seen as *mimēsis* parts or μιμήματα. Their arrangement could then be taken as an example of a syllogistic mimetic structure. That means Aristotle's instructions for arranging the events could also serve as a guide to understanding how syllogizing functions in an artistic work.

Aristotle's most important and explicit rule for the relation among events is that they lead to each other by probability or necessity.[37] As Ricœur has described it, these links permit the events to be effectively 'grasped together'.[38] Following the events in the *muthos* requires moving "forward in the midst of contingencies and peripeteia under the guidance of an expectation that finds its fulfilment in the 'conclusion' of the story. This conclusion is not logically implied by some previous premises," Ricœur adds, but must be understandable and 'acceptable' given what came before.

By this model, syllogizing the parts of the *muthos mimēsis* requires applying the rules of probability and necessity familiar from real life to understanding how the events lead from one to another. The result is that we read "the ending in the beginning and the beginning in the ending," as Ricœur writes. Importantly for understanding what syllogize might mean in this context, Ricœur emphasizes that following the *muthos* has nothing to do with drawing a logical conclusion from a series of premises. Instead, it is a complex procedure that combines 'grasping events together' with expecting what events will come next. The mind ranges back and forth across the events as they unfold, drawing conclusions and making inferences about what has occurred as well as what will occur.

But not all the events in a narrative work are linked by probability or necessity as in the *muthos.* Aristotle appears to apply a very different set of rules to the events of the 'episodes'. These events are held to a lower standard of causality than those in

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36 For attempts to explain the process of recognition itself as a syllogism, see for example Sifakis 2001, 43–45; Redfield 1975, 74. Montmollin 1951, 35 believes the term does (here at least) refer to reasoning in the sense of drawing a true or false conclusion. Lear 1988, 309 confines the sense of the word to "realizing that one thing (an artistic representation) is an instance of another."

37 See for example 1451a12–13, 1451b35 or 1452a20.

38 Ricœur 1984, 66–67.

the *muthos*, but must still be plausible or appropriate.[39] It may at first seem that since these events are also linked by a looser kind of probability, they still can be syllogized by applying the procedure described above for the *muthos*. But Aristotle's example of a good 'episode' in epic shows that it is certainly not always the case.

At 1459a36, he specifically cites the Catalogue of Ships in Book 2 of the *Iliad* as an appropriate 'episode'. This list of fighters and the places they came from can be viewed as a sequence of events. Each entry in the list recounts the arrival of a group or establishes who leads it, in addition to where it is from. But remarkably, the Catalogue is one of the few passages in the epic where it would be hard to identify any kind of causal link between the events. Instead, the list is ordered according to a geographical pattern. The poet starts with a group from a specific location in Greece, then moves to another group whose origin is nearby, and so on. The links between these events are in fact determined almost exclusively by geographical proximity.[40] In this way, the structure of the Catalogue outlines a tour around ancient Greece moving from one region to another. This shows that unlike in the *muthos*, the structure of the 'episode' events may be completely independent of any kind of causality.

But the structure of the Catalogue still permits the reader or listener to follow the sequence of events and predict what would come next. Since the audience was likely familiar with the geography of the regions named in the Catalogue, they would immediately recognize that the poet's list is moving across the terrain of Greece in a systematic way. They would be able to learn what the pattern of movement was, and then apply their increasingly precise understanding of that pattern to predict what places or regions would come next. This process of understanding and prediction would have probably been supplemented by a knowledge of who the groups are, what role they play in the epic, and how their place in the list might additionally reflect the poet's intention to either bring them together or contrast them for the audience.

This example of a good 'episode' widens the meaning of syllogizing considerably. A syllogistic structure must always be intelligible and adequately predictable, but the Catalogue of Ships shows that the connection between *mimēsis* parts can be determined by a rule, pattern or design. This puts these structures in an entirely different category than those built with causal links like in the *muthos*. In the *muthos*, not only are the events individual imitations of reality, the links between those imitations should ideally imitate what is considered probable or necessary in life. In the case of the 'episodes' by contrast, it appears that the links could potentially have no relation to real life at all. Although the order of the Catalogue of Ships relies on the real geography of ancient Greece, I would argue that in principle the list could have been organized by a different rule or pattern without reference to reality, and still remain a *mimēsis*.

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39 For the distinction between the muthos and the 'episodes', see Belfiore 1992, 364–366; Marsh 2015.
40 Stanley 1993, 13–26 sees in addition to the geographical organization a complex thematic organization.

For example, the Catalogue could have been organized on the principle of impor-
tance, starting with the group that plays the most significant role in the epic and pro-
gressing to the most minor group. The audience could still learn from the Catalogue
how and by what criteria the poet ranks each group in importance by following the
pattern, but since they were probably already familiar with the story they would also
be able to guess which groups would come later in the list as it went on. This would
be syllogizing in the sense that I understand it, since it requires 'grasping together'
the parts of the list in order to understand or expect the others. But the connection
between the *mimēsis* parts here would not rely in any way on a link to the real world,
only referring internally to how the groups feature in the rest of the text. Syllogizing
mimēsis parts here means understanding, following, and predicting any pattern, de-
sign, or rule no matter how abstract or independent of the real world. As a result,
mimēsis itself as a structure need have no imitative relation to the real world.

Since Aristotle does not discuss visual arts in detail, I can only speculate on how
this definition of *mimēsis* and syllogizing would apply to the example of a μίμημα
image at 1448b7–19. But if a visual *mimēsis* requires a structure of several images,
then paintings of a single object or person, such as a portrait or still life, would be
excluded. This may at first seem unlikely, but when naming specific artists Aristotle
often refers to the famous painter Polygnotus (at 1448a5 and 1450a27), whose best-
known works are large frescoes of mythical or historical subjects. It could be that
Aristotle is only thinking of such works depicting larger scenes including many fig-
ures in action or interacting when he refers to *mimēsis* in painting. As Lucas com-
ments, "the figure recognized must in most cases have been a mythological one,"[41] in
other words, a mythological (or historical) character in a scene or scenes including
other figures.

In these kinds of paintings, the viewer could potentially follow how the figures
relate to each other and then 'foresee' what will come next. To take a very simple ex-
ample, in Pausanias' description of Polygnotus' painting of the sack of Troy,[42] the first
group in the painting is Menelaus on his boat and the next group Helen surrounded
by others. If Menelaus is preparing his boat to leave, and Helen, who the war was
fought for, is not on it, the viewer could very likely infer that the next group near the
boat will include Helen. These links between images on a much larger and complex
scale across the painting would define the *mimēsis*. Recognizing individual things and
people in the painting would still be part of understanding it as a *mimēsis*, but that
recognition would only be part of what makes the painting a *mimēsis* and does not
alone make it a *mimēsis*.

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41 Lucas 1968, 73.

42 Pausanias 10.25.2–5.

6 A Technical Definition of *Mimēsis*

It is now possible to integrate these observations and analyses into a provisional definition of *mimēsis* based on this new interpretation of 1448b9–19. This definition is a radical departure from previous interpretations of *mimēsis* in the *Poetics* because it relegates the concept of imitation itself exclusively to the μιμήματα or *mimēsis* parts. In addition, this very specific and narrow definition I set out would be unique to the *Poetics*, and in principle unrelated to other uses of the term *mimēsis* such as in Plato. Finally, this definition does not consider *mimēsis* as a philosophical term in the conceptual network of imitation as most previous approaches have. Instead, here *mimēsis* is considered a technical term with a narrow, precise definition tailored to its application in the *Poetics*.

As a result, in the demonstration of this definition that follows I will not attempt at every step of the argument to analyze how my approach to *mimēsis* here engages with previous ones that are much broader, or link it with other concepts of *mimēsis* outside the *Poetics*.[43] Since the concept of *mimēsis* in Aristotle has attracted so much comment in the past, and the definition proposed here is so fundamentally different in almost every respect from previously developed notions of *mimēsis* in Aristotle, such a comparison would require far more space than is available to do it any kind of justice. In addition, the definition I set out and these other definitions are so far apart that there is some question if comparing the two approaches would be intellectually productive or illuminating for either one.

The definition of *mimēsis* proposed here has three elements:

1. A *mimēsis* is a syllogistic arrangement of individual imitations termed μιμήματα.
2. If this syllogistic arrangement of imitations can be adequately followed and predicted, it produces the pleasure of understanding and learning.
3. An individual imitation alone cannot be a *mimēsis*, and is not termed a μίμημα.

If *mimēsis* is a syllogistic arrangement of imitations as described here, this explains why *mimēsis* is limited in scope as I showed in Section 2. By the definition outlined above, *mimēsis* is a specific operation performed by the artist in arranging the individual imitations in an artwork. Although a particular artwork might be primarily a *mimēsis*, this operation could still be missing in some parts of the work. Those parts may not include individual imitations, for example, or individual imitations that are not syllogistically related to the others may appear in the work. For these reasons, *mimēsis* is not necessarily everywhere in the work.

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43 For previous definitions aside from the probably still standard part 2 of Halliwell 2002, see Woodruff 1992 who proposes a precise definition of *mimēsis* related to its dictionary definition that solves some (but not all) of the problems dealt with here. For a brilliantly original definition of *mimēsis* as a threefold structure of narrative reconfiguration see again Ricœur 1984.

Similarly, according to this definition some artworks or art forms would be excluded from the category of *mimēsis* entirely. In certain cases the *mimēsis* operation is impossible, for example, if the artwork contains only one imitation such as a portrait, since there can be no syllogistic arrangement. In others it is optional, for example, as Aristotle indicates is the case of dance, where apparently the dance moves do not necessarily have to be individual imitations.

The limited scope of the definition might also explain an intriguing comment in the pseudo-Aristotelian *Problems* XIX 15, 918b18–20 that dithyrambs 'became' mimetic at a certain time in their development. It could even be that *mimēsis* was not always a feature of certain art forms, and was only introduced when they reached a level of sophistication that could accommodate a syllogistic structure of imitations. This would suggest that *mimēsis* as a creative method was chosen and deliberately applied by the artist.

In addition, this definition would explain why *mimēsis* can be present in greater or lesser degrees within the artwork. It seems reasonable to assume that within the *mimēsis* structure, the quality of the syllogistic connections between the individual imitations may vary. I have already discussed how in tragedy, *muthos* events that are probable or necessary appear to lay the foundation for the 'episodes' that are only plausible or appropriate, and that as a result these *muthos* events may require more *mimēsis*. If it is accepted that events can be viewed as individual imitations (for example the action of pouring a libation discussed above), then it could be that the *muthos* events are 'more mimetic' since their tight causal connections make them easier to infer or logically predict, while the 'episodes' are less so because it is harder to determine how these events are connected with each other or the *muthos* events.

This definition also distinguishes works of *mimēsis* from other works that may produce pleasure through syllogistic understanding and learning. As discussed above, Aristotle in the *Rhetoric* says that some syllogisms in forensic speeches can produce a pleasure similar to *mimēsis* by prompting the listeners to use their syllogistic ability. But the difference in a speech is that the components of the syllogism are not individual imitations, they are premises formulated as propositions or statements. As a result, a forensic syllogism cannot qualify as a *mimēsis*. Only syllogistic arrangements of imitations are in the category of *mimēsis*.

Conversely, the definition discriminates *mimēsis* from non-artistic works that may include a number of related imitations. An anatomy textbook such as Aristotle's lost *Dissections,* for example, might contain diagrams that could be considered imitations, since they represent forms or shapes. The diagrams may even be in a sequence where one leads logically to the next, so that the reader of the textbook could syllogistically follow or predict these individual imitations just as in a *mimēsis*. But the textbook would still not qualify as a *mimēsis*. That is because the reader cannot understand the relationship between the imitations, or only very little, without the explanations in the text that refers to them. In the passage where Aristotle discusses how a μίμημα functions, he appears to assume that predicting what will come next or understanding what

each thing is in the syllogistic structure are operations that the viewer must perform independent of any explanation. This may be confirmed by his comment at 1456b2–8 that the events in a play should produce their proper effect without additional explanation (*didaskalia*, διδασκαλία). Similarly, in the Catalogue of Ships cited by Aristotle as an example of an 'episode' in a narrative *mimēsis*, Homer never alludes to the fact that the sequence of groups named follows a geographical pattern, or even mentions in passing that one location is near the next. So it seems that if the recipient learns or understands by relying on the explanations in a text and not by seeing the relationships between the imitations alone, this would not produce the particular pleasure of *mimēsis*, and cannot be considered a *mimēsis*. As a result, discursive or theoretical works such as an anatomy textbook are excluded from *mimēsis*.

In developing this definition, I have already discussed most of the problems with the term *mimēsis* in the *Poetics* listed in the introduction. But three problems remain to be explained. The first is why *mimēsis* 'with the voice' is listed among the major arts. The second is why towards the end of the text when discussing Homer, *mimēsis* seems to suddenly only apply to direct speech and not narration. The third is why Aristotle criticizes arts that 'imitate everything'.

By the technical definition of *mimēsis*, voice *mimēsis* must mean a syllogistic structure of individual vocal imitations. There were several major categories of performers in this period who worked primarily with the voice. These were actors and rhapsodes, together with orators by extension, since they sometimes 'acted' in reciting their speeches. As Else has argued, it could be then that Aristotle means that these performers would use their voice in performance to imitate a manner of speaking, for example "the organ notes of patriotism" or "the whining tones of an opponent."[44] That would at least plausibly explain why vocal imitation is included in this list, since actors and rhapsodes were intimately connected with major arts such as epic, tragedy, and comedy.

But by this description vocal imitation would still not meet the requirements of the definition of *mimēsis* proposed here. That is because there is still no indication of a larger structure of relationships among the individual vocal imitations. This raises the possibility that by *mimēsis* with the voice Aristotle means a performance seen as a whole. Especially in this period when the actors wore masks, the voice was the central element of a dramatic performance. Appearing as a character on stage, an actor must choose how to say each line and even each word. Ideally, these choices come together in such a way that how the character speaks can be understood as a whole and predicted. That means they function just like μιμήματα in a *mimēsis*.

In addition, these choices of how to use the voice (which would probably be called 'line readings' in modern terms) can be viewed as individual imitations. Speaking a particular line in an angry tone or a pleading tone, for example, are both ways

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44 Else 1957, 20.

an actor could produce individual imitations of how people speak. Such imitations are similar to imitating manners of speech as described by Else, but different because their application is much broader. Instead of using a particular tone for a single patriotic passage or a line quoted from the opponent's speech, here the individual imitations are present in every sentence and even every word that is spoken.

The actor's art then would be building a coherent, syllogistic structure using these vocal imitations for all the character's lines in the play. The same procedure would apply to the rhapsode's art, only at a much larger scale across the many characters and events in an epic. Such an organization of imitations would fully qualify as a *mimēsis* by this technical definition. It would also explain why *mimēsis* with the voice appears alongside the other arts, since acting as a craft is a major art in itself.

Turning to the passage in the *Poetics* at 1460a7–11 where *mimēsis* seems to suddenly exclude narration, this is how Aristotle describes the parts of an epic poem that lack *mimēsis*:

> αὐτὸν γὰρ δεῖ τὸν ποιητὴν ἐλάχιστα λέγειν: οὐ γάρ ἐστι κατὰ ταῦτα μιμητής. οἱ μὲν οὖν ἄλλοι αὐτοὶ μὲν δι᾽ ὅλου ἀγωνίζονται, μιμοῦνται δὲ ὀλίγα καὶ ὀλιγάκις: ὁ δὲ ὀλίγα φροιμιασάμενος εὐθὺς εἰσάγει ἄνδρα ἢ γυναῖκα ἢ ἄλλο τι ἦθος . . ..

> The poet should speak as little as possible in person, since that is not what makes the poet a mimetic artist. Other poets perform in person throughout, making a *mimēsis* rarely and just in a few parts. But Homer after a short introduction immediately brings on a man or a woman or some other character . . ..

The passage clearly indicates that the parts of the poem that lack *mimēsis* are those where the poet appears to intervene 'in person'. But it is less clear what Aristotle may mean by the poet speaking or performing 'in person' in this context. If Aristotle means simple narration as opposed to direct speech, the problem is that the surviving epics of Homer are filled with passages lacking direct speech. If he means exclusively passages where the poet uses the first person such as a proem or invocation of the muses, it seems highly unlikely that other poets besides Homer would have devoted large portions of their poems to these elements.

But another solution has already been proposed that fits perfectly with the technical definition of *mimēsis*. By speaking 'in person', Aristotle is drawing a distinction between "'telling' (a narrator is visible and sums up or interprets for the readers what is happening) versus 'showing' (the story seems to tell itself without intervention of a narrator, the reader having to draw his own conclusions)"[45] as de Jong writes. By this interpretation *mimēsis* is incompatible primarily with the 'visibility' of the author's person in the poem, and only secondarily with the author interpreting the story for the reader.

45 de Jong 2005, 620–621. See also Halliwell 2002, 167–171, who views the problem as an explainable "discrepancy" and Woodruff 1992, 79–80, suggesting the later passage may be Aristotle's "playful" nod to Plato.

But by the technical definition of *mimēsis*, the only problem with the 'telling' passages would be that, as in the case of the anatomy textbook discussed above, the author is explaining the link between the imitations instead of allowing readers to understand and predict these connections on their own. So it could be that other epic poets besides Homer 'show' events or characters in such a way that there was often no way for the readers to follow them without relying on the author's explanations. This means that even in some passages where the author is not more visible than in others, an epic poet could still write lines that are excluded from the *mimēsis* just because they provide explanations necessary to understand the story. Conversely, there could be passages where the author is clearly visible that are still part of the *mimēsis* because they do not provide such explanations. An example of the latter would be a passage from the *Iliad* at 23.176 cited by Lucas: *kaka de phresi mēdeto erga* (κακὰ δὲ φρεσὶ μήδετο ἔργα, "and he was planning evil deeds in his mind").[46] Homer may be visible in this personal judgement of Achilles' thoughts and in that sense 'telling' the reader what to think, but it is hard to believe that any reader of this passage about Achilles sacrificing human prisoners like dogs would not already have concluded those thoughts are in some sense evil. So for passages like these, author visibility would not exclude them from the *mimēsis*.

This analysis may also be substantiated by the final passage at 1461b28–32 where Aristotle criticizes the arts that 'imitate everything':

> ὡς γὰρ οὐκ αἰσθανομένων ἂν μὴ αὐτὸς προσθῇ, πολλὴν κίνησιν κινοῦνται, οἷον οἱ φαῦλοι αὐληταὶ κυλιόμενοι ἂν δίσκον δέῃ μιμεῖσθαι, καὶ ἕλκοντες τὸν κορυφαῖον ἂν Σκύλλαν αὐλῶσιν.

> Assuming the audience will not understand unless they add something in person, they make a lot of movements. For example, bad flute-players go into a spin if they need to imitate a discus, or pull at the leader of the chorus when playing the Scylla.

Just as parts of a poem in which the epic poet 'performs in person' may be excluded from the *mimēsis*, in this passage the performer intervenes 'in person'. But here it is not what the performer says; it is what the performer does that compromises the quality of the *mimēsis*. In addition, Aristotle specifies that these actions are themselves imitative movements. Why are these imitations undesirable in a *mimēsis*, but others not?[47]

It seems that Aristotle believes these imitations are unnecessary additions. The examples given show that they are typically movements made by performers to accentuate a poetic *mimēsis*, which can already be adequately understood and predicted on its own. The audience would be capable of 'grasping' the *mimēsis* without the performer's

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46 Lucas 1968, 67.

47 Commentators have found this statement so confusing Bywater and Gudeman have proposed amending the text so that it means the art "imitating for everyone," or in other words for a vulgar audience; for references and discussion see Lucas 1968, 251–252; Else 1957, 635–636.

'in person' actions, so the actions added are similar to explanations in a poetic *mimēsis*. But unlike those explanations, these movements are imitations themselves, and are understood together with the imitations in the *mimēsis*. As a result, they cannot be excluded from the *mimēsis* that is the total performance. Instead, they only reduce the quality of the *mimēsis* in performance, in this case a poem, because they make it too explicit. This shows that for Aristotle, subtlety in the syllogistic links between the *mimēsis* parts is a hallmark of a qualitatively superior *mimēsis*.

That would also explain what exactly Aristotle means by an art that 'imitates everything'. The imitations he is talking about are not those of the *mimēsis* considered separately from its performance. The undesirable imitations are instead parasitic to the imitations in that *mimēsis*. For example, here the poetic *mimēsis* includes a passage describing the flight of a discus, and the performer imitates the description of the discus with his movements. In the case of tragedy, the same could apply to some of the actor's movements or use of his voice on the stage to perform the text. So the problem with these additional imitations is that they are themselves imitations of imitations, and by 'everything' Aristotle apparently means everything in the *mimēsis* before it is performed. However, he does not appear to disapprove of such imitations entirely, since he accepts that tragedy for example should be performed by actors. But he also clearly believes these additions must be carefully moderated to preserve the quality of the syllogistic structure of imitations in the *mimēsis* they are based on.

7 Conclusion

That emphasis on the quality of the *mimēsis* structure is typical. Throughout this exploration of a narrower definition of the term, Aristotle appears almost entirely focused on the arrangement of the *mimēsis* parts and how they relate to each other. This stands in stark contrast to previous philosophical concepts of *mimēsis*. Extrapolations from the dictionary definition of *mimēsis* inevitably bring the focus back to the relationship between an imitation and an object of imitation, or in broader terms between art and life. This is still an important part of Aristotle's thought, just as it was in Plato's. But by the technical definition of *mimēsis* I have outlined here, these philosophical concerns about imitation or representation for Aristotle would be located primarily at the level of the μίμημα, or the *mimēsis* part. That means that by this technical definition the term *mimēsis* does not necessarily refer to any form of imitation or representation, at least in the *Poetics*. It would refer only to a specific artistic practice founded on a flexible logic of imitations – imitations, which themselves have a particular relationship to the real world.

At the same time, this technical definition of *mimēsis* now emphasizes other philosophical concerns. Since the structure is so important, how the structure is arranged or understood in a mimetic work becomes central to Aristotle's analysis of the arts.

Instead of *mimēsis*, the key philosophical terms become συλλογίζεσθαι ('infer' or 'work out') and προεωρακώς ('having seen in advance'). These conceptual terms describe how we grasp, follow, or predict a story, for example, in a tragic *mimēsis*. There is nothing narrow or specialized about these definitions, so they cannot be considered technical terms. Their conceptual use also extends significantly beyond their colloquial definitions, just as would be expected with philosophical terms.

Although these are certainly surprising results, they may be slightly easier to accept in the case of *mimēsis* because Aristotle never defines the term in any of his writings and practically never uses *mimēsis* in reference to artistic works outside of the *Poetics*. In principle, we simply do not know what *mimēsis* means in these contexts, and so are forced to speculate. But the case of *mimēsis* could suggest that other key terms in the *Poetics* that Aristotle clearly defines as philosophical terms in other works may also have unexpected technical meanings in this text. If a presumably philosophical term such as *mimēsis* could in fact have a technical meaning, it is at least worth considering whether other terms in the *Poetics* that are explicitly philosophical elsewhere may also have consistently narrower, more specialized meanings here.

For example, *ēthos* is of course a key term in the *Ethics*. But it also appears in the *Poetics* in a range of contexts. The use of the term in the text falls into two categories. In the first category, the term is used to refer to one of the six qualitative parts of tragedy as laid out at 1450a8–10, indicating character portrayal in a drama. This meaning has an ethical force that would link it with its use in the *Ethics*. In the second category, the term is used to refer to character in the sense of a general type of person, for example at 1460a10–11 discussed above, where Aristotle praises Homer for quickly bringing on "a man or a woman, or some other *ēthos*." In this phrase, *ēthos* appears to refer to character type (a man or a woman), not character portrayal.

But then there are some passages where it cannot be determined which meaning is intended, for example at 1450a21–2 where Aristotle says that characters are included in the tragedy for the sake of the action. It is unclear whether he means that every tragedy requires agents to perform the action, and these agents may also be portrayed as having some character, or if he means that since there are agents, they must be of a certain type, i.e., male, female, young, old, rich, poor and so on, as required by the action. This shows that even when Aristotle appears to clearly define the meaning of a key term, there are still often uncertainties in the *Poetics* on which meaning is intended or how.

As with *mimēsis*, the conventional approach to these ambiguities would be to rely on context to determine which meaning of *ēthos* Aristotle is thinking of in each instance. Since *ēthos* is part of the conceptual network of character, its meaning can also be expected to shift predictably somewhat depending on how the other terms in the network are used. Many scholars also take into account his uses of the term out-

side the *Poetics* for additional context to clarify its meaning.[48] But just as with *mimē-sis*, there may be instead a single, consistent technical meaning that would fit all of the uses of the term *ēthos* in this text. It could be that neither of the conventional definitions (character type or characterization) is correct. Like *mimēsis*, *ēthos* could have another hidden meaning entirely specific to this text that remains the same across all its uses. That would also mean that all other uses of ethos and its related terms outside of the *Poetics* are no longer relevant to its definition here. That is because as a technical term in this text, it would no longer be part of the conceptual network of character.

It would also make good sense to explore this approach to *ēthos* if *mimēsis* has a technical definition. Since ethos in the *Poetics* is certainly part of the *mimēsis*, the definition of *ēthos* would also be affected if the technical definition of *mimēsis* is accepted. For example, as a *mimēsis* itself, ethos would have to be a structure of individual imitative parts.

But my intention here is not to develop or argue for a technical definition of *ēthos*. My point is that the example of *ēthos* shows how the very existence of a technical term may imply that other terms within the same Aristotelian text, no matter how familiar they may be elsewhere as philosophical terms, could also have surprising technical definitions specific to that text. Since Aristotle was so fond of terminology and coining terms, there is practically no Aristotelian text that does not include some words that are already accepted to be technical terms. But if there is even one technical term in a text, as with *ēthos* that could indicate that other related terms may also be technical terms. In fact, it seems we can know for certain which terms are philosophical in an Aristotelian text only after the technical terms have been identified. That means that across all of Aristotle's works, unrecognized technical terms could be far more prevalent than is typically thought. As in the *Poetics*, other philosophical terms that seem inconsistent, contradictory, or ambiguous could in fact have narrower, consistent technical definitions quite distinct from their colloquial meanings. If true, then only by first studying Aristotle's particular terminological practice can we ever fully come to terms with Aristotle's philosophy as a whole.

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48 For such attempts to define the term see Belfiore 2014, 92–99; Blundell 1992; Schütrumpf 1970.

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Form, Terminology, and Clarity in Aristotle

Abstract: Aristotle's terminology presents a paradox: on the one hand, he creates large nomenclatures which settle the terms of the respective fields of knowledge for the first time, and he always makes sure to (re)define the terms he is about to use. On the other hand, it is not the least because of this constant redefinition that many of Aristotle's terms, amongst them his most famous and successful ones, appear strangely non-standardized, underdetermined, and often hardly terminological. While the non-standardized form of Aristotle's writings is often ascribed to the circumstances of their transmission, one should assume that the terminology remains unaffected by whether Aristotle has copy-edited the text or not. This chapter analyzes Aristotle's terminology precisely as a part of the literary form. The first main part is concerned with Aristotle's explicit reflections on the form of terms, and it inquires after their relevance for Aristotle's own writings. Since Aristotle has not written specifically on terminology, I examine the remarks which he makes on *onomata* ('words', 'terms') as part of his theory of 'stylistic form' (*lexis*) in the *Poetics* and *Rhetoric* and as part of his theory of definition in the *Organon*. I argue that the whole discourse on *onomata* posits clarity as a central aim of stylistic form and that this discourse, because of its cognitive-communicative perspective, may pertain to scientific and philosophical writings in addition to poetry and rhetoric and, thus, also to Aristotle's own works, although it does not do so explicitly. At the same time, the passages on the form of *onomata* reveal that Aristotle does not really follow his own recommendations regarding the form and use of terms. In the second main part of the chapter, I use the example of the term *aitia* and its classifications in different writings to show more systematically what characterizes the form of Aristotle's terms and how it deviates from Aristotle's theoretical reflections. I argue that Aristotle, although he uses largely ordinary terms, as he himself recommends for the sake of clarity, often uses them in a non-ordinary and, contrary to his own advice, homonymous and synonymous way. The function of the form of Aristotle's terminology seems to be, rather than clarity, a kind of flexibility and reusability which allows for ever-new differentiation, adjustment, and hierarchization in different contexts. Besides, there seems to be an unexpected aesthetic dimension to the constant reuse of simple and ordinary words, which is only *prima facie* non-rhetorical.

1 Problems with Aristotle's Terms

Aristotle's terminology presents us with a well-known paradox: While terms and their definitions play an important role both in Aristotle's scientific practice and in his theory of science, his work continues to raise questions about the number, form, meaning, and application of his technical terms.

On the one hand, Aristotle is preoccupied with terms all the time. This is partly because he must be, since he is often faced with a lack of existing technical terminology.[1] In works such as the *Historia animalium*, he creates large nomenclatures which settle the terms of art of the respective fields of knowledge for the first time;[2] and even in his less descriptive works, he introduces a great number of terms of art, many of which are still current today. But his somehow obsessive occupation with terms does not only have to do with the lack of technical terms in the earlier scientific literature. Rather, terms are at the core of his thinking; accordingly, technical terms also quantitatively account for much of his extant works. Typically, Aristotle develops an argument or explores a field by differentiating terms: he explains a term by relating it to other terms, that is, by distinguishing its subcategories or by opposing it to another term. As a result, large parts of his texts mostly consist of taxonomic constructions, that is, hierarchical classifications of concepts or terms, and display a high frequency of terms. Aristotle's focus on terms is matched by his theory of science in which he extensively reflects upon the necessity and method of defining terms; and his work even contains a lexicon which disambiguates 30 of Aristotle's most central terms (*Metaphysics* Δ (book V)).

On the other hand, despite the importance of terms in his philosophy, Aristotle appears to use many of them – amongst them his most famous and successful ones – in a strangely underdetermined, non-standardized, and sometimes even inconsistent way, both regarding their form and their meaning.[3] Although the theory of definition, as it emerges from Aristotle's *Organon*, aims at disambiguating terms, it is designed specifically for the methods of proof or dialectic argument; it is mainly about a consistent *definition* of a term in the sense of 'concept', not about unambiguously using technical terms themselves as part of the scientific language in a non-apodeictic and non-dialectic context. Thus, it should seem unsurprising that Aristotle's use of terms does not live up to his own supposed standards. Rather than defining his terms mathematically, he makes ever-new differentiations of his terms, which often overlap only partly and sometimes even seem to contradict each other. While Aristotle often differentiates the meanings of terms that are 'said in many ways' (πολλαχῶς λέγεται/*pollakhōs legetai*), his lexicon of such homonymous terms *Metaphysics* Δ seems to have

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1 On this problem and Aristotle's strategies of dealing with it, see Sabine Föllinger in the present volume.

2 On this part of Aristotle's terminology, cf. the contribution by Marcel Humar to this volume.

3 Cf., e.g., Köhnken 1990, 135.

become necessary precisely because of his various re-classifications of these terms.[4] A related problem (and one of the causes of homonymy in Aristotle) is that Aristotle recycles ordinary words or preexisting terms and supplies them with new technical meanings. Mostly he continues to use them in the original sense alongside using them in their technical senses without, however, indicating each time to which sense he is referring. Since, in this way, ordinary and technical discourse intertwines and is hard to tell apart, it is difficult to recognize technical terms to begin with.

In the past, there have been various ways of coming to terms with these difficulties posed by Aristotle's terminology. One popular line of argument has been to ascribe the non-standardized form and use of Aristotle's terms (just as other features of the cumbersome style) to the circumstances of the transmission of his writings. For a long time, scholars have perpetuated the claim that Aristotle's extant writings were just 'lecture notes', as they supposedly lacked the kind of elaboration which Aristotle is believed to have bestowed on his so-called exoteric works, that is, his published dialogues. With regard to terminological problems, the assumption has been that Aristotle would have made clear the meaning of the respective term or the relation of different (uses of) terms on revising the text for publication. Over the past 30 years, the 'lecture notes hypothesis' has rightly been questioned and replaced by more nuanced speculations about the audience of the writings which take account of the heterogenous, but often far from crude state of their form.[5] Nonetheless, the underdetermination of Aristotle's terms is still being explained with reference to the superior knowledge of his primary audience ('they would have known which sense of the term Aristotle meant') and the state of transmission ('Aristotle has explained the term in another work which is now lost but was still available to the primary audience').[6] Another line of interpretation justifies the non-standardization of the terms by recalling that Aristotle is not a systematic philosopher who can be expected to display a consistent terminology. Rather, he proceeds problem by problem, indeed, paragraph by paragraph,[7] so that the use of the same terms can vary from treatise to treatise and even within treatises. According to still another, more recent line of thought, the non-standardization and underdetermination of Aristotle's terms is not a deficiency which can be explained by how his writings have come down to us; instead, it is viewed as a corollary of the terminological form which Aristotle chose precisely for its argumentative and cognitive functions.[8] In any case, the view prevails that except for a few remaining inconsistencies, an informed, attentive, as well as committed

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4 On the identity of homonymity and what is called in German "Aussagevielfalt" ('things said in many ways') see below.

5 For example, van der Eijk 1997; Lengen 2002.

6 See Marsh in the present volume, following Halliwell.

7 Netz 2001, 225.

8 For example, Wieland 1992, 173–186, especially 181 f. See also the present contributions by Sabine Föllinger for cognitive benefits of the form and Marsh for the 'conceptual networks theory'.

reader will be able to determine the meaning of almost every Aristotelian term wherever it occurs.

In this chapter, I shall take a closer look at Aristotle's terminology from the point of view of literary form. That is, I look at the textual, linguistic, and stylistic features of the terms and their application. Such an approach is still somehow in need of explanation, even though more recently, a few studies have taken the literary form of Aristotle's writings into view.[9] The general reluctance to deal with Aristotle's style has to do mainly with the above-mentioned state of Aristotle's transmitted writings and with Aristotle's own explicit reservations toward 'style' in the *Rhetoric* and in the comments on poetical authors of science.[10] While I think that it is in any case rewarding to analyze Aristotle's form as it is before thinking about functions or causes of this form, it suggests itself to start from the form when thinking about why Aristotle's terms are so underdetermined: for terms are a part of the linguistic form, whatever Aristotle's stance toward the latter. Moreover, Aristotle's terminology is the part of his literary form, if any, which would have remained comparatively unaffected whether or not Aristotle had copy-edited the text, and therefore can be studied rather straightforwardly. In view of the above-mentioned difficulty of recognizing technical terms in Aristotle, I will start by looking at Aristotle's terminology more generally in the sense of his word usage. For if we approached Aristotle's terminology by looking for terms that meet traditional criteria of technicality such as exactness, formal standardization, and semantic stability, we might end up with few to no terms – and without learning much new about terms in Aristotle.

In the second part of the chapter, I explore what Aristotle's explicit reflections about form can tell us about his conception of scientific word usage. In the absence of an Aristotelian rhetoric of scientific texts or meta-terminology in the manner of Galen's *On medical names* (Περὶ τῶν ἰατρικῶν ὀνομάτων/*Peri tōn iatrikōn onomatōn*),[11] I shall revert to his theory of style and form (λέξις/*lexis*) in the *Rhetoric* and *Poetics*, and to his theory of definition in the logical treatises for Aristotle's recommendations for the form and use of ὀνόματα/*onomata* (itself a multi-faceted term, which can mean 'words', 'nouns', 'names', 'phrases', and 'technical terms' amongst other things). Aristotle reviews all aspects of the stylistic form from the perspective of the overall aim of clarity (σαφήνεια/*saphēneia*),[12] which is particularly interesting in view of the notorious non-standardization and underdetermination of Aristotle's terms. The theory of *lexis* is a theory of clarity (*saphēneia*) at the same time. As if providing a case in point for his use of technical terms, Aristotle does not define *saphēneia*; one can only

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9 For example, Schütrumpf 1989; Natali 2007.

10 Cf. Rapp 2013, 284; the third reason which he mentions is the dominance of analytical philosophy in research on Aristotle which traditionally is concerned with argument *behind* a text rather than with the text as it is, let alone its form.

11 The treatise only survives in Arabic translation.

12 Rapp 2013, 286.

grasp its meaning from the very linguistic and stylistic means which he recommends for achieving *saphēneia* itself, according to which it has a logical dimension (in the sense of "unambiguousness") and a cognitive-communicative one (in the sense of "intelligibility"). In this way, it seems to be directly opposed to the impression conveyed by the form and use of Aristotle's terms. Therefore, I will focus specifically on the relation between terms and clarity when reviewing Aristotle's explicit remarks on 'names' or 'terms'. While analyzing Aristotle's theoretical reflections, I will already note a number of terminological characteristics.

Against the backdrop of my reading of Aristotle's theoretical reflections, the third part of my chapter consists in a close analysis of a sample term, that is, of the classification of *aitia* in different writings. This section will more systematically take up our observations about Aristotle's terms, as we encountered them in the theoretical passages. In the final fourth part, I think about the functions of the form of Aristotle's terms and consider the possibility of a 'poetics of terminology' in Aristotle.[13]

2 Reflections on Form and Clarity in Aristotle

What does Aristotle himself have to say on the form of 'names' or 'terms'? When going through the explicit evidence on literary form, I will first outline the two places where Aristotle talks about 'form', that is, in the *Rhetoric* and *Poetics*, and the scope of each account; second, I will consider the relevance of clarity (*saphēneia*) for the literary form, focusing especially on the relation between word usage and clarity.

2.1 *The Places and Scope of* lexis

First, Aristotle has not reflected about terms as part of the literary form, nor has he written a coherent account about the literary or stylistic form of scientific texts at all (at least nothing thereof survives or is known to have existed). He does make scattered remarks about the form of *onomata* in the *Topics* and the *Posterior Analytics*, but the general perspective on language there is a logical rather than a stylistic one. Moreover, his theory of science does not refer to scientific texts in general, including his own works, but to an ideal which he himself has not realized. This means that Aristotle has not directly nor comprehensively written about what is a major aspect even of his own texts, a fact which, in turn, could indicate that this aspect of the literary form (and literary form itself) is only marginal for him when it comes to (his own) scientific texts.

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13 For the term see the Introduction by Markus Asper.

The places where Aristotle deals systematically with *onomata* as part of the linguistic and stylistic form – both times under the heading of *lexis* – are the third book of the *Rhetoric* (Chapters 1–12), which is the most comprehensive account, and Chapters 19–22 of the *Poetics*.[14] In the logical treatises, the term *lexis* occurs only rarely. This word is another example of how Aristotle applies his terms: he uses it in different senses and does not explicitly define it in each case. I will, first, briefly explain which meanings it can have before exploring its role for Aristotle's scientific texts.

In the accounts of the *Poetics* and the *Rhetoric*, it can, for instance, be equivalent to διάλεκτος/*dialektos* ('everyday speech')[15] or mean "a single word or phrase,"[16] but its main sense is the one which we have to infer from Aristotle's indirect definition at the beginning of the *lexis* account in the *Rhetoric*: "Our next subject will be language and style. For (γάρ/*gar*) it is not enough to know what (ἅ/*ha*) we have to say; we also must know how (ὡς/*hōs*) we have to say it."[17] From the causal connective γάρ (*gar*, "for"), which indicates that the sentence is going to explain the necessity of dealing with *lexis*, we can conclude that Aristotle explains this term by the phrase ὡς δεῖ εἰπεῖν (*hōs dei eipein*, "how we have to say it"). In so doing, he easily and effectively juxtaposes the "what" (ἅ/ha) and the "how" (ὡς/hōs) of speech, that is, the content and its form.[18] This division suggests that the "how," the form, refers to the different 'ways' in which the same thing can be expressed, and the phrase "how we have to say it" to the recommended 'way of saying' it. The sense of *lexis* which emerges from this passage – 'way of saying' – is indeed the most general one to accommodate all the Aristotelian usages in the accounts of the *Poetics* and the *Rhetoric*. Starting from this overall sense, one could distinguish – in the most general way – two main closely related meanings: on the one hand, a sense which simply refers to the "form" of a linguistic unit in a neutral way and, on the other hand, a meaning which – in the sense of "style" – "evaluatively" refers to the form as the "result" of a "choice between different possibilities of wording."[19]

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14 The account of the *Rhetoric* seems to presuppose the one of the *Poetics* (see Rapp 2013, 287).

15 Cf. Janko 1987, 137 on *Poet*. 22, 1459a12.

16 *Rhet*. III 3, 1406b1, see also LSJ s.v. A II.

17 περὶ δὲ τῆς λέξεως ἐχόμενόν ἐστιν εἰπεῖν· οὐ γὰρ ἀπόχρη τὸ ἔχειν ἃ δεῖ λέγειν, ἀλλ᾽ ἀνάγκη καὶ ταῦτα ὡς δεῖ εἰπεῖν (. . .), *Rhet*. III 1, 1403b15–18; unless otherwise indicated, translations are my own.

18 Halliwell 1993, 59–67 shows that Aristotle in his account of *lexis* does not separate style and sense as strictly as the present passage insinuates; rather, he often shows how the *lexis* itself produces a certain sense or that even the *lexis* is necessary for producing it.

19 For the threefold distinction of the senses of *lexis* – (a) "everyday speech," (b) "form of words"/ "wording," (c) "style" – and the overall meaning "way of saying" cf. Halliwell 1993, 53 f. The mere reference to "a single word or phrase," which we also find in the *Rhetoric* (see above), can be accommodated under the non-evaluative sense "form of words," as the passage, by mentioning a "compound word" refers to the "compound form of a word." As for the third meaning "style," Halliwell points out that Aristotle is "taking effective *lexis* (in rhetoric or poetry) to involve an element of the 'strange' or

Since the *lexis* account of the *Poetics* is mainly focused on describing the grammatical side of language in morphological, phonological, syntactical, and semantic terms, to use modern grammatical categories, the non-evaluative sense ('form of words' or simply 'language') often fits here. By contrast, the complementary contribution of the *Rhetoric* mainly contains reflections and recommendations on 'style' (in the evaluating sense of *lexis*) which nevertheless rest on the grammatical (i.e., non-evaluative) account of the *Poetics*.[20] However, both two main senses as well as shades and aspects of these are always present in *lexis*;[21] Aristotle may talk about 'style' and at the same time indicate that this style is produced with the help of certain linguistic devices; conversely, references to *lexis* as 'language' always suggest linguistic 'options' having different effects. In this way, *lexis* is a typically Aristotelian technical term which oscillates between different meanings and can be used with different emphases, and it seems apt to imitate in translation at least its two main facets. Thus, I have translated *lexis* in the present quotation by means of the hendiadys "language and style"; alternatively, both dimensions seem to be present in "linguistic style,"[22] in 'diction', that is, the choice of words or expressions,[23] and in 'literary' or 'stylistic *form*', which aptly recalls the definition of *lexis* as the counterpart of the content.

In the *Rhetoric*, Aristotle's attitude toward *lexis* in the overall sense of 'stylistic form' is at least ambivalent.[24] He explicitly subordinates it to the content, that is, to "the facts themselves" (αὐτὰ τὰ πράγματα/*auta ta pragmata*),[25] which "naturally come first,, whereas "the arrangement (of the facts) by means of the stylistic form (λέξει/ *lexei*)" comes second.[26] While this suggests a subordinate but still decisive role of *lexis* in speeches, Aristotle further on in the text seems to question the role of "diction" in speeches altogether: "It would be fair to fight our case with the mere facts (*autois tois pragmasin*) so that everything apart from proof (τοῦ ἀποδεῖξαι/*tou apodeixai*) is unnecessary."[27] However, Aristotle says, "since the whole business of rhetoric is geared

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20 The last chapter of the *Poetics* account (22) is also a normative one.

21 Halliwell 1993, 53 f.

22 For this translation cf. Halliwell 1993, 52, who also uses the term "language" alone to refer to the subject of *Rhet*. III 1–12 (ibid. 50 f.).

23 This is the translation used by Janko 1987 *passim*.

24 This ambivalence is mirrored by Aristotle's remarks in other works on the statements of earlier philosophers who wrote poetry and/or made use of more conventionally literary means to which he objects (Rapp 2013, 285), which shows that he hesitates to accept stylistic or rhetorical means in philosophical or scientific texts (on these remarks see further below), but in the *Rhetoric*, the ambivalence concerns even the 'import' of questions of style from poetry in to rhetoric itself (ibid. 288).

25 Cf. Halliwell 1993, 52 on the meaning of *pragmata* here: "'things', 'facts', or 'states of affairs'."

26 *Rhet*. III 1, 1403b18–20.

27 *Rhet*. III 1, 1404a5–7. This passage recalls the beginning of the first book of the work, where Aristotle has already emphasized the necessity of showing (δεῖξαι/*deixai*) the facts. In the present passage, Aristotle uses *apodeixai*, which means 'to demonstrate' in his logical treatises; while it has a looser

to opinion (*pros doxan*), we must pay attention to [*lexis*], not as being right, but necessary."[28] The reason why he thinks that *lexis* to some extent indispensable, is "because of the incapacity of the audience" (διὰ τὴν τοῦ ἀκροατοῦ μοχθηρίαν/*dia tēn tou akroatou mokhtērian*):[29] The term *mokhtēria* refers to the cognitive incapacity of the audience of speeches of forming the right opinion on the basis of the facts alone.[30] For this reason, they must be influenced toward the right understanding by means of *lexis*. Subsequently, Aristotle widens the focus from speeches to "instruction" (*didaskalia*) more generally:[31]

> τὸ μὲν οὖν τῆς λέξεως ὅμως ἔχει τι μικρὸν ἀναγκαῖον ἐν πάσῃ διδασκαλίᾳ· διαφέρει γάρ τι πρὸς τὸ δηλῶσαι ὡδὶ ἢ ὡδὶ εἰπεῖν, οὐ μέντοι τοσοῦτον, ἀλλ᾽ ἅπαντα φαντασία ταῦτ᾽ ἐστί, καὶ πρὸς τὸν ἀκροατήν· διὸ οὐδεὶς οὕτω γεωμετρεῖν διδάσκει.

> Nevertheless, the art of style is necessary to a small degree in every instruction; for it makes some difference with respect to clarification whether one speaks in this or that way – though not such a big difference, but all of this is mere appearance and has to do with the recipient. This is why no one teaches geometry in this way.

Since this passage deals with the role of *lexis* in the context of instruction (*didaskalia*), it immediately pertains to our question of the scope of Aristotle's account of *lexis* in the *Rhetoric* and of its relevance for (his own) scientific texts. Let us look at the passage more closely. At first, Aristotle seems to state that *lexis* is universally important in instructional contexts (though not very much so); for he contends that "clarification" depends on it to some extent.[32] But then he immediately qualifies this statement, saying that its justification depends on the kind of recipient. As we have just heard, the recipients of speeches are incapable, so one must conclude from the present passage that the writers of speeches must use *lexis* for their listeners to form the intended opinion. By contrast, Aristotle states that the writers of geometrical texts do not make

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sense in the *Rhetoric*, it is nevertheless remarkable regarding the applicability of the account of rhetorical *lexis* to philosophical and scientific texts that he expresses the exclusive dominance of the facts in speeches in mathematical terms (see below).

28 ἀλλ᾽ ὅλης οὔσης πρὸς δόξαν τῆς πραγματείας τῆς περὶ τὴν ῥητορικήν, οὐχ ὡς ὀρθῶς ἔχοντος ἀλλ᾽ ὡς ἀναγκαίου τὴν ἐπιμέλειαν ποιητέον (*Rhet.* III 1, 1404a1–3).

29 *Rhet.* III 1, 1404a7 f.; cf. also *Rhet.* III 1, 1403b34 f. on the "incapacity of the citizens" (i.e., working as judges in political contests).

30 Freese translates *mokhtēria* as "corruption," but the moral state of the listeners is not the point here.

31 *Rhet.* III 1, 1404a8–12.

32 Aristotle here uses the verb δηλῶσαι (*dēlōsai*) in the sense 'to clarify', 'to make clear'. The adjective δῆλος (*dēlos*), from which it is derived, is commonly used to express that something is 'evident', but in the rhetorical and logical context, Aristotle often uses it synonymously with *saphēs* ('clear', 'distinct'), from which the terminus technicus for the rhetorical virtue of style (*saphēneia*) is derived (see below). – On the relation of form and clarity see below.

use of *lexis* because they do not have to – presumably because their readers are not incapable.

The relationship between rhetoric/speeches, "instruction," and geometry is not quite clear here. Aristotle has widened the focus from speeches to "every kind of instruction," only to state again that the necessity of *lexis* depends on the listener. This refers back to the necessity of influencing the opinion of the defective listeners of speeches by means of *lexis*. Aristotle, thus, seems to regard rhetorical speeches as a form of "instruction." However, he started by saying that he would be talking about "instruction" more generally, that is, about contexts in which knowledge is transmitted and which traditionally are not about "opinion" or persuasion but rather about truth and its cognition.[33] Indeed, he states at first that the *lexis* makes a difference "with respect to clarification" (*pros to dēlōsai*), which suggests that *lexis* has to do with the aim of transmitting knowledge. But then he again says that *lexis* is "appearance" and "for the sake of the reader," which is the reason why teachers of geometry, "his example of *didaskalia*,"[34] do not use *lexis* – presumably because they do not aim at influencing their readers' opinion. In this way, Aristotle suddenly contrasts teaching geometry with *didaskalia* as regards the use of *lexis* rather than providing an example for the general term. This is quite surprising because teaching geometry *is* a kind of instruction, and Aristotle said at the beginning of the passage that *lexis* is "necessary in every instruction."

Metonymically, geometry stands for mathematical texts in general, that is, for Euclid's (now lost) predecessors. It is their logical form which is paradigmatic in Aristotle's theory of science. Thus, the reference to geometry first of all implies that the *lexis* used by writers of speeches would not be a part of Aristotle's own *ideal* of a scientific text. This is in accordance with the comparative absence of the term from the logical treatises in which Aristotle unfolds his ideal of a scientific text.

But what about Aristotle's own texts? While the logical form of the mathematical texts provides a positive model for Aristotle, he does not conform to it in his extant texts (and presumably even less so in his so-called 'exoteric' writings). This evidence is paralleled by the linguistic form of his extant texts: it is different from that of geometrical texts. Take, for instance, conditional clauses: Of course, Aristotle uses conditional clauses in his own texts, but he does not use them in the way Greek mathematicians

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33 As quoted above, Aristotle states at *Rhet.* III 1, 1404a1 f. that "the whole business of rhetoric is geared to opinion" (πρὸς δόξαν/*pros doxan*), recalling the opposition of things "aimed at opinion" and things "aimed at truth" (πρὸς ἀλήθειαν/*pros alētheian*) at *Rhet.* I 7, 1365b1; at the beginning of the work, he explains the connection of knowledge and persuasion similarly to our present passage: "before some people not even if we possessed the most accurate knowledge, it would not be easy to persuade them if we spoke on the basis of this knowledge. For argument based on knowledge implies instruction, but with regard to such people, it is impossible" (*Rhet.* I 1, 1355a24–27). The proximity of science and rhetoric is emphasized, for example, in the same chapter at 1355a4 f. ("persuasion [πίστις/*pistis*] is a kind of demonstration [ἀπόδειξις/*apodeixis*]").
34 Halliwell 1993, 55.

do:[35] In the Euclidean proposition, three types of conditional clauses are employed in an extremely standardized way to accomplish the main steps of the proof. While this shows that conditional clauses are a central feature of the language of mathematical texts, Aristotle does not reflect on conditional clauses anywhere in his work.[36] This shows that Aristotle does not make consistent use of the mathematical language in the way in which the mathematicians use it. Therefore, it is possible for (rhetorical) *lexis* to have some importance in Aristotle's own scientific writings as he claims it does "in every instruction" outside geometry. However, since Aristotle emphasizes that *lexis* is only used because of the incapability of the recipients, it is hard to believe that his audience should identify with those incapable readers who require *lexis* for understanding a text.[37]

In order to understand what the reference to geometrical instruction means for what role Aristotle envisages for *lexis* in instructional contexts, let us examine the reference more closely. It comes rather out of the blue. Aristotle does not explain *how* one teaches geometry, if not "in this way," nor does he specify who the recipients of geometrical texts are, although he insinuates that it is because of them ("for this reason") that geometry is taught differently. This means that he presupposes a certain attitude toward geometrical texts among his readership and suggests that the geometrical texts are somehow notorious: Apparently, Aristotle knows that his (non-mathematical) readers considered these mathematical writings as the epitome of wholly non-rhetorical, unusual, unattractive, and unclear texts because they were different from the style in which all of them were trained.[38]

Similarly, he appears to presuppose such a perception of the form of mathematical texts among his readers in a passage from *Metaphysics* α (book II). Aristotle claims that the success of "lectures" depends on the habits of the audience and that "we expect a lecturer to speak the way we are used to (ὡς εἰώθαμεν /*hōs eiōthamen*)." This is because hearers find language to which they are unaccustomed "somewhat unintelligible and foreign" (ἀγνωστότερα καὶ ξενικώτερα/*agnōstotera kai xenikōtera*), whereas they find customary language "intelligible" (γνώριμον/*gnōrimon*), and he explains this assumption by using the example of mathematical language:[39]

> Some people do not understand those who speak, unless someone speaks mathematically, others unless someone provides examples, still others expect him to adduce a poet as testimony. And some want to have everything done accurately (ἀκριβῶς/*akribōs*), while others are annoyed by accuracy (τὸ ἀκριβὲς/*to akribes*), either because they cannot understand or because of the petti-

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35 Acerbi 2021, n. 225.

36 Acerbi 2021, n. 225.

37 Cf. Rapp 2013, 299, pointedly on the orientation of the *Rhetoric* toward a 'somehow insufficient audience' ('irgendwie insuffizientes Publikum') who seem in need of (stylistic) measures that readers of philosophical or scientific texts do not require to the same extent.

38 Cf. Asper 2007, 116 with n. 159.

39 *Metaph.* α 3, 995a8–16.

ness (τὴν μικρολογίαν/*tēn mikrologian*). For accuracy (τὸ ἀκριβὲς/to *akribes*) has something about it so that as in trade so in argument some people deem it mean.[40] Hence one must have been already trained how to understand everything, because it is impossible to seek simultaneously for knowledge (ἐπιστήμην/epistēmēn) and for the way it is done (τρόπον ἐπιστήμης/*tropon epistēmēs*); it is not even easy to understand one of them. The extreme accuracy (τὴν δ' ἀκριβολογίαν/*tēn d' akribologian*) of mathematics is not to be demanded in all cases, but only in the case of things which do not have matter. Therefore, it is not done in the way (τρόπος/*tropos*) of natural philosophy; for presumably all nature has matter.

Here, Aristotle presents *to akribes* ('accuracy, precision, exactness') as the main feature of the mathematical way of speaking. However, it is not clear whether this passage refers primarily to the mode of inquiry or to the style (the *lexis*) of mathematical texts. The term *tropos*, which is used here to refer to the "way of knowledge" as opposed to knowledge itself, may refer to either aspect of the form;[41] while the context of the passage suggests that it talks about the scientific method,[42] the key term *to akribes* points to the *Rhetoric* where it is closely associated with the main virtue of style, that is, *saphēneia* (clarity).[43] It seems, therefore, that Aristotle is talking about a form of argument associated with a particular style and that the passage at least partly has implications for Aristotle's views on *lexis*.

Aristotle *en passant* distances himself from the mathematical style by the use of his language. For apart from the neutral term *akribeia*, he uses *akribologia* which suggests that accuracy is taken to the extreme or even overdone in mathematical texts, which also has negative ethical and social connotations.[44] These are even stronger and more explicit in the term *mikrologia* which emphasizes the 'pettiness' and 'pedantry' of those who speak over-accurately.[45] The pejorative manner in which Aristotle talks about the form of mathematical texts seems to count on the consent of this readership. For as in the previous passage from the *Rhetoric* ('no one teaches geometry in this way'), Aristotle makes recourse to the form of mathematical texts in order to demonstrate something else. In doing so, the mathematical form serves as an example: in the previous passage, he argues that using *lexis* in the context of *didaskalia* has to do with the reader; in the present passage, he claims that one has to be familiar with the form of a field of knowledge in order to understand what is being said. Each

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40 Cf. Asper 2007, 116 for the social connotations of *akribeia*.

41 In classical Greek, it is otherwise attested only in the sense ('manner, style') in the context of speaking and writing (LSJ s.v. V), but already shortly after in Stoic and Epicurean philosophy and in Philodemus, it is used in the sense 'mode or mood of a syllogism' and, more generally, 'method of instruction or explanation' (LSJ s.v. VI).

42 Aristotle goes on to explain in which order nature should be studied (*Metaph.* α 3, 995a17–20).

43 Vatri 2016, 102–104. On the implications of this passage regarding the relation of the stylistic form and clarity in Aristotle cf. the subsequent section below.

44 Cf. also Arist. *Rhet*. I 5, 1361b34; in the ethical context, Aristotle also uses the term dismissively in the sense 'stinginess' (Arist. *Eth. Nic.* IV 2, 1122b8).

45 Cf. Pl. *Resp.* VI 2, 486a5 and Theophr. *Char*. 10 where it means 'stinginess'.

time, Aristotle's argument would be ineffective if his readers did not agree with him about the peculiarity of the mathematical text form. One must conclude that his readers are not identical with or part of the group of mathematicians and should find a text strange and unclear which does not make any use of (rhetorical) *lexis* at all. Conversely, as we speculated above, it is difficult to imagine that Aristotle aligns his own readers with the audience of speeches who need the effects of *lexis* for understanding a text and to whose insufficiency Aristotle keeps alluding.[46]

Both passages highlight the weirdness of mathematical texts, but they have different implications as to the origin of this weirdness and the role of *lexis* in producing it. The passage from the *Metaphysics* suggests that the peculiarity of mathematical writings is due to extreme accuracy; provided that, as I have argued, *akribeia* refers (also) to the style, the passage implies that the mathematicians pay great attention to the stylistic form. By contrast, the passage from the *Rhetoric* seems to deny geometry of any share in *lexis* whatsoever, and to claim that *lexis* bears only very little relevance to *didaskalia* in general. For the gist of the argument suggests that in the cryptic remark "This is why no one teaches geometry in this way (*houtōs*)," the adverb refers to the aforementioned *relevant degree* of *lexis*: Geometry is not being taught in the way that geometers find *lexis* somewhat necessary but not too much; they find it necessary to a different extent. Since it is unlikely that this passage says that geometers find *lexis more* relevant than do teachers of other kinds of *didaskalia*, he seems to say that they find it less relevant or even not relevant at all. This, however, is in sharp contrast not only with the passage from the *Metaphysics* but also with the impression conveyed by the extant texts of Euclidean geometry: in their own peculiar way, they pay rather great attention to language and style.

In order to take account of this, one would have to understand the *houtōs* ("in this way") of the sentence "This is why no one teaches geometry in this way" as referring to the quality or kind of lexis: in the sense 'using the kind of *lexis* which is mere appearance and for the sake of the reader', that is, 'using the *lexis* of speeches or similar *didaskaliai*.' However, at the beginning of the short passage ("Nevertheless, the art of style is necessary to a small degree in every instruction."), it cannot have this meaning already; for 'the *lexis* of *didaskalia* is necessary to a small degree in every *didaskalia*' does not make sense. On first reading it, the term must have a more general gist here because Aristotle has only just introduced it; this is underlined by the variation of the simple noun *lexis* by means of the phrase τὸ τῆς λέξεως (*to tēs lexeōs*, "the art/matter of style"), which is again a variation of the phrase τὸ περὶ τὴν λέξιν (*to peri tēn lexin*, "the matter of style"), used in the preceding paragraph.[47] This means that the passage seems to begin by talking about how much style in general is used in every instruction and ends up by insinuating an emphatic sense of *lexis*, that is, 'rhetorical

46 Rapp 2013, 299.

47 *Rhet*. III 1, 1403b36.

style'. However, knowing this, one feels the need to adjust the meaning of τὸ τῆς λέξ-εως at the beginning of the passage: "the art of style (that is, of the kind of style which uses elements of the language that do not occur in mathematical texts)."

The implied change of the focus of the term *lexis* indicates that Aristotle envisages different genre-related kinds of stylistic form. Accordingly, he distinguishes a "poetic language" (ποιητικὴ λέξις/*poiētikē lexis*)[48] or "language of poetry" (ποιήσεως λέξις/*poiēseōs lexis*) from a "language of prose" (λόγου λέξις/*logou lexis*).[49] Similarly, he in-sinuates a rhetorical *lexis* besides the poetic one when he sets out to deal with *lexis* in *Rhetoric* III 1: "Therefore we should not treat everything which concerns *lexis* in de-tail, but only that which concerns the kind of lexis which we are talking about [sc. the rhetorical *lexis*]. The other one [sc. the poetical *lexis*] has been discussed in the *Poet-ics*."[50] Moreover, as we have seen, Aristotle is concerned with the *lexis* of *didaskalia*, from which he distinguishes (without explicitly calling it thus) a geometrical *lexis.*

The respective genres differ according to the two related criteria of the "propor-tion[]" of common, ordinary words (κύρια/*kuria*) and uncommon, strange words (ξε-νικά/*xenika*)[51] and of the proportion of (the importance of) sense (διάνοια/*dianoia*) and style (*lexis*). In Aristotle's view, a predominance of sense over style, of content over form, seems to correlate with a predominance of ordinary words; conversely, the use of strange words is due to and at the same time results in a lesser importance of the content. For example, on the one hand, Aristotle claims that poetry, in its begin-nings, used words "beyond everyday language" (παρὰ τὴν διάλεκτον/*para tēn dialek-ton*) and owed its success to its "style" while the contents of what it said were "simple enough."[52] On the other hand, we have seen that Aristotle grants only a small role to "style" in *didaskalia*; this is matched by his recommendations for the "language of prose" (τὴν τῶν ψιλῶν λόγων λέξιν/*tēn tōn psilōn logōn lexin*) as opposed to that of poetry: its terms should be taken mainly out of the realm of "the common" (τὸ κύ-ριον/*to kurion*) or "regular" (τὸ οἰκεῖον/*to oikeion*) and of "metaphor" (μεταφορά/*metaphora*),[53] while uncommon and complicated terms should be used sparingly.[54]

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48 διὰ τοῦτο ποιητικὴ πρώτη ἐγένετο λέξις, οἷον ἡ Γοργίου ("because of this, language first became poetic, like that of Gorgias," *Rhet.* III 1, 1404a25 f.). Ποιητική (*poiētikē*) is a predicate noun here, that is, Aristotle is not talking about the "style of poetry" but about "style" in general, including that of prose (see below).

49 ἀλλ᾽ ἑτέρα λόγου καὶ ποιήσεως λέξις ἐστίν ("the language of prose is different from that of poetry," *Rhet.* III 1, 1404a28 f.).

50 ὥστε φανερὸν ὅτι οὐχ ἅπαντα ὅσα περὶ λέξεως ἔστιν εἰπεῖν ἀκριβολογητέον ἡμῖν, ἀλλ᾽ ὅσα περὶ τοιαύτης οἵας λέγομεν. περὶ δ᾽ ἐκείνης εἴρηται ἐν τοῖς περὶ ποιητικῆς (*Rhet.* III 1, 1404a37–39).

51 Halliwell 1993, 55.

52 *Rhet.* III 1, 1404a33–35 and 24 f.

53 *Rhet.* III 2, 1404b31–33.

54 *Rhet.* III 2, 1404b28–30. More specifically, Aristotle mentions γλῶτται ("strange words"), διπλᾶ ὀνό-ματα ("compound words") πεποιημένα ("neologisms/invented words"). Interestingly, he describes the effect of good prose which uses mainly common and metaphorical terms as *xenikon*, which here

Even within these main categories and diachronically regarding the development of (sub)genres, Aristotle differentiates types of *lexis* or, synonymously, *tropoi* (sc. *lexeōs*, 'ways of speaking')[55] according to the role of style and the preferred types of words. For example, Aristotle describes how tragic authors have come to adopt iambics instead of tetrameters as well as ordinary instead of uncommon words in order to be more prose-like, whereas epic authors still use words beyond everyday language;[56] equally, one may distinguish rhetorical genres based on their style-sense relation: "for those who *write* speeches [sc. of the epideictic genre][57] owe a greater part of their strength to style (*lexis*) than to thought (*dianoia*)."[58] Although, in this way, the *lexis* of prose may sometimes be more poetical than that of poetry itself (and vice versa), *lexis*, on the whole, seems to be more relevant in poetry than in rhetorical prose on Aristotle's view.[59] It is only implied which genres are next on the "scale,"[60] which relates sorts of texts according to the kind of their *lexis* and meaning of *lexis* in them: first, other forms of (the prose of) *didaskalia* which are even less influenced by poetry than rhetoric, that is, genres concerned with the instruction of knowledge (rather than opinions); second, and diametrically opposed to poetry on this "scale," scientific texts like mathematics.

From these genre-related reflections on *lexis*, two conclusions emerge: First, different kinds of texts seem to have different kinds of *lexis*, which means that different genres use different words or use the same words differently. Aristotle often uses adjectives or genitives to designate the genre of the *lexis* about which he is talking. This involves the term *lexis* itself being used in the general sense of 'style' that we have recognized above, for otherwise it could not be concretized by means of attributes. Second, *lexis* seems to be of different importance in different genres. This means that the term does not always refer to all aspects of the literary form of a text but sometimes describes only a certain part or aspect of it. In this way, *lexis* often seems to be used emphatically in the sense of 'poetical *lexis*' or even 'the side of *lexis* which is typical only for (certain types of) poetical *lexis*, that is, uncommon expressions (*xenika*)'.[61]

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means something like "distinguished," while it otherwise serves as umbrella term for 'strange', 'foreign', or 'exotic' terms such as the aforementioned types. I will come back to this when talking about the role of clarity for the stylistic form.

55 For this term see above.

56 *Rhet.* III 1, 1404a29–35.

57 *Rhet.* III 1, 1404a24–26.

58 *Rhet.* III 1, 1404a18 f.

59 Halliwell 1993, 56 and see Aristotle's above-quoted referring to the *Poetics* for the poetical *lexis* and restriction of the *Rhetoric*, thus, to non-poetic genres.

60 Halliwell 1993, 55.

61 Halliwell 1993, 54 who states that Aristotle "is taking effective *lexis* (in rhetoric or poetry) to involve an element of the 'strange' or 'foreign' (*xenikon*)" (see above); the point, however, is that *lexis* means 'poetical *lexis*' or 'strange words' precisely outside reflections about poetry or the most poetical genres of poetry, for example in our passage about *didaskalia* (see below).

This emphatic use, thus, presents a subform that we have to add under the main sense 'style'. The association of *lexis* with poetical elements of style seems to be both due to the origin and success of the use of strange words in poetry as well as due to the view that *lexis* in general, that is, even that of prose (for instance in Gorgias), was at first "poetic."[62]

It is between these two senses that *lexis* seems to oscillate in our *didaskalia* passage: "the art of *lexis* – here used in a general sense but including the reference to the traditional poetical side of it – is of small but limited importance in *didaskalia*," but "nobody teaches geometry in this way, that is, using poetical *lexis*." This oscillation helps explain some of the difficulties of the passage. As for geometry, it means that Aristotle does not deny that it has or pays attention to *lexis* at all, only that it makes use of poetical *lexis*.[63] In this way, its *lexis* can even be described by the categories of the *lexis* account of the *Rhetoric*: it only uses ordinary words. However, the recommendations of the *Rhetoric*, for example, regarding the use of *onomata*, do not pertain to it: Aristotle explicitly excludes it from the cosmos of *didaskalia* about which he is talking (just as he excludes poetry as a target). As for Aristotle's own philosophical and scientific writings, they fall under *didaskalia*; since he distances himself from the style of mathematics, his writings should be imagined somewhere between rhetoric and mathematics on the scale regarding the kind and meaning of *lexis*. Because of the flexibility of the term, it is possible for Aristotle to say seemingly contradictory things in the same paragraph: He states the necessity of *lexis* (sc. in general, including poeti-

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62 *Rhet.* III 1, 1404a24–26 (see above); cf., differently, the translation by Rapp 2002, 130, who takes the whole sentence to concern the origin of the poetic style rather than, in its second part, the influence of poetry on the development of (prose) style: "Da nun die Dichter, auch wenn sie Einfältiges reden, durch die Beherrschung der sprachlichen Form zu ihrem Ansehen gelangt zu sein scheinen, entstand als erstes die sprachliche Form der Dichtung, wie zum Beispiel die des Gorgias." Cf. my translation of διὰ τοῦτο ποιητικὴ πρώτη ἐγένετο λέξις, οἷον ἡ Γοργίου: "because of this, language first became poetic, like that of Gorgias".

63 Although Halliwell acknowledges the emphatic understanding of *lexis* as '(poetical) lexis containing *xenika*' (see above), he does not seem to think that this sense helps to explain the problematic statement that *didaskalia* "has only the minimum use for verbal style," which seems to imply (but does not) "that such discourse is careless of the way it uses words," for "clearly this could not be at all true of geometry" (ibid. 55). Instead, Halliwell argues that "*didaskalia* is assumed to be interested overridingly in its subject-matter; its choices of words will be determined solely by reference to clarity and precision of presentation: *lexis* will function here (. . .) as a transparent medium which calls no attention to its own nature" (ibid.). Accordingly, Halliwell's more abstract criterion of how Aristotle distinguishes the role of *lexis* in different discourses – besides the proportion of *kuria* and *xenika* – is "the extent of their conscious concern with *lexis*" (ibid.). However, this interpretation, on the one hand, does not seem to find support in Aristotle's text, and on the other hand, is still problematic regarding Aristotle's supposed take on the reality of the form of Greek geometry and other scientific texts: If Greek mathematics used its form unconsciously, then only because its form had become extremely standardized at a certain point, while the fact of standardization itself implies a very conscious handling of the form (on the role of the form in Greek mathematics cf. my study of Euclid's *Elements* Gasser *forthcoming*).

cal elements) for *didaskalia,* calls (sc. poetical) *lexis* "mere appearance" for the sake of incapable readers, and insinuates that his own writings do have some share in *lexis* (sc. in general, including poetical elements) as he distances himself from the *lexis*-free style of mathematical *didaskalia.* However, the term does not only accommodate various genre-related aspects but also Aristotle's ambivalence toward the concept which he varyingly presents as vulgar and as effective.

So far, we have traced the use of *lexis* in the *Rhetoric* and *Poetics* starting from a central passage on the role of lexis in *didaskalia* to estimate the relevance of the treatment of *onomata* for Aristotle's own use of terms. We have found that Aristotle sharply distinguishes between poetical and rhetorical discourse, although the *lexis* accounts of the respective two works are closely connected and partly overlap. Aristotle's theory of poetical *lexis* should not be relevant for his own scientific terminology (as it is not even relevant for rhetorical texts according to Aristotle); the account of the *Rhetoric*, however, can be considered relevant. For, as we have seen, Aristotle explicitly widens the focus to include not only speeches, but all texts concerned with *didaskalia*, which he has defined as "discourse based on knowledge"[64] at the outset of the work. He does not draw any sharp distinctions between types of such discourses apart from the one between *didaskalia* in general and the extreme genre of mathematics.[65] This broader perspective is confirmed by the wide range of examples from which Aristotle chooses in the *Rhetoric.* They come from various, even non-rhetorical, prose authors, many of whom are writers of knowledge texts in the broadest sense.[66]

2.2 The Relevance of Clarity for the Literary Form

A further but related aspect regarding the scope and relevance of Aristotle's theory of *lexis* is the relation of the literary form to clarity, to which we will turn now.

It is already in the crucial passage which we have just scrutinized extensively that Aristotle relates literary form to the aim of clarity: it is used "with respect to clarification" (*pros to dēlōsai*). The supreme relevance of clarity for the whole subject of *lexis* can be seen at the 'core' of the *lexis* account, in the definition of the ἀρετὴ τῆς λέξεως (*aretē tēs lexeōs*), of the 'virtue' or 'excellence of style', that is, the definition of

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64 ὁ κατὰ τὴν ἐπιστήμην λόγος/*ho kata tēn epistēmēn logos* (*Rhet.* I 1, 1355a26, cf. Halliwell 1993, 56).
65 For Rapp 2013, 286 (and 299), it is already the generality of the *lexis* (and *taxis*) account of the *Rhetoric* which allows applying its 'basics' ('Grundzüge') to other genres, although he states that Aristotle does not have in mind the form of philosophical texts in the *Rhetoric* (which the central *didaskalia* passage calls into doubt). More cautiously ibid., 286: "Was ich an dieser Stelle behaupte, ist nur, dass Aristoteles mit seiner speziellen Zugangsweise zu *lexis* und *taxis* die Grundlage für die Rechtfertigung einer bestimmten sprachlich-literarischen Gestaltung auch von philosophischen Texten liefert (. . .)."
66 Halliwell 1993, 50 f.

'the good prose style':[67] "(. . .) the excellence of the stylistic form should be defined as being clear (for since a speech is a sign, it will not fulfill its proper work if it is not clear), and neither banal nor exceedingly sublime, but appropriate."[68] Christof Rapp has shown the neglected importance of clarity in this definition. Influenced by the later rhetorical tradition, most interpreters have discovered at least two, if not four virtues of style in it, that is, apart from the virtue 'clarity' at least that of 'appropriateness'.[69] However, Aristotle – not only in this passage – always uses *aretē tēs lexeōs* in the singular and accordingly recognizes only one 'virtue of style'. This leaves the possibility that the criterion of 'appropriateness' which is mentioned at the end of definition (*prepousan*) is part of the one overall virtue. However, the special status of 'clarity' is unequivocally indicated by the "*ergon*-argument" provided in parenthesis which is used to explain why "being clear" (*saphē einai*) is the *aretē tēs lexeōs*.[70] Nonetheless, the definition adds another requirement, namely, to be "neither banal nor exceedingly sublime, but appropriate." The syntactical structure indicates that the 'appropriateness' which at first seems to be the second criterion actually refers to the previously mentioned opposition "banal" and "exceedingly sublime," as Aristotle goes on to explain: the good (prose) style should find the right balance between banality and sublimity,[71] that is, the right balance in relation to the subject of the speech.[72] This means that Aristotle has in mind one single *aretē tēs lexeōs* according to which the stylistic form must be clear and appropriately sublime.

The two criteria clarity and sublimity are related insofar as they are achieved by opposite means: sublimity arises from the use of uncommon words (*xenika*) and counterbalances the use of common words (*kuria*); for these bring about clarity but they also, if employed exclusively, lead to banality. But what is the exact relation of the two qualities as part of the *aretē tēs lexeōs*? Let us read how Aristotle repeats its definition a little further on in the text: "Therefore, if someone does it well, it (sc. the speech) will be unfamiliar (ξενικόν/*xenikon*) and able to conceal it and clear (σαφηνιεῖ/*saphēniei*). This

67 Rapp 2013, 286.

68 (. . .) ὡρίσθω λέξεως ἀρετὴ σαφῆ εἶναι (σημεῖον γάρ τι ὁ λόγος ὤν, ἐὰν μὴ δηλοῖ οὐ ποιήσει τὸ ἑαυτοῦ ἔργον), καὶ μήτε ταπεινὴν μήτε ὑπὲρ τὸ ἀξίωμα, ἀλλὰ πρέπουσαν (*Rhet*. III 2, 1404b1–4). My translation follows the German translation by Rapp 2013, 290.

69 The other two virtues recognized by the later tradition, 'ornateness' and 'correctness' do not even implicitly feature in this definition.

70 Cf. Rapp 2013, 290 for the whole argument so far.

71 *Rhet*. III 2, 1404b4–12.

72 As Rapp 2013, 291 f. explains, the reference point of the requirement of the appropriate balance between banality and sublimity becomes clear a little further on in the text: "In verse (. . .) the persons and things there spoken of are comparatively remote from life; for even in poetry, it is not quite appropriate that fine language should be used by a slave or a very young man, or about very trivial subjects: even in poetry, the style, to be appropriate, must sometimes be toned down, though at other times heightened. All the more so in prose, where the subject-matter is less exalted" (*Rhet*. III 2, 1404b12–18, trans. Rhys Roberts). By contrast, appropriateness in relation to the character of the orator is a post-Aristotelian Quintilianian notion (Rapp 2013, 291).

was the excellence of the rhetorical speech (ἡ τοῦ ῥητορικοῦ λόγου ἀρετή/*hē tou rhētorikou logou aretē*)."[73] Although the aspect of the "unfamiliar" or "strange" which is responsible for sublimity is named first here (unlike in the first version of the definition), the dominant quality of the *aretē* is 'clarity': it is necessary, as we have seen, in order for the speech to fulfill its *ergon*, whereas, as follows from the second definition, *xenika* should only be used to such an extent so as to not even be perceived. This means that sublimity, achieved by using common words, must not be used at the expense of clarity. Too much of 'the uncommon' would not only produce obscurity – for clarity is mainly due to common words – but also appears to be artificial and for this reason causes resentment on the part of the audience so that it turns them away.[74]

The reason why 'the unfamiliar' should be part of the rhetorical *lexis* is to avoid banality. But why should it be avoided? The argument is a cognitive one: As Aristotle says about why language must be made "unfamiliar" (*xenikēn*), "people are admirers of what is out of the way (τῶν ἀπόντων/*tōn apontōn*), and what is admirable is pleasant (ἡδύ/*hēdu*)."[75] The pleasure which is the effect of the use of unfamiliar language helps the cognitive processes of understanding and learning because it makes sure that the audience becomes interested in a subject and in this way keeps them fascinated with it, which at the end of day is an important precondition of learning. In this way, sublimity – as direct effect of unfamiliar words – is not opposed to the aim of clarity but rather adds to clarity in its cognitive dimension, that is, to comprehensibility.[76] Cognitive-communicative clarity is the main aim; the efforts of it are enhanced by the element of 'the unfamiliar'.

As these passages about the *aretē tēs lexeōs* show that the *Rhetoric* presents *lexis* as having a specific purpose. The whole *lexis* account of the *Rhetoric* has a cognitive-communicative perspective: the stylistic form of the *rhētorikos logos* above all serves its comprehensibility, and it is to help the audience to understand the speech in the

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73 ὥστε δῆλον ὡς ἂν εὖ ποιῇ τις, ἔσται τε ξενικὸν καὶ λανθάνειν ἐνδέξεται καὶ σαφηνιεῖ· αὕτη δ' ἦν ἡ τοῦ ῥητορικοῦ λόγου ἀρετή (*Rhet*. III 2, 1404b35–7). Here, the aspect of 'appropriateness' is not even mentioned; this shows that it is not *per se* part of the *aretē* (Rapp 2013, 294). In another repetition of the definition (*Rhet*. III 12, 1414a24 f.), 'the appropriate' features again: "for why does it have to be clear and not banal, but appropriate?" (τίνος γὰρ ἕνεκα δεῖ σαφῆ καὶ μὴ ταπεινὴν εἶναι ἀλλὰ πρέπουσαν;); here, πρέπουσαν is used again in the sense in which it is employed in the first definition of the *aretē tēs lexeos*, that is, with respect to 'not banal,' expressing the opposite of it: 'appropriately sublime'.

74 *Rhet*. III 2, 1404b18–21 (see Rapp 2013, 293).

75 *Rhet*. III 2, 1404b10–12.

76 Rapp 2013, 294. At the end of the *lexis* account, Aristotle calls 'pleasant' the effect of the combination of clarity and non-meanness/appropriateness (*Rhet*. III 12, 1414a22–25; for this passage see also above). The point is that 'the unfamiliar' is the factor by which a text is not only clear but also pleasant and therefore all the clearer.

intended way.[77] Aristotle does not exclude poetical elements from the rhetorical style although he does not have them dominate it, but he does not grant them any aesthetic or non-cognitive functions; the aesthetics of unfamiliar language are employed for cognitive purposes.[78] Even more generally, he does not consider aesthetically motivated form in the *Rhetoric.*

In accordance with the recommendation of the *Rhetoric* to mainly aim for clarity and for sublimity only to an extent which is appropriate, Aristotle says that one should choose words from ordinary language (ἐκ τῆς εἰωθυίας διαλέκτου/*ek tēs eiōthuias dialektou*).[79] From the "words which have been spoken of in the *Poetics*"[80] we should use strange, compound, or coined words only rarely and in few places.[81] Shortly afterward, however, he says that "ordinary and proper words and metaphors" (τὸ δὲ κύριον καὶ τὸ οἰκεῖον καὶ μεταφορὰ/*to de kurion kai to oikeion kai metaphora*) alone are useful for the style of prose since these are commonly used in conversation.[82] Although all three terms are coordinated by *kai* ("and"), *to kurion* and *to oikeion* seem to refer to the same thing (namely ordinary words), while "metaphor" refers to a special use of ordinary words. The statement seems to contradict the fact that Aristotle also allows for a certain amount of strange words in prose; however, he seems to focus here on what prose has in common with ordinary speech, and his point is that metaphor is also a part of the latter, although it leads to both clarity (*to saphes*) and strangeness (*to xenikon*) (and pleasure)[83] – while ordinary words used in their ordinary senses only lead to clarity. In another passage, inappropriate metaphors are ruled out along with compound words, strange words, and "epithets that are either long or unseasonable or too crowded" for causing "frigidity of style" (τὰ δὲ ψυχρὰ (. . .) κατὰ τὴν λέξιν/*ta de psukhra (. . .) kata tēn lexin*). Metaphors are called inappropriate for different reasons: either because they are "ridiculous" or because they are "too dignified and somewhat tragic" or because they are "far-fetched" which makes them "obscure."[84] Here, "strange words" appear as a category among such categories that are otherwise subsumed under it. Other passages positively advise to use only certain kinds of metaphor, that is, "appropriate" or "not far-fetched" ones or "not

77 As Rapp 2013, 296 points out, not all aspects of the long *lexis* account of the *Rhetoric* can easily be related to the cognitive aims of *lexis* as mentioned in the *aretē tēs lexeōs*, but in all cases, it is possible to find a connection to the overall perspective on closer examination.

78 Cf. *Rhet*. III 2, 1405b4–8: "Metaphors should also be derived from things that are beautiful, the beauty of a word consisting, as Licymnius says, in its sound or sense (. . .)." This reveals an aesthetic appreciation of terms; however, the beauty of the terms is not appreciated by itself, but to be exploited with regard to the cognitive value of metaphor.

79 *Rhet*. III 2, 1404b24 f.

80 *Rhet*. III 2, 1404b7 f.

81 *Rhet*. III 2, 1404b26–30.

82 *Rhet*. III 2, 1404b31–35.

83 *Rhet*. III 2, 1405a8 f.

84 *Rhet*. III 3, 1405b35–1406b36.

poetical" ones, or to derive metaphors from certain kinds of words.[85] Metaphor is also mentioned as a means for achieving "loftiness/dignity" (*ogkos*) of style, besides using "the description instead of the name of a thing," epithets, and plural for singular.[86] Finally, metaphor most prominently appears in Aristotle's treatment of "expressions that are witty (*asteia*) and likeable (*eudokimounta*)" in Chapters 10 and 11 of *Rhetoric* III. These are distinguished from ordinary words which we already know and only convey what is obvious anyway, and from foreign words (*glōttai*) which are obscure: *ta asteia* are pleasant because they enable quick understanding.[87] This takes up Chapter III 2, in which Aristotle says that foreign expressions add to the cognitive aim of clarity since they are pleasant and, in this way, motivate for learning and understanding (see above). Of the three means by which, according to Aristotle, the witty effect is achieved – antithesis, metaphor, and energeia – metaphor specifically concerns the kind or form of *onomata*.[88] Accordingly, metaphor is where the stylistic ideal of clarity and an appropriate measure of strangeness crystallizes in the realm of terminology. Otherwise, the ideal is thought to be achieved by a mixture of obvious and strange words. Metaphors must be neither far-fetched nor obvious; they must be taken from what is related, but not obviously so.[89] Aristotle emphasizes that "metaphors by analogy" (*hai kat' analogian*) are the best type;[90] he repeatedly points out that they are *pro ommatōn*, that is, they are 'graphic' or 'vivid' as they manage to put something before our eyes.[91] The notion of "putting something before one's eyes" (*pro ommatōn poiein*), which, notably, is itself a metaphor,[92] corresponds with that of *energeia* ('vividness', 'activity') which Aristotle has mentioned as one of three means by which *to asteion* can be produced. While Aristotle mentions it as a separate means, he chiefly describes it as a quality of metaphors. The effect of the *asteion*, Aristotle says, is also achieved by what surprises or deviates from expectations, for example, by a surprising use of homonyms.[93] However, in another passage he states that ambiguous terms (ἀμφίβολα/*amphibola*) should be avoided in rhetorical prose[94] and insinuates that neither homonyms nor synonyms should be used, as the former are "most useful to the sophist" and the latter "most useful to the poet."[95]

In the *Poetics*, to which we now turn briefly, the *aretē tēs lexeōs* – here: *lexeōs aretē* – is defined in a similar way: "The excellence of the form is to be clear (*saphē*)

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85 *Rhet*. III 2, 1405a10 f., 14–6, 34–6, b5–8; III 6, 1407b31 f.

86 *Rhet*. III 6, 1407b26–37.

87 *Rhet*. III 10, 1410b6–15.

88 *Rhet*. III 10, 1410b35 f.

89 *Rhet*. III 10, 1410b31–33; 11, 1412a11 f.

90 *Rhet*. III 10, 1411a1 f.

91 *Rhet*. III 10, 1411a26–28, b2–9.

92 Rapp 2002, 909.

93 *Rhet*. III 11, 1412b7–16.

94 *Rhet*. III 5, 1407a30–32.

95 *Rhet*. III 2, 1404b37–39.

and not banal (*mē tapeinēn*)."[96] That is, the good poetic style must be clear and sublime, and it must use, as Aristotle goes on to explain, both common and uncommon expressions. The reason which he gives for why the *lexis* should not be entirely clear is again the same: banality. By contrast with the first definition of the *aretē tēs lexeōs* of the *Rhetoric*, the criterion of appropriateness is not mentioned. One wonders how 'clarity' and 'non-banality', that is, sublimity-through-uncommon-words, are supposed to be quantitatively related. From the definition of the good poetic style, it appears that 'non-banality' is as important as clarity; "however, if someone makes all words like that, (his work) will be either a riddle or the Greek of someone who does not really know the language."[97] That is, the *lexis* just should not be *completely* strange or foreign. "Therefore," Aristotle concludes, "one has to mix these in some way," that is, the two kinds, namely common and uncommon names.[98] Eventually, Aristotle also introduces "the fitting" (τὸ ἁρμόττον/*to harmotton*) as a criterion and demands that foreign terms should not be used inappropriately (ἀπρεπῶς/*aprepōs*).[99] Apparently, he relates it, like in the *Rhetoric*, to the subject of the work which is, above all, dependent on the (respective part of the) poetic genre.[100]

Thus, the definition of the good style of the *Poetics* closely resembles that of the *Rhetoric*, but it seems, as we have suspected earlier in this chapter, that Aristotle overall allows a greater amount or share of 'uncommon language' in poetry. Here, it only should not be used exclusively, whereas in rhetoric, it should have so little room as not even to be visible. This fits the statement in our initial *didaskalia* passage that the art of poetry is necessary to a small degree in every instruction; as we have argued above, *to tēs lexeōs* is used emphatically to mean "the art of lexis as we know it from poetry." This poetical *lexis* which may contain a great deal of uncommon terms only plays a small role in *didaskalia*. To be sure, the styles of the different poetic genres differ considerably regarding the number of uncommon terms in them. For instance, "[i]n iambic verses, since they imitate everyday language (*lexis*) as far as possible, those names are appropriate which one could use in speeches (*en logois*) too."[101] The argument here is that iambics roughly use the *lexis* of (rhetorical) speeches since the latter is close to the language of standard speech[102] (although it uses "metaphor" and

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96 *Poet*. 22, 1458a17.

97 ἀλλ᾽ ἄν τις ἅπαντα τοιαῦτα ποιήσῃ, ἢ αἴνιγμα ἔσται ἢ βαρβαρισμός· (*Poet*. 22, 1458a23–25). The translation of βαρβαρισμός/*barbarismos* is based on Fuhrmann's comment (1982, 130): "Die Redeweise eines Nicht-Griechen, der nur mangelhaft griechisch spricht und hierbei beliebige Dialektalausdrücke verwendet."

98 δεῖ ἄρα κεκρᾶσθαί πως τούτοις· (*Poet*. 22, 1458a31).

99 *Poet*. 22, 1458b13–15 and 1459a4–6.

100 *Poet*. 22, 1459a8–14.

101 ἐν δὲ τοῖς ἰαμβείοις διὰ τὸ ὅτι μάλιστα λέξιν μιμεῖσθαι ταῦτα ἁρμόττει τῶν ὀνομάτων ὅσοις κἂν ἐν λόγοις τις χρήσαιτο· (*Poet*. 22, 1459a11–13).

102 *Lexis* is synonymous here with dialektos ('everyday speech'), for this meaning of the term see above.

"ornament" besides ordinary names)[103] or at least much closer than what is traditionally understood as poetical *lexis*. This implies a general difference of poetical and rhetorical discourse in terms of the use of 'the strange'.

Despite the relatively high proportion of unusual expressions in the various poetical styles addressed in the *Poetics*, it presents 'style' – like the *Rhetoric* – as something which is used for a specific purpose. Aristotle explicitly names its function: "By linguistic style (*lexin*), I mean, as we said earlier, communication (*hermēneian*) by means of language (*onomasias*), which has the same potential in both verses (*epi tōn emmetrōn*) and prose speeches (*epi tōn logōn*)."[104] That is, he ascribes to *lexis* the same cognitive function which it has in the *Rhetoric*. This is confirmed by the fact that he explicitly adds that the *dunamis* (i.e., what it can do and what it does) is the same in both poetry and prose. Nonetheless, the importance of clarity is toned down considerably compared with the rhetorical account, and the aspect of 'pleasantness', which in the *Rhetoric* explains why foreign expressions are relevant for cognitive aims, is never used in the *Poetics* in the context of *lexis*.[105] Of course, tragedy is defined as a *mimēsis* "in speech which has been made pleasant" (ἡδυσμένῳ λόγῳ/*hēdusmenōi logōi*) but, as Aristotle himself explains, "by speech which has been made pleasant I mean that which has rhythm and melody."[106]

Although the *lexis* account of the *Poetics* is not focused solely on the genre of tragedy, it is introduced as one of the six qualitative parts of tragedy[107] and one of the two media of *mimesis*;[108] accordingly, its function should be related to the aim of tragedy as it is named in the famous definition of tragedy: that is, "accomplishing by means of pity (*eleou*) and terror (*phobou*) the catharsis of such emotion."[109] Whatever the exact meaning of this much-discussed formulation, eliciting certain emotions seems to be at the center of the function of tragedy. Notably, Aristotle, immediately before he starts talking about *lexis* in Chapter 19, parallels tragedy with rhetorical speeches as regards the production of certain effects by means of the form:

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103 *Poet.* 22, 1459a14. It is not quite clear what κόσμος/*kosmos* means, which I translated as "ornament" following Janko 1987, 32. In one passage of the *Rhetoric*, it means "epithet" (*Rhet.* III 7, 1408a14).
104 τέταρτον δὲ †τῶν μὲν λόγων† ἡ λέξις· λέγω δέ, ὥσπερ πρότερον εἴρηται, λέξιν εἶναι τὴν διὰ τῆς ὀνομασίας ἑρμηνείαν, ὃ καὶ ἐπὶ τῶν ἐμμέτρων καὶ ἐπὶ τῶν λόγων ἔχει τὴν αὐτὴν δύναμιν. (*Poet.* 6, 1450b13–15). It is not clear to what the parenthesis "as we said earlier" refers, because Aristotle has not said anything of the like earlier in the work.
105 In *Poet.* 24, 1460a17, the formulation of the *Rhetoric* τὸ δὲ θαυμαστὸν ἡδύ ("the admirable is pleasant") recurs, but only with regard to marvelous elements of the plot in epic poetry; in *Poet.* 4, 1448b13 it characterizes the effect of "learning" through imitations (not as that which enhances it).
106 *Poet.* 6, 1449b25.
107 *Poet.* 6, 1450a7–10.
108 ἐν τούτοις γὰρ ποιοῦνται τὴν μίμησιν (*Poet.* 6, 1449b33 f.).
109 *Poet.* 6, 1449b24–28.

> It is clear that in the events (*en tois pragmasin*) too, that one should make use of the same forms (*apo tōn autōn ideōn*) when one has to make them pitiable, dreadful, important or probable, except that there is a difference insofar as these (sc. effects) should appear without instruction (*aneu didaskalias*), while those in speech (*en logois*) should be produced by the speaker and arise from speech.[110]

This paragraph is part of a small section on *dianoia* ("thought, reasoning") which precedes that on *lexis*. Aristotle refers the reader to the *Rhetoric* for details on *dianoia*[111] and goes on to say, in our present passage, that the *ideai* (forms) used for achieving certain effects are the same in (the representation of tragical) events (*en tois pragmasin*) as in speeches (*en logois*) – with the exception that the presentation in speeches is mediated (it is a kind of instruction) but that it is direct in (tragic) poetry.[112] Although Aristotle still seems to be talking about *dianoia*, the statement is so general that it could also apply to the following *lexis* account or serve as a bridge between the accounts on the two aspects of the form. The term *ideai*, which denotes the "forms" that are the same in rhetoric and tragedy, is notoriously vague and multi-faceted; here, with respect to *dianoia*, it seems to refer to forms of action and argument, respectively, but it may equally be referred to different kinds of literary form.[113] With regard to *lexis*, the passage could imply that it relates the poetic action directly, whereas in speeches, it accompanies what the speaker says *about* an action. In any case, the passage explicitly establishes that the form of tragedy is no less functional than that of rhetorical speeches, mentioning *eleos* and *phobos* among the desirable effects of the tragic form.[114] That is to say, the function of the mix of clarity and sublimity in the good style is to produce emotions rather than to produce (primarily) comprehensibility; this explains the higher proportion of unusual, potentially obscure terms; a certain degree of clarity is nevertheless needed insofar as comprehension is necessary for developing emotions toward something. Notably, even with regard to poetry Aristotle does not seem to have in mind any aesthetic functions of the form.

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110 δῆλον δὲ ὅτι καὶ ἐν τοῖς πράγμασιν ἀπὸ τῶν αὐτῶν ἰδεῶν δεῖ χρῆσθαι ὅταν ἢ ἐλεεινὰ ἢ δεινὰ ἢ μεγάλα ἢ εἰκότα δέῃ παρασκευάζειν· πλὴν τοσοῦτον διαφέρει, ὅτι τὰ μὲν δεῖ φαίνεσθαι ἄνευ διδασκαλίας, τὰ δὲ ἐν τῷ λόγῳ ὑπὸ τοῦ λέγοντος παρασκευάζεσθαι καὶ παρὰ τὸν λόγον γίγνεσθαι (*Poet.* 19, 1456b2–7). For parts of this translation, cf. Janko 1987, 25.

111 For the relative dating of the two works cf. Rapp 2013, 287.

112 Something similar seems to be suggested by Janko 1987, 125: "Many of the effects the reasoning produces can also be produced by the incidents: there is a rhetoric of action as well as of words"; differently, Fuhrmann 1982, 127: "Der Redner findet den Stoff vor, mit dem er sich befaßt; er kann ihm nur mit Hilfe der Darstellungsweise die erstrebten Wirkungen abzugewinnen suchen. Der Dichter schafft sich seinen Stoff (und sei es nur durch seine Wahl); er hat daher die Möglichkeiten, die erstrebten Wirkungen schon in den Geschehnissen selbst zur Geltung zu bringen." However, Aristotle does not talk about the choice of the subject here.

113 Cf. *Poet.* 5, 1449b8 on 'the iambic form' (*tēs iambikēs ideas*).

114 Aristotle also mentions 'importance' and 'probability' apart from pity and terror as effects to be evoked by tragedy, but the former two seem to be subordinate to the latter.

In accordance with his definition of the good style in the *Poetics* ('clear and not banal'), Aristotle recommends a mixture of common and unfamiliar *onomata* in Chapter 22 of the work. He classifies as "unfamiliar" (*xenikon*) "everything that is contrary to what is common" (πᾶν τὸ παρὰ τὸ κύριον/*pān to para to kurion*), in particular, "exotic name" (γλῶττα/*glōtta*), "metaphor" (μεταφορά/*metaphora*), ornament (ὁ κόσμος/*ho kosmos*), and "lengthening" (that is, of a word; actually "extension"; ἐπέκτασις/*epektasis*); but "lengthenings" (αἱ ἐπεκτάσεις/*hai epektaseis*) are also, along with "curtailments" (ἀποκοπαί/*apokopai*) καὶ "alterations of words" (ἐξαλλαγαὶ τῶν ὀνομάτων/*exallagai tōn onomatōn*), mentioned as means which produce clarity and non-banality at the same time.[115] In a later passage, also "double names" (διπλοῖς ὀνόμασι/*diplois onomasi*, τῶν δ' ὀνομάτων τὰ μὲν διπλᾶ/*tōn onomatōn ta men diplā*) are mentioned together with exotic and metaphorical names, which suggests that they too belong to unfamiliar language,[116] although they are merely introduced as one kind of composite *onoma* in Chapter 21.[117] Too much of the unfamiliar will lead either to αἴνιγμα (*ainigma*, "riddle"), that is, in the case of too many metaphors, or to βαρβαρισμός (*barbarismos*, "gibberish") in the case of using only exotic names.[118] Some kinds of terms which are classified as *xenikon* in Chapter 22 are mentioned as categories of their own alongside the category of *kurion* in the previous Chapter 21: "Every word (*onoma*) is either common (*kurion*), exotic, a metaphor, an ornament, made-up, lengthened, reduced (ὑφηρημένον/*huphēirēmenon*) or altered."[119] The term *huphēirēmenon* (later replaced by the synonymous term ἀφῃρημένον/ *aphēirēmenon*)[120] corresponds to what Aristotle calls *apokopai* ("curtailments") in Chapter 22 and refers to words from which something, that is, a syllable or letters, is taken away.[121] A means mentioned here but left out in the classification of "the unfamiliar" in Chapter 22 is that of "neologism/made-up" (πεποιημένον/*pepoiēmenon*). In Chapter 21, it appears at first as if *glōtta* was the opposite category of *to kurion*, since: "By common, I mean a name which a particular people uses, by exotic, I mean one which other people use."[122] But the subsequent categories also are all defined with respect to how they deviate from what one is used to. Aristotle himself draws the conclusion that the categories are relative rather than absolute ones: "Consequently it is obvious that it is possible for the same name to be both exotic and standard, but not for the same people."[123] At the end of this section, I will go through the remarks which Aristotle makes on the form of

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115 *Poet.* 22, 1458a22 f., a31–b5. The addition "of words" (*tōn onomatōn*) is to be taken *apo koinou* with all three nouns *epektaseis*, *apokopai*, and *exallagai*.

116 *Poet.* 22, 1459a4–6.

117 *Poet.* 21, 1457a31 f.

118 *Poet.* 22, 1458a23–26.

119 ἅπαν δὲ ὄνομά ἐστιν ἢ κύριον ἢ γλῶττα ἢ μεταφορὰ ἢ κόσμος ἢ πεποιημένον ἢ ἐπεκτεταμένον ἢ ὑφῃρημένον ἢ ἐξηλλαγμένον (*Poet.* 21, 1457b1–3).

120 *Poet.* 21, 1458a1–7.

121 *Poet.* 21, 1458a2 f.

122 *Poet.* 21, 1457b3 f.

123 *Poet.* 21, 1457b4 f.

terms and their relation to clarity in his theoretical works on science. It is in different context of the *Organon* that Aristotle unsystematically refers to issues of the linguistic form, mostly within discussions of definitions. Because of this focus, Aristotle's remarks specifically concern the terminological form. In this way, they seem to be highly relevant for our question. However, the focus of the discussion is rather narrow each time so that Aristotle's remarks on the terminological form do not automatically reveal Aristotle's take on (his own) philosophical or scientific terminology.

The subject of the *Topics*, for instance, is, as Aristotle mentions it at the outset of the work, the "dialectic deduction" (ὁ διαλεκτικὸς συλλογισμός/*ho dialektikos sullogismos*),[124] that is, the deduction from 'approved opinions' (ἔνδοξα/*endoxa*) rather than from the first principles. These syllogisms are developed as part of an exercise of argumentation which consists of the questions and answers of two interlocutors, and the *Topics* provides an argumentative method for either opponent: the questioner, who tries to refute the position of answerer, and the answerer, who wants to defend the position taken.[125] Although Aristotle describes the subject of the work in such a way as for it to appear universally relevant[126] and promises that the method will be useful beyond this communicative situation, amongst other things for "the philosophical sciences" (*pros tas kata philosophian epistēmas*), it is not clear how exactly the dialectic method is part of Aristotle's writings and accordingly, how it is relevant for interpreting them.[127] In Book 8 (Θ), he explicitly states that the preceding books, all concerned with the discovery of *topoi*, that is, instructions for the construction of certain types of dialectical arguments,[128] is relevant for the dialectician and philosopher alike, whereas the present book Θ about the arrangement of the questions (of the

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[124] *Top.* A 1, 100a22 f.

[125] Malink 2021, 82.

[126] *Top.* A 1, 100a18–23; cf. Wagner & Rapp 2004, 268 with reference to the beginning of the *Rhetoric* (I 1, 1354a1–11) in which Aristotle describes rhetoric as the "counterpart" of dialectic.

[127] To be sure, Aristotle, on the one hand, goes through the difficulties on both sides of a subject at the beginning of his works, which is one of the two ways in which he says that dialectic is useful for the philosophical sciences; this, however, only concerns the preliminary process of each inquiry. On the other hand, Aristotle claims that dialectic is useful for the first principles (*ta prōta, hai archai*) of each science, but it is not clear how he envisages its contribution in finding them (see Wagner & Rapp 2004, 273; Malink 2021, 82). See also more generally on the relationship between Aristotle's philosophical writings and the dialectical method Wagner & Rapp 2004, 35–38.

[128] Wagner & Rapp 2004, 29 ("Anleitung zur Konstruktion dialektischer Argumente eines bestimmten Typs"). This is at least what can implicitly be concluded about the term *topos* from what Aristotle provides when he announces one; it is again telling regarding the subject of our chapter that Aristotle does not define the term *topos* once in his work τοπικά (*topika*), although six of its eight books list *topoi*. This is at least what can implicitly be concluded from what Aristotle provides when he announces a *topos*; it is again telling regarding the subject of our chapter that Aristotle does not define the term *topos* once in his work τοπικά (*topika*), although six of its eight books list *topoi* (Wagner & Rapp 2004, 29).

questioner) only concerns the dialectician.[129] We will see, however, that the discussion of terminological features is similar in book Θ as in the preceding books.

In the context of providing tools for refuting and defending arguments, Aristotle mentions features of the terminological form mostly insofar as they make definitions or statements unclear and therefore refutable. At the beginning of book Z, which deals with definitions, Aristotle mentions "the use of unclear language" as one of two branches of incorrectness.[130] The term which I have translated as 'language' here (ἑρμη-νεία/*hermēneia*) is almost equivalent to *lexis*: it can refer to a single (kind of) 'expression' or more generally to 'style'.[131] In Z 2, Aristotle goes through different "*topoi* of the unclear" in definitions, that is, different argumentative rules or methods which the questioner can employ to find out whether their opponent in a dialectical exercise is being unclear and whether they can be refuted on these grounds. For example, "one *topos* of the unclear is (sc. to consider) whether what is being said is homonymous with something."[132] While in this context, Aristotle claims that incorrect (including unclear) definitions are easy to refute because of the mistakes which they contain,[133] he says in Θ 3, which is devoted specifically to the question of refutability, that it is precisely unclear definitions that are the most difficult to refute (δυσεπιχειρητότατοι/*dusepikheirēto-tatoi*). Here, such definitions are called unclear (*asaphē*) which contain *onomata* which are unclear (*adēla*) regarding whether they are used in ways which have been classified as unclear in book Z, such as in a metaphorical way, or in a clear way.[134] Reference to unclear statements is made again in Θ 7, which gives advice on what to do when one encounters what is said "in an unclear way" or "in many ways," and on how to dissolve

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129 *Top.* Θ 1, 155b3–16, see Wagner & Rapp 2004, 346.

130 *Top.* Z 2, 139b12 f.

131 Cf. Demetrius, *On style* (*Peri hermēneias*); by contrast, in Aristotle's treatise of the same title on the relationship between language und logic, *hermēneia* means "interpretation" (cf. the Latin title *De interpretatione*, whereas Demetrius title has been handed down as *De elocutione*, which refers to one of the five *officia oratoris* in classical rhetoric, i.e., the stylization of the speech).

132 *Top.* Z 2, 139b19 f.

133 The argument here is somewhat obscure: "It remains, then, to say how to pursue the matter if the object has been either not defined at all, or if it has been defined incorrectly. First, then, we must examine whether it has been defined incorrectly; for it is easier to do it in some way than to do it correctly – it is clear, then, that there are more mistakes in the latter case because it is more difficult, so that the attack [i.e., the refutation] becomes easier in the latter case than in the former" (*Top.* Z 1, 139b6–10). The first distinction here is between not defining at all and defining incorrectly, the second one is between defining "in some way" and "defining correctly," so the two distinctions do not exactly overlap. What Aristotle seems to say is that the attempt to define correctly often ends up in an incorrect definition which contains numerous mistakes and is therefore easy to attack, whereas defining "in some way" seems to end up in no definition at all (which can hardly be refuted) rather than, as one might think, in a definition which is even more likely to be incorrect than a definition that was meant to be done correctly to begin with.

134 *Top.* Θ 3, 158b8–13.

the obscurity.[135] Thus, the *Topics* considers features of the terminological form only from the point of view of 'unclarity', that is, obscurity. While obscurity comes in useful when one tries to refute somebody, it emerges *ex negativo* that one must be clear in order not to be refuted.

Only once – in the above-mentioned passage in which Aristotle defines obscurity as a form of incorrectness – he positively names clarity as an aim of the form of definition: "for the one who defines must use the clearest possible language (*saphestatē tē hermēneia*), since the definition is provided for the sake of gaining knowledge (τοῦ γνωρίσαι/*tou gnōrisai*)."[136] As in the *Rhetoric*, the use of clear language – here *hermēneia*, there *lexis* – is recommended for cognitive reasons, with *gnōrisai* referring both to the communicative activity of the one who defines ('to make something known') and to the cognitive act of the recipient of the definition ('to gain knowledge/understand'). The superlative "clearest" shows that – unlike the rhetorical and poetical *lexis* – the *hermēneia* of definitions does not allow for any obscurity, and nowhere in the *Topics* is obscurity granted any advantage.

As features of the form and use of terms which account for obscurity in definitions, Aristotle lists, in *Topics* Z 2, homonymy (ὁμωνυμία/*homōnumia*, (τὸ) ὁμώνυμον/ *(to) homōnumon* or τὸ πλεοναχῶς λεγόμενον/*to pleonakhōs legomenon*, 'what is said in many ways');[137] lack of distinction of the different ways of 'what is said in many ways', especially if the homonymy escapes notice; metaphor (*metaphora*, τὸ κατὰ μεταφορὰν λεγόμενον/'what is said metaphorically'); metaphors which do not fit so that must be understood in a literal way; uncommon expressions (οὐ κείμενα ὀνό-ματα/*ou keimena onomata*, 'non-established terms'; τὸ μὴ εἰωθός/*to mē eiōthos*, 'what is uncommon'; what "is used neither homonymously nor metaphorically nor literally (οὔτε καθ' ὁμωνυμίαν οὔτε κατὰ μεταφορὰν οὔτε κυρίως εἴρηται/*oute kath' homōmu-mian oute kata metaphoran oute kuriōs eirētai*); obscurity of the definition of the opposite; obscurity of the *definiendum*."[138] In *Topics* Θ 3, Aristotle adds *onomata* which are unclear regarding whether they are said "simply" (ἀπλῶς/*haplōs*) or "in many ways" (here, πολλαχῶς/*pollakhōs*) and whether "literally" (*kuriōs*) or "metaphorically" (*kata metaphoran*).[139] *Topics* Z 2 and Θ 3 are narrowly focused on the question whether the definition clearly defines the *definiendum* and whether the *definiens* is clearly stated. In this way, the passage from the eighth book Θ is closely related to

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135 *Top.* Θ 7, 160a17–34. Here, Aristotle distinguishes obscurity from that which is said in many ways whereas in Z 2, the latter falls under the former (see below).

136 *Top.* Z 1, 139b13–15.

137 Homonymy and 'what is said in many ways' here appear synonymously and indeed seem to be identical in Aristotle's thought (cf. Hübner 2021, 382 with reference to Shields 1999, 22–28, quoted below in n. 162).

138 *Top.* Z 2, 139b19–140a22.

139 *Top.* Θ 3, 158b8–12.

that of the sixth book Z despite Aristotle's remark that the eighth book, by contrast with the preceding ones, is no more relevant for the philosopher.

In the context of talking about definitions in *Topics* Z 2 and Θ 3, 'what is said in many ways' appears as a form of obscurity. However, in Θ 7, which gives advise on how to answer to "what is said obscurely" and what is "said in many ways" in a dialectic debate, Aristotle precisely distinguishes obscurity and homonymy (i.e., 'what is said in many ways'), since "what is said in many ways" can also be "intelligible" (γνώριμον/ *gnōrimon*), that is, clear.[140] In this passage, Aristotle does not consider the possibility that 'what is said in many ways' (here, but not in the former passage, used synonymously with τὸ ἀμφίβολον/*to amphibolon*, 'ambiguity') could be unclear, whereas in the former passage, homonymy automatically seems to lead to obscurity. Maybe 'what is said in many ways' is more likely to be clear if the different ways are explicitly distinguished (as Z 2 mentions the lack of such distinction as another form of obscurity); maybe a term which is said in many ways can be clear from its context; or maybe the differing evaluation of 'what is said in many ways' in Θ 7 has to with the fact that this chapter, unlike the other two, is not focused on definitions in which homonymy would count as unclear in any case. But, either way, one can see that the border between those terminological features that, according to Aristotle, produce clarity and those that lead to obscurity is not always clear-cut.

Similar remarks on clarity and terminological form can be found in the second book of the *Posterior Analytics*, the work in which Aristotle unfolds his theory of *epistēme*, that is, the science of demonstration, which he conceptualizes as an axiomatic science.[141] The relation of this theory to Aristotle's own philosophical and scientific writings is not quite clear, as he does not apply it himself, at least not consistently (except in parts of the *Prior Analytics*). For this reason, there has been much debate about whether the *Posterior Analytics* really provides a theory of knowledge or rather instructions for effectively presenting knowledge from a didactic stance.[142] In any case, Aristotle's brief reflections about the necessity of clarity in definitions here are quite similar to his statements in the context of dialectics. In *Posterior Analytics* II 3, Aristotle does not explicitly refer to the terminological form by using the term *onoma* but the formal features which he says one should avoid for the sake of clarity are those mentioned in the above passages from the *Topics*. At the end of the chapter, which is devoted to "how to hunt out (θηρεύειν/*thēreuein*) the things predicated in 'the what it is' (ἐν τῷ τί ἐστι/*en tō ti esti*),"[143] that is, in definitions, Aristotle emphasizes the usefulness of the inductive method of defining a general term by starting from its particulars (that is, from the subterms of the *definiendum*).[144] For in this way,

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140 *Top.* Θ 7, 160a17–29. For the (partial) synonymy of *gnōrimos* and *saphēs* cf. *Gen. anim.* II 8, 747a27.
141 Malink 2021, 80.
142 Malink 2021, 81.
143 *An. post.* II 13, 96a22 f.
144 Detel 1993, 780.

the requirement of the clarity of the definition[145] could be ensured, as the two main sources of obscurity, homonymies (*homōnumiai*), and metaphors (*metaphorai*) are avoided.[146] While it is evident why "homonymy more often escapes notice among general things than among undifferentiated ones,"[147] the method also avoids obscurity through metaphor since it ensures that a term is attributed to the correct class.[148] That is, Aristotle here mentions those two main features of the terminological form (homonymy and metaphor) which he – apart from uncommon words – also in the *Topics* classifies as those that induce obscurity. Note that he himself uses a metaphor in doing so: *thēreuein*/"to hunt out."

In the context of the treatments of the correctness of definitions, some of the terminology is ontological rather than rhetorical: for example, synonymy is defined in the *Categories* in the following way: x and y are synonyms if they have the same name F, and insofar as they are F, have the same definition D.[149] Aristotle's example is surprising from a rhetorical point of view: humans and cows are synonyms since they are both living beings with the same definition of living being.[150] In the *Rhetoric*, by contrast, Aristotle provides a more common, rhetorical definition of synonymy: "I call both proper and synonymous the terms 'going' and 'walking': for these two are proper and have the same meaning."[151] Homonyms, according to the definition of the *Categories*,[152] are either things which share the same name *apo tukhēs* ('by chance'),[153] that is, which are not generically related such as the different meaning of the word *zōon* ('living being', 'image', 'picture');[154] or the homonymous things can be closely related in the case of "focused homonymy,"[155] in which different but related things carry the same name either in a primary sense, which is the "focal meaning"[156] of the homonymy, or in a derived sense; these are, thus, homonyms *pros hen* ('in relation to one').[157] This second sense is again ontological rather than rhetorical:[158] for example,

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145 *An. post.* II 13, 97b31: δεῖ ὑπάρχειν ἐν τοῖς ὅροις τὸ σαφές ("there must be clarity in the definitions").

146 Detel 1993, 743, 780 f.; Barnes 1993, 250.

147 *An. post.* II 13, 97b29–31.

148 Detel 1993, 780. Aristotle does not explicitly draw this connection, but simply says that one should not define by means of metaphors since one also should not discuss by means of metaphors (*An. post.* II 13, 97b37–39).

149 Horn 2005b, 560 with reference to *Cat.* 1, 1a6–12; Hübner 2021, 382.

150 Ibid.

151 λέγω δὲ κύριά τε καὶ συνώνυμα οἷον τὸ πορεύεσθαι καὶ τὸ βαδίζειν· ταῦτα γὰρ ἀμφότερα καὶ κύρια καὶ συνώνυμα ἀλλήλοις (*Rhet.* III 2, 1404b39–05a2).

152 *Cat.* 1, 1a1–6.

153 *Eth. Nic.* I 4, 1096b26 f.

154 Horn 2005a, 259.

155 Hübner 2021, 384–385.

156 Owen 1960, 169.

157 Hübner 2021, 384–385.

158 Horn 2005a, 259.

the 'health' of humans, medicine, color of the cheek, and gymnastics are all "focused homonyms" in relation to 'health'.[159] In the third sense, a painted or stone eye is an eye (only) homonymously.[160] This third, likewise non-rhetorical sense is related to the aforementioned second one insofar as the things that carry the same name are closely related. Although the origin of this terminology is ontological rather than rhetorical, it enables Aristotle to look at terms both from a linguistic-rhetorical and from an onto-logical-philosophical point of view. 'Homonymy' is 'what is said in many ways' looked at from the side of language, and the above-mentioned "identity" of homonymy and 'things said in many ways'[161] allows for calling both things as well as names both 'homonymous' and 'said in many ways'.[162]

Besides, there is further indication that the present account also has a rhetorical side: Terms like homonymy and synonymy which are philosophical in origin are men-tioned alongside terms of rhetorical origin such as metaphor. Moreover, the array of terminological features mirrors that of the *Poetics* and *Rhetoric*. Those features are treated under similar headwords denoting 'style' and are reviewed from the overall perspective of clarity. In the *Sophistical Refutations*, homonymy is named as a linguis-tic means of the rhetorical deception of the sophists.[163] Finally, the *Topics* as a whole, from which most of our passages stem, can be read, amongst other things, as a rheto-ric of scientific (dialectic) discourse,[164] although the title of the work may be taken to show an ambivalent stance toward rhetoric.[165] One note about Aristotle's own use of terms in the theory of definition: Although the terms 'homonymy' and 'what is said in many ways' indicate a different perspective on the same thing, they are, in a way syn-onymous. This means that Aristotle does not only use synonymy precisely in the con-text of recommending avoidance of synonymy and homonymy, but even does so with

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159 Hübner 2021, 284.

160 *De an.* II 1, 412b12–22, cf. Horn 2005a, 259 f.; Hübner 2021, 377.

161 Hübner 2021, 382: "Die Aussagevielfalt wird meist nicht von der Homonymie unterschieden, er-scheint aber an einigen Stellen als Oberbegriff. Gegenüber der Auffassung, die (. . .), hat sich die Auf-fassung durchgesetzt, dass die Homonymie identisch mit der Aussagevielfalt ist (. . .). Der gelegentlich geübte Kontrast zur Homonymie kann als Kontrast zur zufälligen Homonymie verstanden werden (EN I 4, 1096b27), die vorliegt, wenn die Bedeutungen eines Ausdrucks keinerlei sachlichen Zusam-menhang besitzen."

162 Hübner 2021, 382: "Die Identität von Homonymie und Aussagevielfalt erlaubt es Aristoteles zu sagen, dass nicht nur sprachliche Ausdrücke vielfach ausgesagt werden, sondern auch nichtspra-chliches Seiendes. Wenn ein Name homonym auf verschiedene Dinge zutrifft, gelten die Dinge als Ho-monyme (bezogen auf den Namen); und wenn ein Name in vielen Weisen von verschiedenen Dingen ausgesagt wird, gelten analog die Dinge selbst als vielfach Ausgesagtes."

163 *Soph. El.* 4, 165b23–166a23 (Malink 2021, 83).

164 "Rhetorik des wissenschaftlichen Streitgesprächs" (Wagner & Rapp 2004, 38).

165 The term, originally from pre-Aristotelian rhetoric, where it denotes commonplaces or set pieces – indicates the proximity to rhetoric, although Aristotle criticizes the unsystematic approach of using such set pieces so that he seems to mark himself off the rhetorical use of topoi precisely by using this term for his systematic approach to argumentation.

respect to one of these terms. Also, the term 'in many ways' in the respective phrase is not fixed (*pollakhōs, pleonakhōs*).

I have reviewed both of Aristotle's *lexis* accounts and his statements on the form of terms in the *Organon* at such great length to show their potential relevance for describing and interpreting Aristotle's own terminology. While none of his contributions to the subject of (terminological) form is specifically designed for describing his own terms or providing norms for terms in science and philosophy, all accounts somehow pertain to it in a general way: in terms of the overall function ascribed to the form and in terms of the arsenal of stylistic means provided. As far as function is concerned, all excursions on form display a common, functional perspective in which clarity has a decisive role and must be counterbalanced by sublimity (and strangeness, which is responsible for sublimity) to a different extent, respectively. They show a gradation of the meaning which clarity has for the form and conversely of that which sublimity/strangeness has: The stylistic form of poetry should result in a mixture of clarity and strangeness, the proportion being undefined, but that of strangeness, in any case, considerable; rhetoric prescribes a strong tendency toward clarity, whereas strangeness is only granted some but not too much importance; and according to the remarks in the scientific context, only clarity is accepted there.

Regarding the means of style, all three discourses, the poetic, the rhetorical, and the scientific one, center around the form and use of *onomata*. In the scientific context of the *Organon*, the reference of the term *onomata* comes closer to what we might have in mind when talking about terminology (i.e., the central terms), whereas in the *Rhetoric* and *Poetics*, the reference of *onomata* is closer to all parts of the language; nevertheless, the term *onomata* is used in all three discourses, and the same kinds, problems, and stylistic features that are associated with it are discussed in all of them. At the center of the debate about features of style, Aristotle has put the proportion of ordinary and strange terms which he differently calibrates each time in accordance with the functional gradation of proportion of clarity and strangeness: The works on science only allow for common words as terms, the *Rhetoric* mainly, but not exclusively, common words, and the *Poetics* a mix of common and uncommon words. That is, the shaded, genre-dependent evaluation of *onomata* reveals a common perspective which corresponds with the common functional perspective on the role of clarity in each type of text.

In other words, the different discussions of (terminological) form and clarity form a continuum, as it were, with the individual genre-related contributions differing not essentially but only quantitatively displaying varying emphases. On this continuum, Aristotle's philosophical writings and scientific treatises seem to take a middle position between rhetoric and the ideal of formal logic of the *Organon* because they broadly share the genre and subject area of the latter but lack their rigorousness. This is confirmed by the central passage which implicitly locates knowledge texts, insofar as they are *didaskaliai*, except if they teach geometry, in the vicinity of speeches

(because these are also *didaskaliai*) and insinuates that knowledge texts – if only to a certain extent – fall under the scope of the *Rhetoric*.

The Aristotelian discourse on form as a whole suggests that the position of a genre on the continuum is not fixed, that the transitions on the scale are smooth[166] and that even disparate genres are linked: The *didaskalia* passage, by referring to the aim of clarity, calls up the common cognitive framework of the form; in doing so, it especially links rhetoric and science (under the heading *didaskalia*) which each other, as they most of all are focused on this aim, but it also links knowledge texts with poetry. This underlines that Aristotle's stylistic recommendations can be transferred to his own work; in fact, since Aristotle does not seem to allow for form outside the cognitive framework, transferring its norms to his own text even seems to be inevitable. Thus, from a combination of the position of Aristotle's writings in relation to the discussed genres and the discussion of the same means one should be able to conclude on what would be Aristotle's recommendations even though he has not specified them.

3 Form and Use of Terms in Aristotle: The Example of *aitia*

In the case of the central terms of the discussion of form – *lexis, saphēneia, onomata* – Aristotle does not differentiate the shades of meaning present in these colorful terms. In many other cases, however, Aristotle calls his terms *pollachōs legomena*, 'what is said in many ways', explicitly marking them, in so doing, as homonymous, and subsequently differentiates them. The list of homonymous terms in the above-mentioned 'lexicon', *Metaphysics* Δ, includes αἰτία/*aitia* ("cause"), originally a common legal term.[167] Besides this passage, there are four other places in Aristotle at which he classifies the term: *Metaphysics* A 3,[168] *Physics* II 3,[169] *Posterior Analytics* II 11,[170] and *Parts of animals* I 1.[171] The passage from the *Physics* is almost word for word identical with the one from *Metaphysics* Δ. Since there is reason to believe that Aristotle, in *Metaphysics* Δ, copied it from the *Physics* (and not vice versa),[172] I quote the latter passage here. This distinction of causes comes rather out of the blue: "Aristotle nowhere shows us how he reached it

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166 As we have seen above, certain types of rhetorical prose can be more poetic than some of the more prosaic poetic genres.

167 *Metaph.* Δ 2, 1013a24–34.

168 *Metaph.* A 3, 983a24–32.

169 *Phys.* II 3, 194a16–195a3.

170 *An. post.* II 11, 94a20–24.

171 *Part. anim.* I 1, 639b11–23.

172 Ross 1936, 511; 1924, 292.

nor offers any logical deduction of it.[173] Aristotle states the necessity of inquiring into causes (περὶ τῶν αἰτίων/*peri tōn aitiōn*) as regards their kinds and number, then claims that one can only have knowledge of a thing when one can answer about it "the (question) 'Why?'" (τὸ διὰ τί/*to dia ti*), adding that "this is to grasp the first cause (τὴν πρώτην αἰτίαν/*tēn prōtēn aitian*)," and concludes that we must inquire into the causes of natural change in order to know their principles (τὰς ἀρχάς/*tās archās*).[174] Subsequently, Aristotle proceeds to differentiate four types of causes (which I, unlike Aristotle, number for the sake of clarity):

(1) In one way, then, that out of which as its constituent a thing comes to be (τὸ ἐξ οὗ γίγνεταί τι ἐνυπάρχοντος/*to ex hou gignetai ti enuparchontos*) is called a cause (αἴτιον/*aition*), for example, the bronze of a statue, the silver of a bowl, and the classes of these (sc. materials).

(2) In another way, the form and model (τὸ εἶδος καὶ τὸ παράδειγμα/*to eidos kai to paradeigma*) (sc. is called a cause); this is the account of the what it is to be (ὁ λόγος ὁ τοῦ τί ἦν εἶναι *ho logos ho tou ti ēn einai*) and its classes (as for example of the octave it is the relation 2:1 and in general the number) and the parts of the account.

(3) Moreover, from where the first beginning of the change or of rest is (ὅθεν ἡ ἀρχὴ τῆς μεταβολῆς ἡ πρώτη ἢ τῆς ἠρεμήσεως/*hothen hē archē tēs metabolēs hē protē ē tēs ēremēseōs*) (sc. is called a cause), for example, the adviser is cause (αἴτιος/*aitios*) (sc. of a thing), and the father (sc. is cause of) the child, and generally what makes (sc. is cause) of what is made, and what changes (sc. is cause) of what is changed (τὸ ποιοῦν τοῦ ποιουμένου καὶ τὸ μεταβάλλον τοῦ μεταβαλλομένου/*to poioun tou poioumenou kai to metaballon tou metaballomenou*).

(4) Moreover (sc. a thing is called a cause) as the end (ὡς τὸ τέλος/*hōs to telos*). This is that for the sake of which (τὸ οὗ ἕνεκα/*to hou heneka*), for example, of walking health is the cause. For why (διὰ τί/*dia ti*) does one walk? In order to be healthy, we say, and in saying so, we believe to have indicated the cause (τὸ αἴτιον/*to aition*).[175]

This passage is typically Aristotelian in terms of terminology: it abounds with terms, but these terms are often hardly recognizable, mostly because of their form. Let us start by looking at the central term which the passage aims to define – or rather: at the central *terms*. For what I have invariantly translated as "cause," is, in the Greek, not one single term, but many; or perhaps, it is one term which is not fixed in terms of form: It occurs as an adjective (*aition*, *aitios*), as a nominalized adjective (τὸ αἴτιον/ *to aition*) in the phrase *peri tōn aitiōn* of the introduction of the distinction, and as a noun (*aitia*). Such a paronymy is common in Greek and has been acknowledged by

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173 Ross 1924, 126.

174 *Phys*. II 3, 194b16–23.

175 ἕνα μὲν οὖν τρόπον αἴτιον λέγεται τὸ ἐξ οὗ γίγνεταί τι ἐνυπάρχοντος, οἷον ὁ χαλκὸς τοῦ ἀνδριάντος καὶ ὁ ἄργυρος τῆς φιάλης καὶ τὰ τούτων γένη· ἄλλον δὲ τὸ εἶδος καὶ τὸ παράδειγμα, τοῦτο δ' ἐστὶν ὁ λόγος ὁ τοῦ τί ἦν εἶναι καὶ τὰ τούτου γένη (οἷον τοῦ διὰ πασῶν τὰ δύο πρὸς ἕν, καὶ ὅλως ὁ ἀριθμός) καὶ τὰ μέρη τὰ ἐν τῷ λόγῳ. ἔτι ὅθεν ἡ ἀρχὴ τῆς μεταβολῆς ἡ πρώτη ἢ τῆς ἠρεμήσεως, οἷον ὁ βουλεύσας αἴτιος, καὶ ὁ πατὴρ τοῦ τέκνου, καὶ ὅλως τὸ ποιοῦν τοῦ ποιουμένου καὶ τὸ μεταβάλλον τοῦ μεταβαλλομένου. ἔτι ὡς τὸ τέλος· τοῦτο δ' ἐστὶν τὸ οὗ ἕνεκα, οἷον τοῦ περιπατεῖν ἡ ὑγίεια· διὰ τί γὰρ περιπατεῖ; φαμέν "ἵνα ὑγιαίνῃ," καὶ εἰπόντες οὕτως οἰόμεθα ἀποδεδωκέναι τὸ αἴτιον (*Phys*. II 3, 194b24–35).

Aristotle,[176] but is at least notable in the context of definition. Both because of the formal variety and because the adjective and the noun are extremely common Greek words, the central concept is expressed here rather inconspicuously.

Aitia/aition is said in many ways, as Aristotle confirms[177] after having differentiated the term. This differentiation has a clear structure: Four times, Aristotle first substitutes the term by means of other terms and then supplies examples. Although he, in this way, outlines the range of meanings that are present in *aitia,* he does not explain the content and reference of the meaning of *aitia* itself – this is apparent from the fact that the meaning of the term here and in the other above passages – whether it is "cause" or something like "explanation"[178] or "reason,"[179] that is, whether the term primarily refers to "being" or "thinking,"[180] whether *aitiai* are "things," "facts," or, linguistically, "terms" or "propositions"[181] – is still contested. In any case, the meaning of the term in common language which is still dominant in Plato, 'guilt', 'blame', and 'accusation', is neither part of the scheme nor is it its underlying general sense. All we can say is that it is the "answer to the question 'why?'"[182] Aristotle packages the question as a term in the introduction to his differentiation of *aitia*: "we do not believe to know each thing prior to having grasped *the* '*Why?*'" (*to dia ti*) about it," that is, as we paraphrased it above, prior to having found the answer to the question 'Why?'; for "this is to grasp the first cause."[183]

Unfortunately, thus, the general answer immediately provided to this question here is not merely *aitia,* but rather "the first cause" (*tēn prōtēn aitian*). It is not clear what the simple attribute "first" means in the present passage: whether "proximate" or "ultimate"/"primary." For Aristotle does not explain nor refer to this qualification again in the subsequent distinction of (senses of) *aitia.* Ross argues that while it means "ultimate" at the beginning of the *Physics* in almost the same statement ("For we do not believe to know a thing until we have gained knowledge of its first causes and first principles (*ta aitia ta prōta kai tās arkhās tās prōtās*) (. . .)"),[184] it means "proximate" in our present passage because of the "instances given" in the following one.[185] In the parallel passage from *Metaphysics* A 3, however, which again states that "we say that we know each thing the moment when we believe to gain knowledge of its first cause,"[186] it seems to mean "ultimate," since the focus of the context here is

176 *Cat.* 1, 1a12–15
177 *Phys.* II 3, 194a3 f.
178 Barnes 1993, *passim.*
179 Kirwan 1993, 124.
180 See Barnes 1993, 226 *contra* Ross 1936, 512.
181 Detel 2021, 369.
182 Kirwan 1993, 124 with reference to *Phys.* II 7, 198a14–16.
183 *Phys.* II 3, 194b18–20, my italics.
184 *Phys.* I 1, 184a12–14.
185 Ross 1936, 512.
186 *Metaph.* A 3, 983a25 f. (transl. Ross 1924, 126)

the "knowledge of the causes that are effective from the beginning."[187] Accordingly, although Aristotle proceeds to provide exactly the same fourfold distinction as in the *Physics* (except that he does not offer any examples here), he mentions what it is called 'formal cause' in the reception of Aristotle first (unlike in the *Physics*) and emphasizes its primacy: "we say that one of these (sc. four causes) is the substance (*ousian*) and the 'The what it is to be' (*to ti ēn einai*); for the 'Why?' is finally (*eskhaton*) traced back to the definition (*logon*), and the first 'Why?' is a cause (*aition*) and principle (*arkhē*)."[188] Here, the 'being first' of the cause is explained by *eskhaton*. The use of this adjective shows that more unambiguous terminology than *prōtos* ('first') is available. Thus, it appears that apart from the respective immediate answer to the question 'Why?', there is a kind of primary cause among the four causes, and that there is a "first 'Why?'" corresponding to it, while both primary cause and first 'Why?' may also be referred to by simple terms *aitia* and *to dia ti*.

With regard to the introduction of our *Physics* passage ("we do not believe to know each thing prior to having grasped *the 'Why?'*" (*to dia ti*) about it; this is to grasp the first cause (*aitian*))," this means that the passage equates *to dia ti* with *aitia*, regardless of the instantaneous qualification "first," and indeed, Aristotle often uses *to dia ti* in the place of *aitia*, so that *to dia ti* can be regarded as a term itself – a term which is, in the rhetorical sense, synonymous with *aitia*. Although the nominalized question is highly transparent (there can be no question as to the meaning of the simple question 'Why?'), it does not add anything regarding what could be the meaning of the answer to the question 'Why?', that is, *aitia*. The term *to dia ti* is meaningless and underdetermined; it is a slot that must be filled with meaning in a particular case, a placeholder for a concrete instantiation.

Before Aristotle indeed begins to classify *to dia ti*, he states why it is necessary to grasp the causes of every kind of natural change (so far, he has only argued in general that it is necessary to grasp the first cause of things to know them): it is to know their "principles" (τὰς ἀρχάς/*tās arkhās*) and trace every problem back to them. That is, Aristotle says "principles" where we would expect "causes." The term *arkhē* is another one of these Aristotelian terms which are simple in form but extremely multi-faceted in meaning, both due to their origin and long history in the common language and to the special philosophical sense attached to it – and, not least, to the overlap of the common and technical senses. Of course, Aristotle's informed readers know that he closely, sometimes even synonymously, relates the terms *arkhē* and *aitia*, as for example in *Metaphysics* Δ 1 in which he distinguishes the ways in which *arkhē* is said: "Causes (*ta aitia*) are said in an equal number of ways; for all causes (*panta ta aitia*) are principles

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187 τῶν ἐξ ἀρχῆς αἰτίων (. . .) ἐπιστήμην (*Metaph.* A 3, 983a24 f., for the translation cf. Szlezák 2003, 7).
188 *Metaph.* A 3, 983a27–9.

(*arkhai*)."[189] Despite this statement, the terms are not always synonymous.[190] Either one carries the respective meaning from the common language, and they function as an answer to different questions. My point here is that Aristotle relies on the synonymy in the present passage from *Physics* II 3 and indeed makes use of it. Notably, Aristotle employs the term here in a linguistic context which is the same as the one in which he uses *aitia* in the above passage from *Metaphysics* A3: both employ the terminology of 'knowing' (*eidenai*) and 'tracing something back to' (*anagein*) with regard to *arkhē* and *aitia* (more precisely, to the primary cause 'logos'), respectively.[191] In *Metaphysics* A 3, Aristotle subsequently uses the two terms again in the same breath: "the first 'Why?' is a cause and principle (*aition . . . kai arkhē*).[192] Since Aristotle, here, as often, relates two main terms by means of a simple, underdetermined *kai* ("and"), it is not clear how the two terms are related. They could be used synonymously and, thus, pleonastically for the purpose of emphasis; they could function as *hendiadys*, so that the two terms, in sum, semantically amount to something more than what each of them means by itself; or Aristotle could mean that "the first 'Why?'" is both "cause" and "principle" in the same way or at the same time.

Turning now to the above-quoted taxonomy of *aitia* in the *Physics* itself, we realize that the terms which are given as an answer to the question 'Why?' are, by themselves, no less abstract and meaningless than the term *to dia ti*. This is because several of these terms precisely take the form of *to dia ti*: of nominalized questions, that is, questions that are marked as terms by the neuter article put in front of them. Their formulaic generality enables their application in each and every case where they need to be posed and answered specifically. For example, the question which inquires after the 'final cause' (τὸ οὗ ἕνεκα/*to hou heneka*, "that for the sake of which") is answered exemplarily: "For why (διὰ τί/*dia ti*) does one walk? In order to (ἵνα/*hina*) be healthy (. . .)."[193] This shows, incidentally, that the question *dia ti* may adopt different senses according to the different causes for which it asks, and is, thus, homonymous. The nominalized relative clause *to hou heneka* appears in slightly modified form as a nominalized question (τὸ τίνος ἕνεκα/*to tinos heneka*) in the scheme of *Posterior Analytics* II 11.[194] While both *to hou heneka* and *to dia ti* are semantically transparent, a more complicated instance of a nominalized question is the famous τὸ τί ἦν

189 The divergent classification of *arkhē* and *aitia* in *Metaphysics* Δ 1 and 2, respectively, has to do with the origin of the text of *Metaphysics* Δ 2 in the *Physics*, which is not to say that Δ 2 has been inserted into the *Metaphysics* only after Aristotle (Ross 1936, 511).

190 On the relation of the two terms and on the linguistic cause of their semantic overlap ("daß die Fragen nach dem Woher (ὅθεν) und nach dem Warum (διὰ τί) nicht beziehungslos nebeneinander stehen, sondern sich in ihren Intentionen in bestimmten Fällen unterscheiden") see Wieland 1992, 178 f.

191 *Phys.* II 3, 194b17–23 and *Metaph.* A 3, 983a25–28.

192 See above, p. 165 with n. 188.

193 *Phys.* II 3, 194b33 f.

194 *An. post.* II 11, 94a23.

εἶναι (*to ti ēn einai*, literally translated: 'The what it is to be').[195] Although it only consists of ordinary words, the result is a highly artificial construct, and the formation and exact meaning of this term is still far from clear.[196] In this way, too, it is typical of Aristotelian terms. In any case, *to ti ēn einai* is another instance of a term that itself has no meaning but awaits implementation in a particular case. While in the classifications of *Metaphysics* A 3 and *Posterior Analytics* II 11, *to ti ēn einai* is one of the terms which represent the 'formal cause', it occurs as an attribute of *logos* in the taxonomy of the *Physics*, resulting in a variation of the term for 'formal cause': "the account/definition of the what is was to be" (*ho logos hou to ti ēn einai*).[197]

The formulaic term *to ti ēn einai* still remains recognizable because it is so important and famous, but in other cases, the syntactical variation of terms which consist of small and ordinary words can make it hard for a reader to identify these terms in the first place and to determine their meaning. The problem of recognizability is also connected to the length of the terms: a collocation like *to ex hou gignetai ti enuparchontos* ("that out of which as its constituent a thing comes to be")[198] is hardly recognizable as a term, and the question is whether it may count as a term at all. In fact, from a formal point of view, it is only the *to* which could point to the terminological status of the term. But what if even the thematizing article is missing, like in the version of the term in the *aitia* scheme of *Metaphysics* Δ 2, where a nominalized phrase dissolves into a mere relative clause (*ex hou gignetai ti enuparchontos*)?[199] (This is, in fact, the only difference in this passage compared with the text of the *Physics*.) It seems justified to regard the article-including phrase *to ex hou gignetai ti enuparchontos* as a term since it stands for the 'material cause' analogously with the other terms of the *Physics* passage which are used to denote the remaining causes and of which many are also formed in the nominalizing way. The justification in turn for regarding as a term the mere non-nominalized relative clause from *Metaphysics* Δ 2 is that it – except for the article – agrees word for word with the nominalized version. This example indicates a certain preference of the periphrastic form because the parallel passages show that other, more concise and thus more term-like terms would have been available to express the notion of 'material cause', such as *hulē* or *to hupokeimenon*.

A similar case is that of the 'terms', if there are any at all, for the 'efficient' cause: it is called, in the present *Physics* passage and in the *Metaphysics* lexicon ὅθεν ἡ ἀρχὴ τῆς μεταβολῆς ἡ πρώτη ἢ τῆς ἠρεμήσεως (*hothen hē archē tēs metabolēs hē protē ē tēs ēremēseōs* "from where the first beginning of the change or of rest is"). A shorter version, likewise non-nominalized, which uses a different noun, can be found in *Meta-*

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195 On the structure of this kind of Aristotelian terms cf. the essential contributions by Tugendhat 1958; Wieland 1992, 173–186 ("Zur Thematisierung der Funktionalbegriffe").

196 Cf. Szlezák 2003, xxix.

197 *Metaph.* A 3, 683a27; *An. post.* II 11, 94a21; *Phys.* II 3, 194b27.

198 *Phys.* II 3, 194b24.

199 *Metaph.* Δ 2, 1013a24 f.

physics A 3 ὅθεν ἡ ἀρχὴ τῆς κινήσεως (*hothen hē arkhē tēs kinēseōs*, "from where the beginning of movement is"). Finally, the same latter term, but nominalized this time, is used in *Parts of Animals* I 1. As the headword of the distinction there is the noun *aitia*, the nominalizing article is the feminine one for a change rather than the neuter article within the terms from the passages of the *Physics* and *Metaphysics* where the headword is the neuter *aition*.[200] The common element of the variations of the term-like collocation is the small phrase ὅθεν ἡ ἀρχὴ (*hothen hē arkhē*), "from where the beginning?"), followed by a variable element indicating what the *arkhē* is the beginning of. In this way, the phrase is formulaic on multiple levels (the said noun may vary because of the variability of the phrase as well as the thing with regard to which the 'efficient cause' is being discussed). This example shows how many of Aristotle's terms are just so standardized as to represent a concept (i.e., on closer analysis or, in any case, in the eyes of an expert readership); but they are so variable that they do not catch the eye as technical terms. It is true that the nominalizing *to* is a common linguistic feature and can nominalize all kinds of word classes, word phrases, statements, or even questions. However, one feels inclined to share Lennox's impression regarding terms like *hē hothen hē arkhē tēs kinēseos* and *hē hou heneka* that "the Greek (. . .) would have looked as odd to Aristotle's readers as the English translation does to mine."[201] This is to say, on assuming that the intended readership of Aristotle's writing were members of the Peripatetic group, they surely would have been acquainted with such terminology at some point (however, not as being native speakers but as being Peripatetics), just as (some of) Lennox's readers are used to 'Aristotelian English' as students or scholars of Aristotelian philosophy.

The other main type of terms which we encounter in the classifications of *aitia* is simple, common, but semantically extremely multi-faceted noun terms, such as τὸ εἶδος (*to eidos*, here: 'form'), τὸ παράδειγμα (*to paradeigma*, here: 'pattern'), ὁ λόγος, ἡ οὐσία (*hē ousia*, here: 'substance, form, essence'), ὁ λόγος (*ho logos*, here: 'account, definition'), τὸ τέλος (*to telos*, here: 'ende'), and ἥ ὕλη (*hē hulē*, here: 'matter'). All of these come with a number of connotations from ordinary language and earlier, especially Platonic, philosophy and evoke a net of references within Aristotle's work. To further complicate the matter, Aristotle tends to accumulate terms. In our *aitia* passages, he does so many times by relating two terms by means of *kai* and by adding further terms by means of τοῦτο δ' ἐστὶν (*touto d' estin,* 'that is' or 'this is').

The latter means seems to unambiguously indicate the relation of the terms before and after the *touto d' estin*. This is the case, for example, with the formulation: "Moreover, (sc. a thing is called a cause) as the end (*hōs to telos*). This is (*touto*

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200 The neuter article *to* is, in fact, ambiguous as to its origin: In a term like *to ti ēn einai*, it is simply the abstract signal of the nominalization of a question, in a term like *to hou heneka*, it could have the same function or be the result of the ellipsis of *aition* ('the reason for the sake of which'). On the function of the article cf. Wieland 1992, 183 f.

201 Lennox 2001, 126.

d' estin) that for the sake of which (*to hou heneka*)." Here, the term *to hou heneka* indeed explains the preceding term *to telos*; the two terms mean the same, but only insofar *to telos* takes the meaning of *to hou heneka*, and this is what is made clear by *touto d' estin*. However, take the sentence "the form and model (*to eidos kai to paradeigma*) (sc. is called a cause); this is (*touto d' estin*) the account of the what it is to be (*ho logos ho tou ti ēn einai*)," which offers three or even four different terms – considering the interlocking of two terms in *ho logos ho tou ti ēn einai* – for defining the 'formal cause'. The relation of the latter term to the former is not so clear because the relation of the first two terms (which the third term *ho logos ho tou ti ēn einai* is going to explain) to one another is not clear in the first place. So what exactly, that is, which of the two terms or which common idea is the third term going to explain? In any case, the *touto d' estin* seems to have the function of defining the kind of *aitia* more precisely, so one wonders why Aristotle does not mention this most precise term of all from the start: Do all terms mentioned mean the same, and does he aim to list all terms connected to a notion? Does he let his readers participate in his process of thinking and specification? Or are all the terms more or less related to the notion of 'formal cause' and add up to a comprehensive explanation?

These questions especially pertain to two-term phrases which are linked most generally by *kai*, the problems of which we have discussed with regard to the double expression *aition . . . kai arkhē* which occurred in the immediate context of the taxonomy of *Metaphysics* A 3. Within the differentiations of kinds of *aitia*, we encounter the following term pairs linked by *kai*: *to eidos kai to paradeigma*; *tēn ousian kai to ti ēn einai*; τὴν ὕλην καὶ τὸ ὑποκείμενον (*tēn hulēn kai to hupokeimenon*); τὸ οὗ ἕνεκα καὶ τἀγαθόν (*to hou heneka kai tagathon*); and τὸ οὗ ἕνεκα καὶ τὸ καλὸν (*to hou heneka kai to kalon*). The introduction of these term pairs is either "we say that one *aitia* is x" or "in one way, *aitia* is said x," with the x often consisting of the form 'one term *kai* second term'. That is, Aristotle announces one, but mentions two terms. This suggests that the *kai* is meant explicatively, rather that additively, or that the two terms add up to one term which merges two notions. In any case, the conjunction is still ambiguous; mentioning more terms does not lead to more clarity, but the underdetermination of their textual relation makes one wonder how they are related to one another and to the *definiendum*. One gets the feeling that Aristotle does not use this form accidentally, for he uses it quite often in our taxonomies although there would have been linguistic alternatives, as the use of *touto d' estin* shows.

The plethora and variability of terms increases even more if one compares the four main passages which explicitly distinguish kinds of causes (besides numerous passages which merely allude to what has come to be known as the 'doctrine of four causes'). As we have said, such a comparison is, if at all, of limited use, since Aristotle is not a systematic philosopher. Nonetheless, by juxtaposing the parallel passages, one can see the impressive number of terms from which Aristotle chooses and the great variability of the terms. Indeed, it is precisely the great consistency of the form of the taxonomies that shows the differences *en détail*. We have already seen some of the minor formal

differences such as the variation between *to hou heneka* and *to tinos heneka* as well as that between using the nominalizing article and leaving it out; and we have seen that Aristotle – for the same concept – uses terms which completely differ from one another in form and content such as the different terms employed for describing the 'material cause'. In most of these cases, as we have seen, the exact degree of their semantic overlap is not clear; it is only their being mentioned in explanation of the same kind of cause in different passages which suggests that they somehow overlap at the moment when they are used. The synonymy is indicated more strongly where the 'final cause' is called τὸ οὗ ἕνεκα καὶ τἀγαθόν (*to hou heneka kai tagathon*) in one passage and τὸ οὗ ἕνεκα καὶ τὸ καλὸν (*to hou heneka kai to kalon*) in the other. Here, the exact relation of the respective terms which are connected by the underdetermined conjunction *kai* is not clear;[202] but the analogy of the two conjunctions and the analogical form of the two nominalized adjectives *to kalon* and *tagathon* suggest that these two terms are indeed (intertextually) synonymous.

Besides formal variety, also semantic instability occurs, as the same terms are applied for *different* concepts of the four causes scheme: The term *logos*, for instance, "can refer to a variety of linguistic units (words, definitions, reasons, arguments, books), as well as to mathematical relationships, such as ratios; and it can also refer to the *content* of a definition, or the *relationship* denoted by a ratio."[203] It occurs in the *Physics* passage, as we have seen, as part of the term for the 'formal cause' (*ho logos ho tou ti ēn einai*), meaning "account" or "definition." In *Parts of Animals*, it refers again to the "definitional account" but in the sense of the "end product itself," that is, of a craftsman who must know the account in order to accomplish the product.[204] In this way, *logos* refers to the same thing in either passage; and although in *Parts of Animals*, it is applied from the perspective of the 'final' rather than the 'formal cause', "the argument trades on an ambiguity in the Greek term."[205]

Further, more radical variation of terminology is due to differing conceptualizations of *aitia/aition*. In the *Posterior Analytics* passage, three out of four causes can be unequivocally identified, but the term which occurs at the place where we would expect the 'material cause' is τὸ τίνων ὄντων ἀνάγκη τοῦτ᾽ εἶναι (*to tinōn ontōn anankē tout' einai*, "that if which items hold is it necessary for this to hold").[206] This phrase has been interpreted to denote the "premises of deduction" and to present, thus, "a special case of material explanation – viz. the case in which the fact that the matter of *X* is such and such does necessitate *p*."[207] Aristotle himself draws the connection be-

202 The relation does not become any clearer by the fact that, as Lennox 2001, 126 f. notes, "Aristotle often conjoins, as here, references to what is good with references to goals."
203 Lennox 2001, 126.
204 Lennox 2001, 125 f.
205 Lennox 2001, 125.
206 Transl. Barnes 1993, 59, modified.
207 Barnes 1993, 226.

tween "'matter' or 'material explanation'" and "deductive premises" at another passage later in the work and at passages in other writings,[208] but the present passage itself does not indicate the 'material cause' nor does it reveal the relation to other terms which normally denote the 'material cause'. However, it suggests itself to interpret the cited phrase as a term denoting an "instance" of the 'material cause'[209] and to restore the "canonical"[210] four causes because the 'material cause' is the only one seemingly missing from the four causes which are mentioned.

The problem with the passage in *Parts of Animals* is that it mentions only two instead of four causes and that it does not really say whether the number of causes which it mentions is exhaustive. First of all, it announces πλείους αἰτίας (*pleious aitiās*, literally, "more causes"),[211] but the comparative seems to be used either synonymously with the positive ("many"),[212] as an "intensive" to mean quite like the positive "many,"[213] in a softening way ("rather many"),[214] or elliptically ("more [sc. than one]").[215] The following οἷον/*hoion* ("such as") suggests that the subsequent distinction is somewhat arbitrary and includes only some of the causes which really can be found. For, normally, *hoion* is used to introduce examples, which can be seen in the *Physics* passage where the word is used to introduce examples for the kinds of causes which are being distinguished rather than to introduce the kinds of causes themselves. In the present passage from *Parts of Animals, hoion* calls up the fourfold distinction from the *Physics*, since it marks the introduced causes as examples. However, upon having stated two causes, Aristotle claims that he must "determine, about these causes, which sort is naturally first and which second."[216] If there are more than two causes and the two stated are only stated exemplarily, then why establish an order of these two? Thus, Aristotle implicitly calls into question the indefiniteness of his first announcement of the number of causes, and indeed, further down in the same chapter, he states that "there are, then, these two kinds of causes: (. . .)."[217] A similar oscillation between vagueness and definiteness as regards the number of causes can be seen in the *Physics* passage, which, after listing the four causes, states that "the causes are said in more or less so many ways (σχεδὸν

208 Barnes 1993, 226 with reference to *Part. anim.* IV 2, 677a18; *Phys.* II 3, 195a15–18; *Metaph.* Δ 1, 1013a15.

209 Ross 1936, 512.

210 Barnes 1993, 226.

211 *Part. anim.* I 1, 639b11 f.

212 Smyth § 1083.

213 Smyth § 1067.

214 Smyth § 1082d.

215 Smyth § 1082. For this interpretation, cf. Lennox 2001, 124.

216 *Part. anim.* I 1, 639b13 f.

217 *Part. anim.* I 1, 642a1 and again 642a13. By contrast, in the following passages (amongst others, Aristotle argues that all four causes are necessary: *Phys.* II 7, 198a21–b9, *Metaph.* H 4, 1044a32–b20; Ross 1924, 292).

τοσαυταχῶς/*skhedon tosautakhōs*),"[218] even though he, further on in the text, explicitly confirms the number of four causes.[219] What complicates the situation even further is that Aristotle's first distinction of two causes in *Parts of Animals* (upon stating that there is more than one cause) is not the same as the one which he provides after saying that there are two kinds of causes: first, Aristotle distinguishes 'final' (*tēn hou heneka*) and 'efficient cause' (*tēn hothen hē archē tēs kinēseōs*); the second dichotomy consists of 'final cause' (*to hou heneka*) and something called "that from necessity" (τὸ ἐξ ἀνάγκης/ *to ex anankēs*). Although Aristotle has dealt with the term in the text between the two twofold distinctions, and although the notion of 'necessity' can be related to the 'formal' and, as we have seen before, to the 'material cause', it is nevertheless surprising in view of the first distinction – especially because Aristotle does not explicitly relate the two distinctions or explain the difference between them. This example shows that Aristotle's drive to define by means of classification results in ever new taxonomies, even within the same passages. The lack of overlap of the taxonomies gives rise to questions of terminology: above all whether a differing term denotes a different concept or rather is (merely) the result of formal variability. It is precisely in view of this variation between different taxonomies (not only of the term *aitia*) that the almost equal wording of the classifications of *aitia*/*aition* in *Physics* II 3 and *Metaphysics* Δ 2 is so conspicuous and indicative of a dependency of the two passages, even though two equally worded definitions of the same term should hardly give rise to suspicion.

Let us now, at the end of this section, collect the features of terminology as they emerge from our reading of the *aitia* passages.

1) Use of ordinary words: With respect to the dichotomy of common and uncommon words, Aristotle re-uses and recycles mostly ordinary words which he supplies with new meanings; he does not use strange, poetic expressions nor does he coin (noun) terms (neologisms). The first main category of ordinary words which Aristotle uses is that of ἄσημα/*asēma*, that is, in themselves meaningless words, of which there are many in the Greek language. Using these *asēma*, Aristotle assembles new terms which nonetheless consist of ordinary words. The *asēma* are used to form artificial phrases that remain meaningless since they are placeholders to be filled with meaning in a specific case. In a way, these can be regarded as neologisms and strange terms, in the sense that they are not terms of the common language. To be sure, the nominalizing article is a common feature of Greek ordinary discourse, too; it is more the particular combination which makes them strange. However, they are not 'strange' in the way described in the theoretical accounts of style. Apart from collocations consisting of *asēma*, Aristotle uses common noun terms which often have a history in the earlier literature. However, he always uses them at least to some extent in a non-ordinary way. The noun

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218 *Phys.* II 3, 195a3 f.
219 *Phys.* II 3, 195a15 f.

terms come with one or several non-ordinary meanings, with the ordinary meaning(s) remaining more or less present. Mostly, these terms keep their original meaning either as a nuance that is made to shine through now and then or as an ordinary word alternately used with the word in its new terminological meaning, from which confusion may arise as to which meaning has to be assumed when a term is used. The exact proportion and relation of the various meanings of a term is different in the case of each term (and its respective uses) and often remains unclear.

2) Semantic emptiness: Many of the terms in Aristotle do not have actual content but are suitably filled with meaning when used in a specific context. In this way, they are, on the one hand, de-contextualized and reusable in other contexts, on the other hand, when specified, not easily recognizable as an instance of an abstract term.

3) Formal variability and instability: This feature pertains, on the one hand, to the question of what a term is in Aristotle and what formal features it has. Generally, Aristotelian terms can take all kinds of unexpected grammatical forms, that is, of relative clauses, of adjectives, of adverbs, of questions, of nouns, of nominalized expressions, and so on. On the other hand, the feature of formal variability concerns the question of the stability of particular terms. Many Aristotelian terms are hardly ever used in the same way, not even within works or paragraphs. Their form varies, for instance, because of paronymy, sometimes because of the adaption to the syntax of the classification (indeed, they can be adapted because of their syntactic flexibility), because the nominalizing article is left out, or because word types change within term collocations (e.g., from interrogative to relative pronoun).

4) Lack of recognizability: As far as their form is concerned, Aristotle's terms are inconspicuous and look non-technical. They are formally indistinguishable from ordinary discourse and, thus, not automatically understood in their technical meaning. Further, they are hardly recognizable because of their formal instability. What demarcates them thus as terms is rarely their form. Rather it is their appearance in a classification which demarcates technical terms as such. However, since much of Aristotle's text consists of classification, the fact that his terms have no recognizable form makes it hard to identify them.

5) Restriction of technical vocabulary: Since Aristotle constantly recycles his terms, the amount of technical vocabulary is very much confined. At least in philosophical or theoretical contexts, Aristotle does not add many terms to the Greek language. The same broad vocabulary is used in all kinds of contexts, and it is semantically adjusted if necessary. If, however, one counts all variations of the terms as terms of their own, the number of technical terms is much higher.

6) Homonymy: Aristotle's differentiations of terms which are said in many ways such as that of *aitia*, both in his lexicon *Metaphysics* Δ and in the classification throughout his work show that many of his central terms are homonymous; the recurring classifications of the same term show that they must be continuously adjusted according to context. Outside their explicit classifications, terms are used homonymously; they are

constantly readjusted in content and focus on different aspects at different times – even within the same passage. Homonymous terms also appear within classifications in order to explain one of the meanings of a likewise homonymous term, but the meaning in which they themselves are used is not made explicit. If at all, such terms are implicitly explained by other terms mentioned alongside itself or by examples. But as we have seen, the relation of several terms which are mentioned in explanation of one of the senses of a homonymous term often is not clear, and similarly, the examples sometimes obscure a term rather than clarify it.

7) Synonymy: In and outside terminological classifications, terms are densely concentrated. One of the reasons for the abundance of terms might be, ironically, the restriction of the number of terms which there are to choose from. Since Aristotle uses a small number of terms loaded with many meanings, he seems to feel the need to mention several terms in order to express one concept, presumably for the sake of disambiguation.[220] These terms semantically overlap and are often synonymous or nearly synonymous with their exact relation being unclear. Regarding our example of *aitia*, it is interesting that Aristotle mentions a number of terms which we trace back to what we invariantly call 'material cause', 'motive cause', 'formal cause', and 'final cause'. Interestingly, Aristotle does not seem to feel the need for such a stably used overarching term that integrates all others.

8) Superfluousness: If terms are indeed used synonymously, many of them are superfluous. This is surprising in view of the general economy of the Aristotelian text which consists, above all in classifying and relating terms, and because the *Topics* explicitly recommends avoiding superfluousness in definitions.

9) (Non-)Systematicity: On the one hand, Aristotle uses his terms and terminological taxonomies non-systematically in the sense that that they are not applicable throughout a work or even across works. On the other hand, classifications suggest systematicity and Aristotle invites comparing passages as he classifies terms in a general way ('there are two kinds of *aitia*', as if this were to hold in general), only then to break the expectations of systematicity which he himself has raised. His constant drive to explain by classification has classification develop a theoretical life of its own. Aristotle develops ever new systems in which he reuses terms which he has given a specific meaning in other classifications. While regularly acknowledging the homonymy of terms, Aristotle saves himself meta-remarks about how the different classifications of a term are related. The terms are formed so as to fit their respective taxonomy and, as a result, only work within that taxonomy. Classifications as a whole can be taken out and adapted, but many subordinate terms have no use or existence independent of the classification out of which they evolve.

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220 On the small number of terms in Aristotle and their lack of semantic differentiation as being a consequence of the form of these terms cf. Wieland 1992, 181 f.

10) Metaphor: Aristotle's occasional use of this feature is already well-documented; in our examples, we have noted only one metaphorical use of a word, though a non-terminological one (*thēreuein*, in the first part of the chapter).

4 Synthesis and Interpretation: Aristotle's Poetics of Terminology

To sum up our results: In the first main part of the chapter, we have seen that Aristotle's reflections on the form of *onomata* all have a common perspective: All three accounts – in the *Poetics*, in the *Rhetoric*, and in the theory of definition, regard the terminological form from a functional perspective and center on the criterion of clarity. Although the treatments of the *Poetics* and *Rhetoric* mention a lot more stylistic means than the passages in the *Topics* and *Posterior Analytics*, and although in the latter, the phenomena of homonymy and synonymy play a more important role than in the *lexis* accounts, the common focus in all three discussions is the proportion of common and uncommon words. Accordingly, the three discussions indicate a continuum with the poetic form of *onomata* occupying one end of the scale, the scientific one the other end, and the rhetorical one a middle position between the two as it makes use of poetic features but shares the cognitive perspective with the scientific view on *onomata*. Aristotle does not explicitly talk about his own genre of writing in any of the accounts, let alone his own texts; we have, however, argued that they can be located somewhere between the *Rhetoric* and the writings of the kind to which the *Organon* pertains, because, on the one hand, their form differs from dialectic and apodeictic discourse (on which the writings of the *Organon* are focused), and because the *Rhetoric*, on the other hand, proclaims to be relevant for all *didaskaliai* except for the teaching of geometry. In this way, it seems that the account of the *Rhetoric*, and, because of the fluid boundaries of the accounts, maybe even the whole theoretical discourse on style in Aristotle pertains to his own writings.

In order to realize this, we have had to discuss the central terms of the passages, above all the meaning and use of *lexis*, at great length. The discussion of this and other terms such as *saphēneia* and its synonyms has implicitly shown that Aristotle clearly deviates from the terminological requirements of the theory of definition in the *Organon* and of the recommendations of the *Rhetoric*. He does so above all by using synonymy, homonymy, and metaphor (as is forbidden by the scientific accounts), by not distinguishing the different ways in which homonymous terms are said, and by using common expressions in uncommon ways. Ironically and strikingly, Aristotle does so precisely while – as part of scientific treatises – discussing the terminological form and the said features as such that are to be avoided.

In the second main part of the chapter, we have analyzed the five passages in which the homonymous term *aitia* is explicitly differentiated according to the ways in which it is said. Our discussion has confirmed the impression which we have gained from Aristo-

tle's practical use of terms when trying to understand his theoretical view on scientific terminology, and we have more systematically worked out the features of Aristotle's terminology. Although he uses largely ordinary terms, as he himself recommends for the sake of clarity, he often uses them in a non-ordinary and, contrary to his own advice, homonymous and synonymous way. Thus, nearly all its features are to be avoided in the special kinds of scientific contexts of the *Organon*. Some of those features are allowed in poetry, for instance, synonymy and homonymy. However, it would not occur to us to call Aristotle's *lexis* 'poetical' in the sense which emerges from the *Poetics* and *Rhetoric*, not even a small part of it, as the *Rhetoric* concedes it to speeches. This is because Aristotle does not make use of the category that is most characteristic of the poetical *lexis*, namely *xenika*, 'strange words'. He only uses common words in an uncommon way (against which the *Rhetoric* advises) or forms new term phrases out of ordinary words. In turn, what is really typical for Aristotle's terms is not reflected anywhere in his accounts of *onomata*. It is not part of the genre-spanning discourse. This is a most astonishing fact. But why does Aristotle not reflect these features of the form? The answer to this question could have to do with the function and meaning of the form.

So far, we have focused on the obscurity of Aristotle's terms. We have struggled with the underdetermined and non-standardized use of *lexis* in trying to come to terms with Aristotle's theory of it, and we have analyzed some of Aristotle's terms through Aristotle's own lens from the perspective of clarity – and noted, again, underdetermination and non-standardization. But Aristotelian terms do not only have the potential to impede understanding, but also are extremely useful precisely because of their peculiar form. Because of their formal variability, they can be adjusted to the syntax; one and the same term can be formulated as a question, declined as an adjective, take attributes as a noun, and it can be a genitive of something when its genitive becomes nominalized. Because of their semantic emptiness, they can be (re-)used in different thematic contexts and filled with ever new meanings instantaneously. Because of their origin in ordinary language and semantic broadness, they can carry a lot of meanings – technical, related, competing – at the same time and are transparent as to the original common meanings which they let shine through the specialized ones. Rather than being clarity, the function of the form of Aristotle's terminology seems to be a kind of flexibility and reusability which allows for ever-new differentiation, adjustment, and hierarchization in different contexts. Most importantly, the terminology is able to support the process of thinking and accompany it in writing, and it makes the thought process available to Aristotle's readers. For them, the peculiar form of the terminology would not have been problematic – otherwise it would have been different. It is this form that is indicative of Aristotle's communicative context which the terminology mirrors: He would not have had to sell his terms and mark off his school like the Greek medical authors; rather, he would have been able to count on his inclined readership to follow his thoughts and be acquainted with certain central, ever-recurring terms. In view of this situation, the question arises all the more why Aristotle keeps relating ever new terms where one of them could stand for all or

why he laboriously nominalizes long phrases where enough noun terms to choose from would have been available.

I would like to suggest that there is an unexpected aesthetic dimension of the terminology besides the functional one. In doing so, I do not mean to insinuate that Aristotle practices some sort of *l'art pour l'art* in the way which Hellenistic literature is only yet to develop. Rather, the terminological features of the Peripatetic writings, for example, nominalized questions like the *to dia ti* first would have been singled out because of their functionality, and other terms would have been formed by analogy with the existing ones. At some point, however, when Peripatetic readers and writers alike would have gotten used to the form of such term phrases, they might also have developed an aesthetic preference for such terms, that is, nominalized questions consisting of the simplest words: *asēma*. Similarly, different reasons for using extremely common noun terms could have emerged: While it proved highly practical to apply technical senses to existing well-known words that have a common meaning that is somehow connected with the technical one, using such terms and supplying them with ever new meanings might also have been due to an aesthetic criterion at some point. There even seems to be an aesthetic dimension to the constant classification of terms and to the practices of using of terms within these classifications, which we have seen. Of course, the taxonomies such as that of *aitia* serve the differentiation of the different meanings of a term and, in this way, its definition. However, one also gets the feeling that Aristotle likes relating and re-relating terms. One way of relating them is by the connection of two underdetermined terms by means of an underdetermined *kai*. It is not really useful from the point of view of unambiguous definition (compared with linguistic alternatives of relating two terms); I argue that Aristotle aesthetically favors the form of two generically similar underdetermined terms being connected by an equally underdetermined *kai*. This can be seen from the fact that the terms which he connects in this way are indeed of a similar kind from a formal point of view.

Let us consider, in closing, how Aristotle introduces another, if not *the* central term of the *Poetics*: μίμησις (*mimēsis*), an iridescent term with common and technical nuances, which is not explicitly defined anywhere in the work. I do not want to go into the question of its meaning(s), on which much ink has been spilled, and leave the term itself untranslated.[221] Instead, I am interested in the differentiation of aspects of the term at the beginning of the *Poetics*. Aristotle straightforwardly claims that poetry is a kind of *mimēsis* and immediately proceeds to a threefold division (which at the same time is an outline of the first three chapters): Different kinds of *mimēsis* differ in three ways: 'by using for the mimesis different media, different objects, and a different manner'; literally 'by doing mimesis either in other things, of other things, or otherwise' (*tōi en heterois mimeisthai*, *tōi hetera*, *tōi heterōs*). Thus, Aristotle simply uses the word *heteros* ("another") in different grammatical functions – as part of a

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221 For one more try cf. the chapter by Loren Marsh in the present volume.

prepositional phrase, as a transitive object and as an adverb – for what has conventionally been rendered into English by the abstract nouns 'media,' 'objects,' and 'manner.' The term *heteros* can hardly be translated. It effectively points to the fact that medium is 'one' in a certain genre and 'another one' in another genre, and that mimesis is 'another one' or 'different' each time regarding its medium.

For being some of the most common words of Greek everyday speech and as non-nouns, *en heterois*, *hetera* and *heterōs* run counter to our expectations of what technical terms should look like. However, they are demarcated as terms by their very position in the unfolding taxonomy. Just as they tag *mimēsis* as a technical term, they themselves are explained by a further classification: As media of mimesis Aristotle names 'rhythm,' 'speech,' and 'melody,' as its objects 'people in action' who are either 'better than we are' or 'worse' or 'such (as we are),' and as manners 'narration' either by 'becoming another (person)' or by 'remaining the same', and 'dramatization'. It is only by this differentiation that *en heterois, hetera*, and *heterōs* are given the specific technical meaning they have in connection with the term *mimēsis* / *mimeisthai* in the context of Aristotle's theory of poetry. The neuter plural *hetera*, for example, does not refer to any objects of mimesis, like animals or pottery, but specifically to the quality, that is, the character and social status, of the people in action. There is, however, nothing about the term itself ('other things') which suggests this meaning.

The three word forms are semantically highly under-determined and not in any way recognizable as technical terms outside the *Poetics* or even outside their immediate context. They need to be filled with meaning by the examples to follow, that is, by their own concrete subcategories. In what is the most general instantiation of each term, the recurring *heteros* serves as a placeholder: It foreshadows the classification ahead of the term which is vital for its own meaning. In the differentiation of the subcategories, the *heteros* is no longer part of the term; only the form *to hetera mimeisthai* is repeated one more time in Chapter 2. Instead, the term occurs in a non-technical way to denote 'other' arts or artists using a particular medium etc. Typically, Aristotle manages to confuse the reader by the close succession of the terminological and the non-terminological version of the common *heteros*.

The fact that the terms are virtually content-free suggests it is their grammatical form that is their stable feature which makes up for their semantic emptiness and guarantees their being at all recognizable. Indeed, this seems to be the case for all further instances of the terms that likewise lack concrete content. At the end of the discussion, which repeats the general division from the beginning, the terms are adjusted to their syntactical position, taking no longer the place of objects of *mimeisthai*, but of relative pronouns (Chapter 3: *en hois te kai ha kai hōs*). While the *heteros* becomes redundant by the change of syntax, the grammatical form of each term appears to be its stable feature, that is, that which makes it a term. However, the form of the concrete implements of the term deviates significantly from this. The media of mimesis are not consistently denoted by *en* + dative, but rather by the mere (instrumental) dative or *dia* ('by means of') + genitive, from which confusion on the reader's part

may arise as to which of the examples are media of poetic mimesis and other arts, and which are not.

Thus, the terms (or rather non-terms) for the media, objects, and manner of mimesis share all the features which we have seen so far: they are highly common, inconspicuous *asēma*, placeholders that are underdetermined in content, awaiting to be filled, unstable in form, adjustable to fit their respective syntactic implementation; they are highly functional and effective since they are extremely flexible; indeed, they are so flexible as to be non-standardized; and they fit in with the aesthetics of Aristotle's terminology. The aesthetic quality of the terms is most apparent at the beginning of the passage 'by doing mimesis either in other things, of other things, or otherwise' (*tō en heterois mimeisthai, tō hetera, tō heterōs*). This phrase seems to be rhetorical even in the classical Aristotelian sense with its paronymous tricolon.[222] However, these stylistic features rather seem to be a corollary of functionality. The *aesthetics* of this statement precisely lies in the utmost concision, simplicity, and austerity of its formulation.

The assumption that Aristotelian terminology is both functionally and aesthetically motivated could explain why Aristotle does not reflect upon the specific nature and point of his terminology. His approach to *lexis* is a technical one: He describes the means and their benefits as regards the overall function of the genre or work. From the cognitive perspective of rhetoric and science, he recommends using mostly, or even only common words. Although we have argued that Aristotle deviates from this recommendation by using common words in uncommon senses (a category which he also recognizes in the *Rhetoric*), it is still a fact that he uses common words, especially because the common meaning(s) remain(s) always present to a smaller or larger degree (though how exactly, it is not sure). This, by the way, is an argument against assuming certain once and for all fixed technical senses. As for the aesthetic dimension, it is unsurprising that Aristotle does not reflect upon it because he does not do so either in the case of the poets: Just as he does not attempt to grasp the specific aesthetic quality of, say, Sophocles, he does not talk about aesthetic qualities of his own style which, in either case, does not mean that there is no such dimension.

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[222] Here and there, classical figures and tropes may be found in Aristotle's writings (cf. Schütrumpf 1989), but they do not make for the specificity of his style.

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Marcel Humar

Scientific Nomenclature of Species and Naming Practices in (Ancient) Biology

Abstract: The history of biology and its nomenclature of species are full of allusions to mythology, borrowings from literature, appreciation of authorities, and curious puns. The chapter offers an account of the different naming practices employed by naturalists from antiquity to the modern era. The various practices, which allude to mythology, draw comparisons, honor authorities, or coin playful names, are systematized using specific concepts and revealed as 'strategies of displaying competence'. Thus, scientific nomenclature can serve as a tool for self-representation, it can raise public awareness, or even insult competitors. Naturalist, especially in the Renaissance and modern era, also used ancient authors to increase their authority and create the image of an educated and well-studied scientist.

To Noah Yaro who wasn't that difficult to name.

1 Introduction: Systematic Classification and Naming Practices in (Ancient) Biology

Since humankind discovered nature, a deep urge has persisted to order and systemize the living world. In the Western world, Aristotle is regarded as the founder of zoology and biological classification.[1] His immense influence in the emergence of systematic classification is undisputed, although he may have had predecessors such as Speusippus.[2] Aristotle's zoological works, especially his major work *Historia animalium* (*History of Animals*), were recently examined by modern biologists regarding the accuracy of his organization of the living world.[3] The process of classification involves the invention of higher and lower groups and (although not unanimously agreed upon)[4] the assign-

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1 See Pellegrin 1982.

2 The extant fragments of Speusippus suggest that he was inclined to systematic classification as well; on this, see Lloyd 1983, 15. There are similarities between his terminology and the Aristotelian terms. See, for example, the name of the modern *crustaceans* (μαλακόστρακα, literally referring to 'soft-shelled' animals) in fr. 8 Athenaeus *Deipn.* 105b which is also used by Aristotle several times (e.g., in *HA* IV 8, 534b14 and IV 9, 537a1; *GA* I 3, 717a3 and I 21, 729b9).

3 For taxonomical studies, see Tipton 2006; Voultsiadou & Vafidis 2007; Fürst von Lieven & Humar 2008; Laurin & Humar 2022.

4 On the discussion of the use of rank-based (Linnaean) nomenclature and the claim for an end of the use of species and rank-based systematics, see Ereshefsky 2002; Laurin 2005 who stresses that rank-based codes are no longer considered sufficient to a growing number of systematists in modern biology.

ment of a species-concept.[5] Thus, the development of a system, by Aristotle and later authors, requires the naming and description of single groups, families, and finally species.[6] In biology, most notably, where the number of living beings to be ordered is vast, the scientist is highly challenged because he or she has to find names for each single species;[7] scientific denominations for species (and sometimes higher groups) must be invented. To classify an animal or plant in antiquity, in the Renaissance, and later in the time of the Swedish taxonomist Carl Linnaeus, was to describe a certain species (or *taxa* in general) in an appropriate way. Above all, the naming of animals or plants in these times eminently reflects the scientist's education, linguistic competence, and, not least, his or her fantasy and creativity.[8]

As already mentioned, the taxonomist who wants to record all creatures is confronted with an enormous number of living beings to describe.[9] As the British biologist Theodore H. Savory put it:

> The zoologist has had a much harder task than the chemist. He has had to name the animals he has found, and in contrast to ninety-two elements he has well over a million different kinds waiting for christening.[10]

What Savory states can be applied to every taxonomist or naturalist, ancient as well as modern. Therefore, the following questions arise: What naming practices can be found in the scientific literature from antiquity to the modern age dealing with the naming and classification of organisms? Do certain naming practices have a deeper function than simply 'naming' species? Naming practices can be defined as the way cultures or single scientists refer to objects – whether animate or inanimate[11] – and, hence, give some insight about cultural aspects of biological nomenclature.

This article presents some case studies within the history of animal and plant nomenclature and provides a review of the different naming practices in biological texts from antiquity to modern times, followed by a brief discussion of the purpose of several naming practices and the backgrounds of certain names of organisms. Since I am

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5 On the concept of species, see Mayr 1982, 273 and the discussion in Atran 1987. On the development of the concept in the history of biology, see Toepfer 2011, Vol. 1, 61–131.

6 This point is also stressed by Hardy & Totelin 2016, 97: "Naming always involves a form of classification." But see note 4 above.

7 A singular instance might be the Scythian plant which was named *Anonymous* because no one found a suitable name. Hence, the plant "found a name by not finding one," as Pliny (*Hist. nat.* 27, 31: *Anonymos non inveniendo nomen invenit*) states. See Hardy & Totelin 2016, 96.

8 Today with the definition of codes of biological nomenclature, there are rules to follow which make the naming of species a little bit more controlled and less free concerning the creativity of the suggested names.

9 Cf. Vergil *Georg.* II, 103–104: *sed neque quam multae species, nec nomina quae sint, | est numerus: neque enim numero comprendere refert*.

10 Savory 1967, 99.

11 Cf. Schiebinger 2007, 91 who describes the naming of objects as 'a deeply social process'.

interested in the relationship between names and their function besides their refer-
ring to a species, this paper focusses on naming practices with a (supposedly) deeper
function than only 'naming' a species.[12]

Preliminarily, I will give a short remark on biological nomenclature of today,
which is used throughout this paper. When a species – a plant, an animal, a fungus,
or a bacterium – is discovered, it receives its official name followed by a detailed de-
scription and a publication of the results.[13] At the most simple level of scientific no-
menclature, each species has a scientific name made up of two components: a generic
(or genus) name and a specific name or epithet. Together, these two names are re-
ferred to as a binomial or binary name.[14] Binomial names are always given with the
generic name[15] first starting with a capital letter; the specific epithet follows with a
lower-case letter. Both names are customarily italicized, and it takes at least two parts
to name a species. The generic name can be understood as a 'collective name'[16] for a
class[17] and indicates a grouping of organisms that all share a suite of similar charac-
ters, for example, the generic name *Panthera* (coined by Oken 1816) referring to the
family of large cats (*Pantherinae*), including lion, tiger, leopard, and other species. The
specific name allows for a distinction between different organisms within a single
genus, for example, the *Panthera leo* as the binominal nomenclature for the lion, and
Panthera tigris for the tiger, and the *Panthera pardus* for the leopard. If the organism
described cannot be reliably assigned to a certain species, modern taxonomists use
the abbreviation *sp.* (*species*)[18] instead of the epithet to mark this circumstance. This
binary name is often (but not compulsorily) supplemented with the name-giver (often

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12 The case studies are limited to species names, but also higher rank names could be taken into
account.

13 The description of a newly discovered species commonly contains four basic components: 1. The
new binomial name; 2. A detailed description of the species' morphology; 3. Etymology of the given
name; 4. Geographic distribution of the organism (extant taxa; for extinct taxa the stratigraphic range
is documented). In botany, the deposition of specimens is also given in the publication. On these com-
ponents, see Bernhardt 2008, 9–10.

14 The term 'binominal' or 'binary' nomenclature arises in the late eighteenth and early nineteenth
centuries; it is used, for example, by Duchesne 1796, 148–149 ('nomenclature binaire') and Cuvier 1807,
374. On the development of the nomenclature, see Toepfer 2011, Vol. 1, 97–98. Essentially, the binomi-
nal naming started with two important works of Linnaeus: the *Systema naturae* (1735 and several edi-
tions; on this, see below) and his *Species plantarum* (Stockholm 1753).

15 This generic name has to be in the form of a noun or a substantivized adjective treated as a noun
and must be unique in the zoological world.

16 But see note 4 above.

17 Nevertheless, taxa are no longer considered to be natural kinds by many scientists; instead, they
view them as individuals. About this, see Baum 1998; Ghiselin 2002. I thank Michel Laurin for several
comments on this topic.

18 This is also possible for higher ranks; so, one could name an animal as *Mammalia indet.* if the
identification is not more precise.

abbreviated) and the year of the original description of that species under the given name, e.g., *Panthera tigris* (Linnaeus 1758). Hence, the basic scientific name of a species consists of (at most) four parts.

2 Examples of Naming Practices in Antiquity

Neither the ancient Greeks nor the Romans developed a scientific zoological or botanical nomenclature which differs from commonly spoken language.[19] However, an interest in the naming of species and a discussion of the aptness of their names as well as different naming practices are found in several texts from antiquity. A popular naming practice was the naming after the species' morphology, its typical forms of behavior, or its peculiar qualities and activities. Another inspiration for animal names is to be found in certain peculiarities regarding their lifecycle (so-called *morphonyms*).[20] One example for the first practice is the naming of the woodpecker, the *druokolaptēs* (δρυοκολάπτης). The Roman writer Aelianus describes the etymology of this species' name in *De natura animalium*:

> τὸ ζῷον ὁ δρυοκολάπτης ἐξ οὗ δρᾷ καὶ κέκληται. ἔχει μὲν γὰρ ῥάμφος ἐπίκυρτον, κολάπτει δὲ ἄρα τούτῳ τὰς δρῦς, καὶ ἐνταυθοῖ ὡς ἐς καλιὰν τοὺς νεοττοὺς ἐντίθησιν [. . .].

> The bird 'Woodpecker' derives its name from what it does. For it has a curved beak with which it pecks (*kolaptei*) oak-trees (*drus*) and deposits its young in them as in a nest [. . .].[21] (Translation after Scholfield 1958)

Another example from zoology is the teleost called *ouranoskopos* (οὐρανοσκόπος). This fish was known under several names in antiquity[22] which demonstrates the problem evolving from a nomenclature not being consistent in Greece and Rome.[23] Pliny the Elder, recognizing the peculiar position of the eyes of this species which causes the effect that it always looks upwards, provides an explanation for giving the name *ouranoskopos*:[24] *Idem piscis et uranoscopus vocatur ab oculo, quem in capite habet.* – The same fish is also called *uranoscopus* from the eye it has in its head.[25]

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19 An exception are, of course, loanwords from Eastern languages. On this, see below p. 189, note 43.
20 See Jobling 2010, 11–12.
21 *De nat. an.* 1, 45.
22 Other synonyms include καλλιώνυμος and νυκτερίς. The fish can be identified as belonging to the genus *Uranoscopus* (stargazer-fish); on the identification, see Thompson 1947, s.v. καλλιώνυμος. Discussions of that species can be found in Oppian, *Hal.* 2, 199–205 and Athenaeus, *Deipn.* 282c-e. A detailed analysis and discussion of the several synonyms of the *Ouranoskopos* is missing.
23 Especially Pliny the Elder discusses several times the problem of multiple names of species; see Doody 2010, 28. See also Pliny's comment below, p. 189, note 41.
24 The name can be traced back to Galen who discusses the fish in *De usu part.* 3, 182–183 Kühn. Pliny's explanation given above is echoed in Isidor. *etym.* 12, 6, 35.
25 *Hist. nat.* 32, 69–70.

This naming practice can also be observed in ancient botany: Several plants are named after one of its characteristics, such as smell and color, physical properties or morphological aspects.[26] One example might be the plant called *aeizōon* (ἀείζωον),[27] which means 'ever-living', because of its evergreen leaves.[28]

The passages quoted above, and several others in the works of Aristotle and Aelianus, prove that animals in antiquity were named after their behavioral or morphological features.[29] Aelianus frequently discusses the suitability of a given term for a certain animal: In *De nat. an.* 7, 24, the author emphasizes that the name *dromias* (δρομίας, designating the runner-crab or horseman crab) mirrors the animal's principal activity "most properly" (*prepōdestaton*, πρεπωδέστατον). The aptness of particular designations is commented on in numerous other passages.[30] This short extract shows that there is an interest in the problem of whether naming practices describe species aptly and that this question is also discussed in the texts dealing with the nomenclature of organisms.[31]

However, it is not only the observation of a specific trait or peculiarity that determines the name; in biological texts, we find the allusion to everyday life or traditional association very often. The most common example might be the term denoting the butterfly: the *psukhē* (ψυχή). By examining the detailed description of their metamorphoses, it becomes obvious why the Greek chose this name:

γίνονται δ' αἱ μὲν καλούμεναι ψυχαὶ ἐκ τῶν καμπῶν, αἱ δὲ γίνονται ἐπὶ τῶν φύλλων τῶν χλωρῶν, καὶ μάλιστα ἐπὶ τῆς ῥαφάνου, ἣν καλοῦσί τινες κράμβην, πρῶτον μὲν ἔλαττον κέγχρου, εἶτα μικροὶ σκώληκες καὶ αὐξανόμενοι, ἔπειτα ἐν τρισὶν ἡμέραις κάμπαι μικραί· μετὰ δὲ ταῦτα αὐξηθεῖσαι ἀκινητίζουσι, καὶ μεταβάλλουσι τὴν μορφήν, καὶ καλοῦνται χρυσαλλίδες, καὶ σκληρὸν ἔχουσι τὸ κέλυφος, ἁπτομένου δὲ κινοῦνται. Περιέχονται δὲ πόροις ἀραχνιώδεσιν οἳ οὔτε στόμα ἔχουσαι οὔτε ἄλλο τῶν μορίων οὐθὲν διάδηλον. Χρόνου δὲ πολλοῦ διελθόντος περιρρήγνυται τὸ κέλυφος, καὶ ἐκπέτεται ἐξ αὐτῶν πτερωτὰ ζῷα, ἃς καλοῦμεν ψυχάς.

The so-called psyche or butterfly is generated from caterpillars which grow on green leaves, chiefly leaves of the raphanus, which some call *krambē* or cabbage. At first it is less than a grain of millet; it then grows into a small grub; and in three days it is a tiny caterpillar. After this it grows on and on, and becomes quiescent and changes its shape, and is now called a chrysalis. The outer shell is hard, and the chrysalis moves if you touch it. It attaches itself by cobweb-like filaments, and is unfurnished with mouth or any other apparent organ. After a little while the

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26 See Amigues 1984.

27 E.g. in Theophrastus, *HP* 1, 10, 4 and Dioscurides 4, 88.

28 For further examples, see Hardy & Totelin 2016, 98.

29 See Aelianus, *De nat. an.* 4, 21; 8, 24; 9, 24. On this, see Fögen 2009, 51–52. For some naming practices in Aristotle's works, see Fürst von Lieven & Humar 2017, 21–24.

30 See Fögen 2009, 52.

31 We find also discussions on the names of animals outside of scientific or technical literature; see, for instance, the discussion of the ostrich's name (στρουθοκάμηλος) in Diodorus Siculus 2, 50, 3–4.

outer covering bursts asunder, and out flies the winged creature that we call the *psukhē* or butterfly.[32] (Transl. by Thompson 1910)[33]

This meaning of *psukhē* as a butterfly was not used before Aristotle.[34] The reason why the butterfly is synonymous with the soul is obvious from the extract;[35] this passage describes, in detail, the holometabolic development of the butterfly. The term 'holometabolic' describes a development (especially of certain insects) that is characterized by a complete change in physical form or substance. Therefore, insects with a holometabolic lifecycle undergo complete metamorphoses with four developmental stages: out of the egg, the larva develops, (which is a stage of active feeding and growth), the insect turns into the pupa, and a period of reconstruction begins (larval tissues are dismantled and rebuilt following the adult body plan), followed by the rising of the adult animal. As a pupa, the insect often has a sclerosed exoskeleton, which remains behind as a dead shell. The analogy to the imagination of the soul is evident: the adult animal leaves the hard, dead body behind. Therefore, the beliefs concerning the soul were the reason for the naming of this group of insects.

The naming of species after parallels in mythology was also a very popular practice. Further, we find more examples of mythological naming practices, e.g., in Aelianus. In a chapter on the species of mullets (*De nat. an.* 9, 36), he describes the Adonis-fish as a creature living in both land and water.[36] The name-givers probably intended to hint at Adonis, the god of beauty and desire who was desired by Aphrodite, representing the upper world, and Persephone, standing for the underworld.[37]

There are also examples of species named after a character of classical mythology or of one of their attributes in botany. The *Nymphaeae*, a genus of aquatic plants commonly known as water-lilies, bear a name inspired by the Nymphs (νύμφαι). A special plant of that genus, probably the so-called yellow water-lily (*Nymphae lutea*), is described by Theophrastus in his *Historia plantarum* (*HP*) 9, 13, 1. Later, Pliny the Elder gives the following explanation for the naming of that plant: *Nymphaea nata traditur nympha zelotypia erga herculem mortua – quare heracleon vocant aliqui, alii rhopalon*

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32 *Hist. an.* V 19, 551a13–24. Text after Balme 2002.

33 In Thompson's translation the addition "or butterflies" is not contained in the text. On the *psukhē,* see also Theophrastus, *HP* 2, 4, 4 and Plutarchus, *Moralia* 636 c. The lifecycles of holometabolic insects are described in Pliny, *Hist. nat.* 11, 112: *Multa autem insecta et aliter nascuntur, atque in primis e rore. Insidet hic raphani folio primo vere et spissatus sole in magnitudinem milii cogitur. Inde porrigitur vermiculus parvus et triduo mox uruca, quae adiectis diebus accrescit, inmobilis, duro cortice. Ad tactum tantum movetur, araneo accreta, quam chrysallidem appellant. Rupto deinde cortice volat papilio.*

34 See LSJ, s.v. ψυχή.

35 On this passage in detail, see Humar 2021, 18–19.

36 The Adonis-fish or *Exocoetus* (literally 'sleeper-out') is hard to identify; beside Aelianus, the sources for its description include Athenaeus, *Deipn.* 8, 5 33b-e (Clearchus fr. 101) and Oppian (*Hal.* 1, 155–160).

37 On this, see Fögen 2009, 54. We find a similar case in modern nomenclature: *Betta persephone* (Schaller 1986), a species of fish living in the waters around Malaysia, derives its name from the goddess of the underworld because of its blackish color arousing an association to the underworld.

a radice clavae simili [. . .][38] – It is said that Nymphaea was born of a nymph who died because of jealousy toward Hercules – for this reason some call it *heracleon*, others *rhopalon*[39] because its root looks like a cub.

Pliny, briefly discussing the etymology of this genus, gives two explanations. Some people say that the plant is alluding to the mythological story of a nymph being so jealous of Heracles that she died and turned into a water-lily. On the other hand, the root of that plant highly resembles the mighty cub of Heracles and might be the reason for its name.[40] These names could be described as (mythological) *eponyms*.[41]

Besides these naming practices we find, of course, other names which are determined by the geographic origin (hence called *toponyms*)[42] of the species, mainly plants, or simply the names are borrowed from other languages (which could be called *autochtonym*).[43] Since this paper focuses on nomenclature and naming practices as a display of competence, these practices are omitted here.

Considering the naming practices found in works by Aristotle, Aelianus, and Pliny the Elder, it becomes obvious that the two prominent naming practices involved naming after a character in mythology or naming after certain peculiarities in the behavior or lifecycle (*eponyms* and *morphonyms*). Regarding the function of those naming practices one could say that they serve a simple purpose: Names which are well-fitting because they refer to observable peculiarities (*morphonyms*) or draw comparisons to known figures (e.g., figures of mythology) or concepts (*eponyms*) are easy to remember; they serve as 'mnemonic tools'. They do not have to be rehearsed or continually repeated to stay in mind. Therefore, those names were coined by ancient naturalists or even by lay-men because they are easily learned (in contrast to *toponyms*);

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38 *Hist. nat.* 25, 75.

39 The Greek word for the cub.

40 See Carnoy 1959, 142–143.

41 On *eponyms*, see Jobling 2010, 12–13. Another example is the plant named *Paeonia* which refers to the god Paean (Παιήων). Pliny writes: *Vetustissima inventu paeonia est nomenque auctoris retinet, quam quidam pentorobon appellant, alii glycyside. Nam haec quoque difficultas est, quod eadem aliter alibi nuncupatur.* (*Hist. nat.* 25, 10); cf. Lloyd 1983, 146 n. 97.

42 See Jobling 2010, 14. Primarily in botany, we find the description of species with geographic epithets. In Theophrastus' works, numerous plants are given a geographic epithet denoting the origin of the particular species usually in comparison with other, more or less similar genera; for example, the Persian nut-tree (i.e., the walnut, *Juglans regia*) in *HP* 3, 6, 2; the Euboean nut-tree (probably the sweet chestnut, *Castanea sativa*) in *HP* 4, 5, 5; the Heracleotic nut-tree (i.e., the hazelnut, *Corylus avellana*) in *HP* 3, 14, 1–2. Another example is the Persian (or Medic) 'apple-tree' (*Citrus medica*) in *HP* 4, 4, 2. Similar to this practice is the naming of a plant after its habitat, for example, with the stem *petr-* designating a growth on stones or rocks as in πετροσέλινον (common parsley, *Petroselinum crispum*). On this point, see Hardy & Totelin 2016, 99.

43 On *autochtonyms* see Jobling 2010, 13–14. For examples, see, e.g., Bodson 2005, 455–456. For plant names borrowed from foreign languages, see Hardy & Totelin 2016, 97–98 with further literature. For example, the Greek names for exotic animals like the lion (*leōn*) or the elephant (*elephas*) are borrowed from Eastern languages; on this, see Bodson 2005, 453–454.

thus, these naming practices reflect in a certain way the competence of the naturalists since they had to observe conspicuous features to coin names aptly. However, since we do not have a scientific nomenclature in antiquity, assumptions concerning the purpose of naming practices in antiquity should be treated with reservation.

Because mythology seems to have been a rich vault of inspiration regarding the invention of names as can be seen from the examples given above, I want to ask if the important role of mythology or folklore as a source for scientific nomenclature persists today and, further, how naturalists dealt with the possibility of naming species after the personage of myth. In the next chapter I will first present some naming practices of the Renaissance referring to ancient authors generally and, second, discuss the role of mythology in that era of biological nomenclature on the basis of several case studies.

3 Naming Practices in the Biology of the Renaissance and the Works of Linnaeus

The reason why most scientific names of species today are directly derived from their Latin or Greek sources is simple: During the Renaissance, the writers bestowed an immense labor on determining the names by which species were known to the ancients. Almost every naturalist starts his own remarks to certain species with a discussion of the ancient texts.[44] Aristotle, Pliny the Elder, and Theophrastus are among the most important sources and references for most of the naturalists dealing with the kingdoms of animals and plants with regard to the description of animals as well as to their generic as well as eponymous names; often, the Greek name was later translated into Latin.[45]

At times, if the ancient sources provided a detailed description of a certain species, the names were borrowed and immediately transformed into a binary name;[46] they are *autochtonyms* from Greek and Latin. For example, the description of the common catfish in Greek sources (Aristotle, *Hist. an.* IX 37, 621a21 ff.) and in Latin texts (Pliny, *Hist. nat.* 9, 44 and 165) is so rich in detail that Linnaeus combined the

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[44] See, for example, Pierre Belons *L'histoire de la Nature des Oyseaux* (Paris 1555) or Guillaume Rondelets *Libri de piscibus marinis* (Lyon 1554–1555).

[45] An example is the group of insects. In the 10th edition of *Systema naturae*, Carl Linnaeus classified the arthropods, including insects, arachnids, and crustaceans, among his class *Insecta*, which is the translation of Aristotle's *Entoma* (ἔντομα): both meaning 'incised'. In addition, the German term *Kerbtiere*, coined by P. von Zesen (1619–1689), alludes to the peculiar form of the insect's body.

[46] This practice has been criticized by Gill 1896, esp. 587–589.

Greek (*glanis*, γλάνις) and the Latin (*silurus*)[47] terms and coined the binary name *Silurus glanis* (Linné 1758).[48] The same is true of the naming of the common ivy *Hedera helix* (Linné 1758); this name combines in the same manner both ancient roots (*helix*, ἕλιξ in Greek, *hedera* in Latin).[49] Sometimes, a name is adopted with a certain amount of creativity: For example, the genus of *Delichon*, a small genus of passerine birds that swallows belong to, was coined by Horsfield & Moore (1854, p. 384). The name is an anagram of the Greek term designating the swallow (*khelidōn*, χελιδών).[50]

However, modern nomenclature sometimes contains names that referred to another species in antiquity under the same name because the authority of the ancient was not questioned and no further research to confirm the correctness of the denomination was undertaken. One example is the bird named χαραδριός (*kharadrios*). In recent nomenclature, we find the Kentish plover (*Charadrius alexandrinus*), a small wader, which is sometimes identified with the Greek *kharadrios*. A recent study shows, however, that the identification of the ancient *kharadrios* with its modern equivalent is doubtful.[51]

Another example might be the *ekhenēis* (ἡ ἐχενηΐς) or remora, commonly identified with the ship-holder (*Echeneis remora* L. 1758). In addition, in this case, the adoption of a name coined in antiquity and its unquestioned application to a species seems debatable because all the ancient sources referring to the *ekhenēis* contain descriptions of characteristics matching the morphology of the *lamprey*.[52]

The same phenomenon can be observed concerning plant names: Various ancient plant names have been adopted by Linnaeus and correspond exactly with their ancient equivalent.[53] In other cases, Linnaeus borrowed ancient names and applied them to completely unrelated plants; e.g., the modern *cactus* (a member of the plant family *Cactaceae*) is not the same plant as the Greek κάκτος (*kaktos*), which probably describes the cardoon or artichoke thistle (*Cynara cardunculus* L.).[54]

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47 The Latin version of Greek σίλουρος, another sheatfish (Aelianus, *De nat. an.* 14, 25; Galen *De simp. med. temp. ac fac.* 12, 377 Kühn).

48 See Cuvier's comment on this species in his commentary on Pliny's *Hist. nat.* (1828). For details concerning the γλάνις and the σίλουρος, see Thompson 1947, 42–48 resp. 233–237.

49 On the ivy in Theophrastus, see *HP* 3, 18, 6; 7, 8, 1. On the *hedera*, see Vergil, *Georg.* IV, 47; Pliny, *Hist. nat.* 16, 144–152.

50 According to Joblin 2010, 14–15, names of species which are constructed by resemblance or any relationship to other names referring to species can be called *taxonyms*. The genus *Delichon* is listed under this category; further examples of this naming practice are diminutives and generic combinations.

51 See Lunczer 2011. Lunczer suggests the *charadrios* being either the Scopoli's Shearwater (*Calonectris d. diomedea* Scopoli 1769) or the Yelkouan Shearwater (*Puffinus yelkouan* Acerbi 1827); see esp. the detailed analysis in Lunczer 2011, 55–63.

52 On this particular case, see Humar 2015. For another case, see Tipton 2006. See also Lytle 2016 for a reconsideration of the species ἀμία and γομφάριον.

53 For instance, the binary name of the myrtle (Greek μύρτος) is *Myrtus communis* L.; on this case see Hardy & Totelin 2016, 94.

54 See Hardy & Totelin 2016, 94.

3.1 Mythological Naming Practices in the Works of Carl Linnaeus

A turning point in the history of classification is marked by the *Systema Naturae* (Stockholm 1735),[55] published by Carl Linnaeus.[56] Before Linnaeus it was common to name species using long Latin phrases describing the features of the species.[57] Linnaeus chose a binominal naming-scheme using only the genus name and the specific name.[58] While arranging his genus and species names, he consulted and compared the names given to species by ancient as well as Renaissance writers. Facing the huge number of new species to be described, or re-described, Linnaeus used the same naming practice as his ancient antecedents. Most of his descriptions and denominations derive from mythology (drawn from classical literature), which functioned as a welcome inspiration for his scientific nomenclature.[59]

The archetypal example of mythological naming practices in the work of Linnaeus with an explanation of the origin of the name is probably the story of the bog-rosemary (*Andromeda polifolia* L.), a species of flowering plant native to the Northern hemisphere.[60] During his 1732 expedition to Lapland,[61] Linnaeus observed this small shrub and named it after Andromeda, a prominent figure in Greek mythology. With excitement, he describes the beauty of the plant "decorating the marshy grounds in a most agreeable manner."[62] After a moment of contemplation, he "could not help thinking of Andromeda as described by the poets"[63] and decided to name it after her. Immediately, he gives a detailed explanation of his inspiration to that name, of course, with a close connection to the ancient poets:

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55 The important tenth edition of the *Systema* (Stockholm 1758) is understood as the beginning of biological nomenclature as definition and separation of groups of biological species based on morphological peculiarities arranged in a hierarchical classification. His *Species plantarum* (1753) plays a similar role in botanical nomenclature.

56 On the history of biological nomenclature and the role of Linnaeus, see Schiebinger 2007.

57 These 'polynomial' names can be found in every botanical work before Linnaeus' *Systema*. See, e.g., the plants listed in Joachim Camerarius' *Hortus medicus et philosophicus*, Frankfurt 1588 and in his *De plantis epitome utilissima*, Frankfurt 1586. Another quite illustrating example is the *The Herball or Generall Historie of Plantes* by John Gerard (1597) where almost every common name of a plant is listed; cf. also Schiebinger 2007, 95 shortly discussing the second edition of the *Herball* (1633).

58 See above pp. 185 f.

59 On the naming practices in Linnaeus' work, see Kranz 2019 who shows that the Swedish botanist already took the poetic dimensions of plant names into account.

60 The Andromeda is a small shrub with slender stems; the leaves are evergreen, the flowers are bell-shaped with a white or slightly pink color, and the fruit is a small capsule containing numerous seeds.

61 C. Linnaeus, *Iter lapponicum*, Stockholm 1732.

62 *Iter lapponicum*, 188.

63 Ibid.

> Andromeda is represented by them [sc. the poets] as a virgin of most exquisite and unrivalled charms; but these charms remain in perfection only so long as she retains her virgin purity, which is also applicable to the plant, now preparing to celebrate its nuptials. This plant is always fixed on some little turfy hillock in the midst of the swamps, as Andromeda herself was chained to a rock in the sea, which bathed her feet, as the fresh water does the roots of the plant. Dragons and venomous serpents surrounded her, as toads and other reptiles frequent the abode of her vegetable prototype, and, when they pair in the spring, throw mud and water over its leaves and branches. Hence, as this plant forms a new genus, I have chosen for it the name of Andromeda.[64]

In this passage, Linnaeus demonstrates a deep familiarity with ancient literature and artistically intertwines the origin of this binary name with the mythological background embellished with a drawing (see Fig. 1). In this way, he displays his education and competence.[65] Hence, Kranz speaks of the *nomenclator botanicus* as *poeta doctus*.[66]

Fig. 1: Illustration from Linnaeus' *Iter Lapponicum* (1732).

However, the mythological explanations of binary names can also be misleading. In his *Species plantarum* (1753), Linnaeus describes the Herb Paris, or True Lovers' Knot: a perennial herb with four filiform petals and only one blueberry-like fruit, which is poisonous. The symmetric arrangement of the leaves and the exposed flower in the middle give the one berry an ornamental shape. The scientific name of this plant, *Paris quadrifolia*, is, at first glance, mythological; the plant illustrates the famous judgment of Paris, which is

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64 *Iter lapponicum*, 188–189 (Translation James Edward Smith 1811). On this, see also Kranz 2019, 104–105.

65 In numerous passages, Linnaeus is quoting from Vergil, Propertius, and other Roman poets to decorate his texts, which reflects, again, his familiarity with classical texts. On Linnaeus literary education, see Lindroth 1983.

66 See Kranz 2019, 106.

preserved in several ancient sources.[67] The four petals represent the three goddesses, Hera, Aphrodite, and Athena, together with Helen, while the single fruit in the center is the Trojan prince Paris.[68] This interpretation is found in the plant's English trivial name Herb Paris (in Italy, L'Herba Paris). In fact, the generic name *Paris* derives from the Latin root *par* (equal, similar) and refers to the similarity of the four petals.[69]

Even the re-naming of certain species can show the scientist's familiarity with Greek mythology. For example, the German entomologist Jakob Hübner (1761–1826) renamed Linnaeus' butterflies. In his *Systema Naturae*, Linnaeus originally placed all butterflies and moths under the genus *Papilio*;[70] within this group, he described the *Papilio io*, the Io butterfly (European peacock or peacock butterfly). The most eye-catching structures on this butterfly are its two spots on each wing, which highly resemble eyes. Linnaeus' choice for the epithet name *io* is clearly motivated by the mythological story about Io, the daughter of Inachus.[71] Io, in Greek mythology, was a priestess of Hera in Argo; Zeus, inflamed with passion, seduced her. To escape Hera's detection, he turned Io into a heifer. This metamorphosis into a heifer, known for having big round eyes, probably was the model for naming this butterfly after Io in the *Systema Naturae*. Later, Jacob Hübner erected a new genus (*coitus*, in German: 'Verein') for *Papilio io* within the family of Angulatae (Anglewings). The ranking of the *Papilio io* as a single genus was accompanied by a re-naming. Moreover, within this task Hübner shows his familiarity with Greek mythology as well; he named this species *Inachis io*, which is: Inachus' daughter, Io.[72] This re-naming is in two ways impor-

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67 See, for example, Ovid (*Heroides* 16, 71 ff., 149–152 and 5, 35f.), Lucian (*Dialogues of the Gods* 20), and Hyginus (*Fabulae* 92).

68 Another possible interpretation is to see the single fruit as the apple thrown by Eris to induce the quarrel of the three goddesses.

69 This insecure etymology is already remarked upon, for example, by Strohecker 1869, 65; for further details, see Genaust 1996, s.v. Paris. In order to prevent misunderstandings regarding the sources of names it is now an established practice to specify as an author what inspired the name; see the most modern examples of nomenclature below on pp. 199 f.

70 The documentation of the nearly 200 species of butterflies known to Linnaeus is full of names from classical mythology as specific names. These were thematically arranged into six groups. The first such group is named *Equites*, which was divided into the *Equites Trojani* (Trojan army) and *Equites Achivi* (Achaean army), alluding to the Trojan War. Between the two groups, most of the figures involved in the war were named. The second group was the *Heliconii* comprising Apollo and the Muses. The third group was the *Danai*, which was divided into the *Danai Candidi* and the *Danai Festivi*, representing the Danaids and their husbands. The fourth group was the *Nymphales*, or nymphs, divided into the *Nymphales gemmati* and the *Nymphales phalerati*. The fifth group, the *Plebeji*, was divided into *Plebeji Rurales* and *Plebeji Urbicolae*. The final group was the *Barbari*, or *Argonauts*. For Linnaeus' catalog of Trojan heroes and Nymphs or Muses, see Heller 1945.

71 Other fathers are named in Apollodorus, *Bibl.* 2, 5. See also 2, 1, 3 and Hesiod's *Catalogue of Women* fr. 124.

72 See Hübner 1816, 37. The taxon *Inachis* (Hübner 1816) has been synonymized with the taxon *Aglais* (Dalman 1816) relying on a DNA-based study conducted by Wahlberg & Nylin 2003. The binominal of the European peacock is *Aglais io*. This renaming is not entirely accepted; see, e.g., Tshikolovets 2011.

tant. On one hand, it is anatomically justified because of the degree of difference from other *taxa*. On the other hand, it is a precision concerning the aptness of the name regarding the mythological background. Thus, Hübner by coining this name 'outperforms' Linnaeus twice: systematically and concerning mythological accuracy.

However, what is the reason for such a vast usage of mythology in the naming of species? The purpose of mythological naming practices can be described as a demonstration of competence.[73] In other words: Naturalists, like Linnaeus (and other authors before and after him), demonstrate their education and knowledge by choosing terms or names that are very rich in allusions to ancient mythology. The author of a species presents himself or herself as adept to the ancient source and literature. Hence, the naming of species after figures in mythology exceeds purely ornamental intentions.[74] Further, the naming after figures known to society raises public awareness of the naturalist's discoveries or of biodiversity, in general. These strategies can be observed even in modern naming practices of species as will be shown below.

3.2 Naming Practices as Competence Strategies

All zoological and botanical works dealing with the naming and description of animals or plants show a high level of familiarity with ancient sources (poetry as well as prose). Often, the naturalists paid more attention to the naming of authorities than to investigating the accuracy of their descriptions. Guillaume Rondelet (1507–1566), for example, in his *Libri de piscibus marinis* (1544–1545), mentions the Roman poet Ovid and the Greek poet Oppian several times. Because these poets focused on poetic description and literary devices, they did not offer detailed descriptions of the species named in their works. Rondelet pays high attention to their actions and often comments on their descriptions of fish with phrases like 'ut Ovidius eleganter dixit' or 'bene dixit'. However, the works seldom exceed the accuracy of the ancient descriptions and do not provide a detailed analysis or re-evaluation of the ancient sources. It seems, rather, that ample lists of ancient works studied and recited in the works of Rondelet serve as a way of 'name-dropping' to increase his own reputation as a highly educated and diligent naturalist. Rondelet even supports allegations of the ancient writers that can hardly be true. For example, concerning the Adonis-fish

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73 On the display or representation of competence and knowledge in antiquity, see Fuhrer & Renger 2012.

74 Heller, for example, explains the usage of mythological figures in the works of Linnaeus only by decorating purposes: "It needs no demonstration that in this age references to classical mythology were sought after as an embellishment not merely in poetry, but in technical and scientific writing as well" Heller 1945, 335.

mentioned above, he asserts that he observed several species of that fish sleeping on land many times.[75]

Nevertheless, Rondelet also contributes to the variety of zoological nomenclature: For a long time, it was uncertain where the genus of dragonflies (*Libellula*)[76] got its name. Two independent papers[77] revealed that Rondelet coined this term. In the context of the discussion of the dragonflies, he reports that

> Insectum hoc libellam fluviatilem libuit appellare, a similitudine quae illi est cum fabrili instrumento, et cum Libella marina. Haec bestiola parva est admodum T, litterae figuram referens, pedes ternos utrinque habet, cauda in tres appendices definit, quae viridi sunt colore, iisdem et pedibus natat.[78]

> it was much-loved to call that insect river-libella, because of the similarity it has to the craftsmen's instrument and to the marine *Libella*. This little animal resembles pretty much a T, referring to the shape of that letter; it has three legs on each side, the tail ends into three appendages, which are of green color; it swims by these and by the feet. (my translation)

Rondelet observed little dragonflies, or, more precisely, their larval stage, resembling the letter T because of their head with protruding lateral eyes. Rondelet connects the shape of the dragonfly to the level, or bubble level, of a scale and to the marine *Libella*, which might be the hammerhead shark (Greek: ζύγαινα).[79] In his chapter on the hammer-head (*Zygaena*) he reports that Theodorus of Gaza translated the Greek term ζύγαινα with *libella*, alluding to the similarity to the craftsmen's instrument. Since this shark with its lateral extended eyes indeed highly resembled the larvae of the dragonflies, Rondelet then coined the name *Libella* for the dragonflies.

These examples show how names can indirectly impart the education of its name-giver. Another strategy, also found in scientific names, is to honor the education of another scientist. This is briefly outlined in the following section.

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75 See Rondelet, *De piscibus marinis*, s.v. *Exocoetus*. It seems that already Theophrastus doubted the plausibility of the *Exocoetus* coming on land when he tells the story as follows: "The most wondrous case is, if it is true, the case of the so called 'sleeping outside': This fish, they say, makes its bed every day on land, which is the reason why it has got its name." Theophrastus fr. 171, 1 (my translation).

76 Often misinterpreted as derivation from the Latin word for book (librum, libellum).

77 See Kemner 1942; Jarry 1962.

78 *Universae aquatilium Historiae pars altera, cum veris eorum imaginibus* (1555), cap. 39.

79 The name for the hammerhead-shark itself is quite metaphorical since the word ζυγός literally describes a yoke of a plough. The particular structure of the shark's head definitely deserves such a metaphorical expression.

3.3 Authorities as Eponyms

Another common naming practice, especially in the Renaissance and following eras, was the naming of species after authorities[80] (*eponyms*) meritorious in certain fields of research. Especially in botany, there are many species or families bearing a scientist's name. For example, the French botanist Charles Plumier (1646–1704) honored the German naturalist Conrad Gesner (1516–1565) with a family named *Gesnera*.[81] Further, Plumier was honored by Joseph Pitton de Tournefort (1656–1708) by his family *Plumeria* (Apocynaceae); in return, Plumier named the family *Pittonia*.[82] This name was later revised and renamed by Linnaeus. He turned the *Pittonia* into the *Tournefortia*[83] because this name was more popular.[84] Often, these eponyms have no connection to the authorities they are named after. In some cases, however, there is a relation between the names of the genus and the name-giver; e.g., the family *Bauhinia* was named by Charles Plumier[85] after two Swiss-French brothers, Caspar (1560–1624) and Johann Bauhin (1541–1613), who were both meritorious in botany. This genus within the family of *Fabaceae* is characterized by leaves that seem to consist of two leaves that have grown together and, thus, resemble two inseparable brothers.[86]

It is possible that affiliated naturalists named different generic groups or species after each other, not only out of a genuine appreciation for these scientists' works, but also to increase their renown. Another intention might have been that young naturalists were motivated to partake in intensive research because there were higher chances of success and honor and, hence, their diligence was enhanced.[87]

However, the naming after 'persons' was also used to brand competitors or critics, as can be already seen in Linnaeus' binary names.[88] Daniel Rolander, a student of Linnaeus who collected thousands of specimens, once refused to turn them over to his master, intending to describe and publish them by himself and establish his repu-

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80 We find a few cases of this naming practice in ancient texts. For instance, according to Pliny (*Hist. nat*. 25, 77) the plant *euphorbia* (εὐφορβία in Dioscurides 3, 82) was named after the physician Euphorbus, a brother of a famous doctor. The plant *Mithridateia* was named after Mithridates VI by the ancient botanist Crateuas (*Hist. nat*. 25, 62). See Hardy & Totelin 2016, 100–101 for further examples.

81 Adapted by Linnaeus under the genus *Gesneria*.

82 Charles Plumier, *Nova plantarum americanarum genera*, Leiden 1703, 5.

83 Carl Linnaeus, *Genera plantarum*, Leiden 1742, 62.

84 Interestingly, there are several reflections on the rules concerning the naming after authorities, for example, the remarks of the Swiss Alphonse de Candolle (1806–1893), holder of the Linnaean Medal (1889), and member of the Leopoldina since 1836. In his *Introduction á L'Etude de La Botanique* (Paris 1835), he emphasizes that, if a man has two names, like in the case of Pitton de Tournefort, the name of the genus named after him should bear the more prominent name; see de Candolle 1835.

85 Charles Plumier, *Nova plantarum americanarum genera*, Leiden 1703, 26.

86 Another example might be genus *Trembleya*, named after three brothers who were all active in botanical studies. On this, see de Candolle 1835, 8.

87 See de Candolle 1835, 8.

88 On the practice of insult naming, see Heard 2020, 104–114 with several examples.

tation. Linnaeus answered this behavior by naming a bug after his disobedient pupil: *Aphanus rolandri* (Linné 1758). The Greek word *Aphanus* stands for ignoble and obscure. In addition, Linnaeus coined another name with insulting intentions:[89] the genus *Siegesbeckia*,[90] a small creeping sometimes foul-smelling herb that grows in mud, was named for Linnaeus' main critic, the Prussian physician and botanist Johann Siegesbeck (1686–1755), with whom Linnaeus quarreled.[91] Linnaeus was honored by the Twinflower named after him (*Linnaea borealis*) by Jan F. Gronovius (1611–1671).[92]

4 Naming Practices in Modern Biology

At first glance, the described naming practices we find in texts from antiquity to the Renaissance seem to hardly be applicable to modern nomenclature; the majority of modern scientists perhaps lack a profound knowledge or deep interest in ancient mythology.[93] However, we find many names alluding to fables of modern times, often, though, without any connection to the character concerned. For example, the Cinderella fat-tailed mouse opossum (*Thylamys cinderella*, Thomas 1902) is a species of opossum in the family Didelphidae or, *Crocidura cinderella* (Thomas 1911), a species of mammal in the Soricidae family. The Jurassic genus of ichthyosaurs named *Excalibosaurus* sp. (McGowan 1986) was denominated after the famous sword in the Arthurian legend because of its jaw resembling a sword.

Probably, the fantasy novel *Lord of the Rings*, published by J. R. R. Tolkien (1954–1955) had one of the most pronounced influences on modern taxonomists. We find the main characters of this novel in many species, such as the snout beetles *Macrostyphlus frodo* (Morrone 1994), *Macrostyphlus gandalf* (Morrone 1994), or the cicada *Macropsis sauroni* (Hamilton 1972).[94] But, likewise, *Harry Potter* is catching up.[95] This proves that also modern biologists show their penchant for their favorite literature

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89 This insulting naming practice is now forbidden by the codes of nomenclature, see below.

90 Description in *Hortus cliffortianus*, Leiden 1737.

91 On the controversy between Linnaeus and Siegesbeck, see Jönsson 2000.

92 Gronovius coined the name this way because it was Linnaeus's favorite plant. Linnaeus had helped Gronovius to complete his *Flora virginica* (two parts, published 1739 and 1743).

93 However, some names in modern taxonomy contain references to antiquity, albeit in a humorous way: *Vini vidivici* (a parrot, named by Steadman & Zarriello 1987) and *Ytu brutus* (coined by Spangler 1980), a water beetle.

94 The Finnish taxonomist Lauri Kaila provides a large catalogue of elves in the description of several species belonging to the *Elachistidae*, a genus of moths. We find *Elachista amrodella* (Kaila 1999), *Elachista aredhella* (Kaila 1999), *Elachista gildorella* (Kaila 1999), and many more.

95 See Heard 2020, 152–161.

via naming practices. These practices resemble the naming after (mythological) *eponyms* in antiquity.

Another prominent naming practice in modern nomenclature is still the naming after authorities. For example, the alfalfa gall midge (*Asphondylia websteri*, Felt 1917) is named after the entomologist Francis M. Webster who encouraged the examination of the species. In some cases, we even find a 'double naming' after authorities, as in a roundworm (nematode) of the genus *Koerneria* (Meyl 1960), named after the nematologist Hermann Koerner; the epithet in turn is named after another modern German specialist in nematology, Walter Sudhaus (*Koerneria sudhausi*). In contrast to the naming of species after authorities in the Renaissance without a (necessary) connection to the species or the field of research it falls under, today it is a common practice to name species after researchers meritorious in the field in which the species description was published.

The examples given above show that, even in modern nomenclature, we find names alluding to (fictitious) traditional narrative. Further, we can observe a naming practice similar to the allusion to mythology of today's naming of species: As ancient mythology and its heroes were to the naturalists in antiquity, and the ancient authorities to the Renaissance writers, so are figures of popular culture to the modern scientists. Thus, nowadays famous persons, such as athletes, actors, singers, or ensembles, inspire numerous names of organisms. One finds examples of these eponymous taxa that were simply chosen to honor the respective celebrity by devoting a denomination of a newly discovered organism, often without any connection to the name-giver. For example, the worm species *Neanthes rooseveltí*, the beetle *Maxillaria gorbatchowii*, or the trapdoor spider *Aptostichus barackobamai*.[96] In singular cases, one finds reflections on the naming of species: Recently a newly discovered moth occurring in Southern California and Northern Mexico with a remarkable yellowish-white color of the scales on the head was named after the current president of the United States: *Neopalpa donaldtrumpi* (Nazari 2017). Nazari explains explicitly that the scales with its color reminded him of the hair-style of the name-giver and connects this explanation with an important remark concerning the protection of biodiversity:

> The new species is named in honor of Donald J. Trump, to be installed as the 45th President of the United States on January 20, 2017. The reason for this choice of name is to bring wider public attention to the need to continue protecting fragile habitats in the US that still contain many undescribed species. The specific epithet is selected because of the resemblance of the scales on the frons (head) of the moth to Mr. Trump's hairstyle.[97]

To raise attention to environmental problems is a very modern motivation of naming practices, and quite necessary and (maybe) beneficial as another example might prove: Recently, a deep-sea amphipod has been found in depths of more than 6000 m.

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96 For more examples for species named after celebrities, see Heard 2020, 49–56.

97 See Nazari 2017, 89.

However, the species contained a lot of PET plastic in its stomach which is a result of the rising plastic pollution of the oceans. Alan Jamieson, one of the authors of the publication on the newly discovered species, stated:

> We decided on the name *Eurythenes plasticus* as we wanted to highlight the fact that we need to take immediate action to stop the deluge of plastic waste into our oceans.[98]

Other names refer to specific characteristics observed in the organism that parallel those of the eponym. For instance, the male species of a carabid beetle, holding markedly developed, almost 'biceps-like' middle femora, was named *Agra schwarzeneggeri* (Erwin 2002) in reference to the imposing physique of the famous Austrian actor and former governor. A certain species of wasps discovered in Ecuador was named *Aleiodes shakirae* (Shimbori & Shaw 2014) since parasitism by this species causes the host, a particular type of caterpillar, to characteristically bend and twist its abdomen in ways that reminded the scientists of a Colombian singer who is famous for her belly-dancing moves. Marilyn Monroe likewise inspired scientists to name a species of trilobites, *Norasaphus monroeae* (Fortey & Shergold 1984), after her for its hourglass-like shape. These naming practices do not seem very traditional, but are witty and creative.[99] Moreover, these strategies serve the purpose of creating an image, which, on the contrary to the strategies of the Renaissance-naturalists,[100] does not focus on the demonstration of education and knowledge, but on the self-representation of scientists as humorous and widely interested people, instead of nerdy specialists.

Facing the high increase of newly discovered species and the availability of names or prominent figures, it seems reasonable that some scientists focus on their imaginative humor to define and name new species; a strategy unfamiliar to antiquity or the Renaissance. For example, a species of braconid wasps with conspicuous huge eyes named *Heerz lukenatcha*[101] (Marsh 1993), a species of the scarab beetle *Cyclocephala nodanotherwon* (Ratcliffe 1992), the pyralid moth *La cucaracha* (Blesynski 1966), or the snail *Ba humbugi* (Solem 1983). The historical archetype of the invention of 'humoristic' names might be the insulting naming of the species *Anisonchus cophater*

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98 Weston et al. 2020. Another example can be added here: A new genus of huntsman spiders (*Thunberga*) found in Madagascar has been described recently by the German arachnologist Peter Jäger and was named after Greta Thunberg because of her commitment to stopping the climate change. On the original description, see Jäger 2020.

99 The entomologist Spencer Less showed little creativity and humor when he had to face the task of inventing names for his newly discovered species of flies; he chose perhaps the most uncreative way of sequential naming: *Ophiomyia prima*, *O. secunda*, *O. tertia*, and so on. The same concept can be observed in chemical elements: While several elements are named after the place of discovery (e.g., *Hassium* and *Darmstadtium*) or famous scientists (e.g., *Einsteinium*, *Curium*, and *Roentgenium*), some elements are simply named after their number within the periodic table (*Ununtrium*, *Ununquadium*, *Ununpentium*).

100 However, Linnaeus had his own sense of humor; see Jönsson 2002.

101 Read out loud: Here's looking at you.

(Cope 1884). The comparative anatomist Edward D. Cope (1840–1897) comments with this species of a Miocene mammal on the diverse hostilities of, especially, Othniel Charles Marsh. In a letter to Henry F. Osborn he wrote:

> Osborn, it's no use looking up the Greek derivation of cophater, [. . .] for I have named it in honour of the numbers of Cope-haters who surround me [. . .].[102]

These names could be described as *poetonyms* since they do not bear any relation to a (real) person (like *eponyms*), to morphological or behavioral features, (like *morphonyms*), and they do not borrow elements from a foreign language (like *autochtonyms*) or refer to a special place (like *toponyms*). Therefore, they must be seen as inventions originating from the authors' fantasy or creativity.

In consideration of these new naming practices, it seemed necessary that the International Commission on Zoological Nomenclature (ICZN)[103] emphasized that no zoologist should propose a name that, to his knowledge, gives offense on any grounds or is insulting in any way; however, we have evidence that this rule was previously neglected.[104]

5 Conclusion

This overview of the different naming practices demonstrates that, from ancient times to today, naturalists and systematists showed a high level of creativity in inventing names for species. The sources of their names are particularly mythology and lit-

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102 On this, see Davidson 1997, 69.

103 The ICZN was founded in 1895 after the First International Congress of Zoology in Paris. Its main task is to publish and periodically revise the International Code of Zoological Nomenclature. The rules concerning the Zoological Nomenclature are regularly revised by the ICZN. The equivalent in botany is the International Commission on Botanical Nomenclature (ICBN). The rules of nomenclature are manifold and the ICZN has the agenda to minimize synonyms of the same species to avoid confusion. Thus, also linguistic lapses are preserved, if they belong to the original description of a certain species and therefore are valid. For example, the genus of burying beetles, first named *Nicrophorus* by Fabricius (1775), was emendated by Carl Peter Thunberg (1789) in *Necrophorus*, which is linguistically correct. However, the first description was made by Fabricius in 1775; hence, Thunberg's emendation is not valid. In other disciplines of biology, we have similar committees serving the establishment of rules of nomenclature: The ICSP (International Committee on Systematics of Prokaryotes), for instance, and the IBC (International Botanical Congress). On the ICZN and its nomenclature, see Laurin 2005.

104 See the example in Linnaeus' work and the case of the *Anisonchus cophater*. Another example might be the English entomologist George W. Kirkaldy (1873–1910), a specialist in *Hemiptera*, who coined many generic names ending with *-chisme* (e.g., *Polychisme*, *Peggichisme*, and *Florichisme*). The Greek suffix *-chisme* is pronounced similar to "kiss me," while the prefixes of Kirkaldy's generic groups belong to various women from alleged affairs. On Kirkaldy and his nomenclature, see Fletcher 1934.

erature, certain peculiarities of the species, and, especially in later periods, prominent authorities. Hence, the naming practices can be described as highly 'cultural'.

In the process of inventing names, creativity, education, and knowledge were, and still are, displayed by giving names rich in allusion and referring to external sources. Therefore, naming practices fulfill a further function beyond simply naming species: They can be used to reinforce the appreciation of the naturalist's education and awareness of details.

The naming practices of modern times in particular prove that, within the task of describing new species and inventing names, a parallel competition emerges; scientists seem to attempt to outperform each other with the naming of their species. Thus, scientific nomenclature serves as a tool for self-representation and demonstration of one's own education and creativity. In modern times, also the wish to raise attention for questions regarding environmental issues can be connected to the invention of names. Therefore, all those different practices of naming species should be treated with view to their cultural (and temporal) context.

But, as the amateur entomologist Lieutenant Colonel Arthur Maitland Emmet (1908–2001) puts it, sometimes the names given to species simply amuse their inventors:

> Scientific names have much in common with crossword puzzles. The nomenclator is the setter; he searches for a name that is neat and appropriate and if he can mystify his fellow entomologists, he will derive sadistic pleasure in so doing.[105]

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105 Emmet 1991, 13. Such a case of riddles in nomenclature might be the genus of orchids called *Empusa* by John Lindley (1799–1865). *Empusa* refers to a frightening demigoddess in Greek and Roman mythology. Bernhardt 2008, 85 was puzzled why John Lindley "cursed" this species of orchids "with the name of the filthiest she-demons in Greek mythology" and provides some ideas about the origin of the name. For another case, see Bernhardt 2008, 136.

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Dominik Berrens

The Rise of Botanical Terminology in the Sixteenth and Seventeenth Centuries

Abstract: Early modern scientific literature was to a big part written in Latin and until today many technical terms are derived from a Greek or Latin root. Botany, in particular, has maintained this tradition of describing and naming new plant species in Latin to this day. The sixteenth and seventeenth centuries saw a sudden and unprecedented increase in knowledge of plants not only due to the Europeans' encounter with other parts of the world but also due to a more thorough study of the indigenous flora and the new possibilities that inventions like the microscope offered. This new knowledge sparked the development of more comprehensive and specialized terminologies. The following chapter aims at giving an overview of this development and tries to answer the questions why new terms were introduced, how they were formed, and what contributed to their acceptance and success. The study is based on several important texts from the sixteenth and seventeenth centuries and the findings are exemplified by a close reading of passages on the development of fruits.

While Latin has been the main language in many scholarly disciplines in Western Europe from late antiquity, the predominant position of Latin gradually declined to give way to vernacular languages beginning in the seventeenth century. This process did not develop everywhere at an equal pace as, for example, emerging academies of science in England, France, and Italy actively fostered the publication of scientific results in the respective vernacular, while scholars from the European periphery, in Eastern or Northern Europe, for instance, stuck to Latin much longer. Moreover, there were differences between the scientific disciplines. Botany, systematic botany in particular, was without doubt the discipline that remained true to Latin the longest. Until 2012, the first description of every newly found plant, alga, or mushroom had to be in Latin. Since then, English and Latin are allowed.[1]

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1 Turland et al. 2018, Article 39.

However, even though Latin was the main language of the scholarly discourse for centuries, it has some linguistic disadvantages for this purpose because it lacks a direct article and the possibility to easily nominalize expressions. Moreover, Latin composites were regarded as poor style.[2] Despite these linguistic deficiencies, Latin could maintain its dominance as the language of science for such a long time because it had developed some kind of internationally recognized scientific terminology that moreover remained comparably stable over centuries. Latin has changed little with respect to morphology and syntax since the first-century BCE so that someone who can read Pliny can probably also read Leonhart Fuchs, although they lived about one and a half millennia apart.[3]

However, in the wake of the growing knowledge on plants in general and plant species in particular in the sixteenth and seventeenth centuries this was soon going to change. With an increase in knowledge and a decreasing influence of the stylistic models from antiquity, more fine-grained and comprehensive terminologies developed. Our contemporary botanical Latin is hardly recognizable and understandable for those trained in ancient Latin.[4] Especially in the eighteenth and nineteenth centuries, influenced not least by Carl Linnaeus (1707–1778), Latin was adapted to the needs of a technical language. Not only were further specialized terms introduced and meanings of words changed, but there also came to be differences in the preferred spelling of words and in grammar.[5] At this stage, botanical Latin ceased to be a language of general communication and developed into a purely technical language for specialist discourse.

In the following chapter, I will focus on the sixteenth and seventeenth centuries when Latin had to adapt to new knowledge and advanced techniques of observation and description, but still remained firmly rooted in its ancient origin even though scholars felt decreasingly obliged to write in Ciceronian Latin. Since this would still cover a vast number of texts, I will discuss select texts from different periods that proved to be influential. Moreover, I will deal with general botanical terminology and not with specific names for certain plant species.

1 Ancient Texts and Early Modern Observations

Early modern authors were fierce opponents of the scholastic Latin that had been developed at medieval universities. Orienting themselves toward a new stylistic ideal, the Neo-Latin literature saw a return to classical, that is, mostly Ciceronian Latin.

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2 See Roelli 2018, 2021 on Latin as scientific language.

3 Roelli 2018, 390–392; see also Stearn 2004, 15.

4 Stearn 2004, 15.

5 Ibid. 11, 15 f.

How far this imitation of Cicero should go was hotly debated at the end of the fifteenth and the beginning of the sixteenth centuries, but there was a general consensus to follow this model as much as possible.[6] In this first phase of the rediscovery of ancient Latin and increasingly also Greek texts, many scholars had the impression that their ancient scientific heroes such as Hippocrates, Aristotle, Theophrastus, Pliny, Dioscorides, or Galen already knew basically everything. Hence, a philologically sound edition and Latin translation of their writings, the identification of *materia medica* mentioned in them, and moreover the abolition of Medieval Latin or Arabic terms that had become common in late medieval medicine would ultimately lead to the restoration of the ancient knowledge.[7] Due to this intellectual current – the ideal of Ciceronian Latin and the idea of intellectual superiority of ancient scholars – we can hardly expect any new botanical terminology in this phase although Latin translations of Greek texts, which had a much more specialized and established philosophical and scientific terminology, proved to be challenging in this respect.

A main task for naturalists at the end of the fifteenth and the beginning of the sixteenth centuries was to identify plants that were mentioned in ancient texts; general and theoretical aspects of botany, by contrast, were less important.[8] Hence, Dioscorides' collection of plants in his *Materia medica* was a much more popular, studied, commented upon, and imitated work than Theophrastus' philosophical botanical works. However, the latter were available in a Latin translation by Theodorus Gaza (1410–1475) from 1454 that appeared in print in 1483.[9] The volume comprised both the *Historia plantarum* and *De causis plantarum*. Gaza struggled with Theophrastus' text, not only because his Greek was rather terse and dry, at times even obscure, but also because the translator had to be educated in *philosophia*, that is, have a sound understanding of the content. An additional difficulty arose from the lack of suitable Latin authors on this topic and the resulting lack of an adequate Latin terminology as Gaza lamented in the preface (1483, fol. Aiii[r]-Aiii[v]). In a letter included in the volume between the *Historia plantarum* and *De causis plantarum* (1483, fol. Kvi[v]), the humanist Giorgio Merula (1430–1494), who saw the work through press, praised Gaza's translation and defended his use of rare words as inevitable. Theodorus Gaza thoroughly searched Latin authors, Pliny, in particular, for suitable terminology.[10] The passage on the development of fruits will provide an idea of Gaza's translation. In the following discussions of later works, the treatment of this process will also serve as an example in order to make the individual differences as well as general trends in terminology and style easier to compare. This topic was chosen because

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6 See, e.g., Helander 2014, 39 f.; Fantazzi 2014; Korenjak 2016, 35–37.

7 See also, e.g., Dilg 1980, 115–121; Morton 1981, 115–118; Ogilvie 2006, 30–34.

8 Dilg 1980, 116 f.; Morton 1981, 122; Ogilvie 2006, 138.

9 Dilg 1975, 230; Morton 1981, 122; Ogilvie 2006, 138.

10 *Hic quotiens nobilium philosophorum libros in Latinum convertit, diligenter nostros scriptores rimatus et imprimis a Plinio non discedens adeo omnia facunde et Latine explicuit*, [. . .] (1483, fol. Kvi[v]).

it is discussed in many texts and most descriptions are comparably easy to follow without much additional information. Theophrastus treated the development of fruits in his *De causis plantarum* 1.16.1 with the following words:

> Ἡ δὲ πέψις ἐστὶν ἐν τῷ περικαρπίῳ· τοῦτο δὲ δεῖ γίνεσθαι καὶ λαβεῖν χυλὸν ἁρμόττοντα πρὸς τὴν ἡμετέραν φύσιν. Ἴσως δὲ αὐτὸ τοῦτο πρότερον εὖ ἔχει διελεῖν, ὅτι πέψις ἐστὶν ἡ μὲν οὖν τῶν περικαρπίων, ἡ δ' αὐτῶν τῶν καρπῶν, καὶ ἡ μὲν πρὸς τὰς ἡμετέρας τροφάς, ἡ δὲ πρὸς γέννησιν καὶ διαμονὴν τῶν δένδρων· οἱ γὰρ καρποὶ καὶ τὰ σπέρματα τούτων χάριν. Ἑκατέρα δέ πως ἐναντιοῦται πρὸς τὴν ἑτέραν. Ἅμα γὰρ τὸ περικάρπιον ὑγρότερον καὶ πλεῖον καὶ ὁ καρπὸς ἐλάττων, καὶ ἅμα μείζων οὗτος καὶ τὸ περικάρπιον ἔλαττον καὶ σκληρότερον καὶ δυσχυλότερον.[11]

> But concoction is in the pericarpion; and this must be produced and must acquire a savour that agrees with our human nature. Perhaps it is well to make a distinction about this last point. There is to be sure a concoction of the pericarpion, but there is another of the fruit proper; and the former concoction serves to provide man with food, the latter serves the generation and perpetuation of the tree, this being what fruit and seed are for. Each of the two concoctions interferes in a way with the other: with greater fluidity and size in the pericarpion goes smaller fruit, and with larger fruit goes a smaller, harder and more ill-flavoured pericarpion.[12]

Theodorus Gaza translated the passage like this (1483, fol. bii^r):[13]

> [. . .] *concoctio in pulpa fieri solet: quam scilicet confici et succum saporemque capessere nostrae naturae congruum necesse est. Sed forte hoc ipsum prius distinxisse oportet: coctionem aliam pulparum, aliam seminum esse et earum alteram ad cibum hominis accomodatam, alteram ad generationem perpetuitatemque arborum pertinere. Fructus enim et semina earum rerum causa natura produxit. Utrumque vero coquendi genus alteri quodammodo opponi videtur. Cum enim pulpa humidior et plenior est, fructus minor includitur. Cumque is maior est, pulpa minor, durior saporeque deterior ambit.*

Gaza tries to make sense out of some rather obscure passages in Theophrastus by adding, for example, *natura produxit* or *coquendi genus*. Otherwise, he remains quite close to the Greek text. For the technical term πέψις (*pepsis*), meaning a softening or ripening through heat, that has already been introduced by Theophrastus' teacher Aristotle for such physiological processes,[14] Gaza chose the Latin equivalents *concoctio* or *coctio*, a suitable choice since both nouns denote the process of cooking (πέσσω (*pessō*)/*coquere*[15]). In the sense of 'digestion' – expressing in this case almost the same concept – the Latin words *concoctio* and *coctio* have already been used by ancient

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11 Text: Amigues 2012, 39.

12 Translation: Einarson & Link 1976, 127–129.

13 I have normalized Latin spelling according to modern conventions throughout the article. All translations are mine if not otherwise indicated.

14 E.g., Aristoteles, *Meteorologica* IV 3, 380 a 11 (ripening of fruits); 381 b 7 (digestion); *De generatione animalium* I 2, 719 b 2 ('concoction' of semen). See also Liddell et al. 1996 s.v. πέψις. For Aristotle's concept of πέψις see, e.g., Lloyd 1996, 83–103. Amigues 2012, 139 states that πέψις is specifically used for the ripening of fruits by Theophrastus and has in most instances the same meaning as 'maturation'.

15 These verbs are actually derived from the same Indoeuropean root. See, e.g., Frisk 1960, s.v. πέσσω; Beekes 2010, s.v. πέσσω.

Latin authors, most notably by Pliny.[16] Considering it was explicitly highlighted by Merula that Gaza looked for suitable terms in good Latin authors, especially in Pliny, it is reasonable to assume that he found this word in the respective writings. The term περικάρπιον (*perikarpion*) literally just means anything around the fruit and was already employed by Aristotle in the sense of the often fleshy covering around the seed of which many fruits consist.[17] This term is still in use (although there is further subdivision into endo-, meso-, and exocarp). Gaza chose to translate it with the Latin word *pulpa* that basically means 'flesh' but could sometimes refer to softer tissue in plants and fruits in antiquity.[18]

However, although Gaza tried to pave the way for Western European scholars interested in plants, his translation did not render Theophrastus' complicated text much easier to comprehend. Commentaries were not available before the second half of the sixteenth century.[19] This might be a reason why Theophrastus' rather philosophical works on plants were less studied at the beginning of the sixteenth century.[20]

The first early modern author likely to have been inspired by Theophrastus' ideas was Jean Ruel (1479–1537). Apart from publishing *inter alia* a Latin translation of Dioscorides' *De materia medica* in 1516,[21] Ruel wrote *De natura stirpium* (1536). This work consists of three books and contains descriptions of some 600 plants, almost all of which were already mentioned by Theophrastus and Pliny.[22] Book one starts with 22 chapters (over 128 pages) dealing with general topics such as habitus, organs of plants and their functions, colors, odors, fruits and seeds, and medical use of plants. There is also a large chapter on botanical nomenclature (Chapter 20, pp. 90–117) where Ruel explains the etymology of some plant names. This part seems to be inspired by Theophrastus, but Ruel hardly went beyond the Greek philosopher as already noted by Theophrastus' true early modern successor Andrea Cesalpino (1519–1603).[23] Ruel's sentences in these introductory chapters are rather short and often contain definitions of technical terms, though they are largely based on ancient texts. The Chapter (11) on fruits and seeds starts as follows (1536, 44):

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16 For example, Pliny, *Naturalis historia* 20.37, 101 (*concoctio*). See also *Thesaurus linguae Latinae* s.v. *concoctio* and *coctio*.

17 Aristoteles, *Meteorologica* IV 3, 380 a 11; *De generatione animalium* I 18, 722 a 15. See also Liddell et al. 1996 s.v. περικάρπιον.

18 For example, Pliny, *Naturalis historia* 16.185 f. (soft tissue in wood, especially of fruit trees); Palladius, *Opus agriculturae* 4.10.35 (pulp of figs). See also *Thesaurus linguae Latinae* s.v. *pulpa.*

19 Dilg 1975, 230 f.

20 Another reason might be that Theophrastus was virtually unknown in Western Europe during the Middle Ages as Dilg 1975, 230 pointed out.

21 Ogilvie 2006, 32.

22 Morton 1981, 122; Valderas 1988, 277 f.

23 *Apud nostros autem Ruellius tentavit quidem, sed praeter ea, quae a Theophrasto excerpsit circa rationem commune, ulterius nequaquam est progressus* (Cesalpino 1583, fol. a3ᵛ)*.* Cf. also Morton 1981, 122; Valderas 1988; Ogilvie 2006, 223.

> *Fertilium pars maior fructum in medio flore concipit, alit fovetque tantisper in amplectentis utriculi sinu, dum flavescens emarcescat aut pereat caducus. Fructus flore exutus sensim increscens ad maturitatem perducitur. Fructus alii carne et nervo constant, alii carne tantum concreti. Nonnulli cute teguntur, sed humore omnes imbuti. Carne nervoque pruna cucumeresque coguntur, humore et cute mora punicaque coaluerunt. Sed publica haec distinctio, ut pars exterior cortex, interior caro intelligatur. Quibusdam quoque nucleus sequitur. Postremum in omnibus semen interne decumbit.*

> The largest group of fertile (plants) conceives the fruit in the middle of the flower, nourishes and fosters it in the bosom of its surrounding uterus until the falling flower becomes yellowish and withers away or vanishes. After it has been stripped off the flower, the fruit slowly grows into maturity. Some fruits consist of flesh and 'nerves', some just of flesh. Some are covered by a skin, but all are filled with liquid. Plums and cucumbers are held together by flesh and 'nerves', mulberries and pomegranates by liquid and skin. But this is a general distinction that the outer part is the rind, the interior the flesh. In certain fruits there is also a kernel. Finally, there is a seed inside all fruits.

Ruel not only used terms that are closely associated with plants but also terms taken from animals such as *utriculus* (here diminutive of *uterus*), *caro*, or *nervus*. The two latter words denote different qualities of rather unspecified tissue that Ruel discussed in Chapter 4 (*De carne, nervis, venis*; pp. 14–16). *Caro* is a soft tissue, *venae* are what we would call vascular tissues in which saps and water are transported. *Nervi* are some kind of fibers, smaller than the *venae*.[24] Also other terms deriving from structures in animals are used in this chapter such as *medulla* ('marrow', here used like *caro*, but also in the sense of the heartwood),[25] *pulpa* (in contrast to Gaza's translation, here likely referring to the softer parts of wood), or *ossa* ('bones', here in the sense of harder structure into which the *caro* develops). Plants are thus partly described as animals, a quite common metaphor or analogy[26] that we can already find in Aristotle and Theophrastus, and that will remain an important conceptual tool in naming and describing plant anatomy, as we will see.[27]

A much shorter but very influential glossary of terms can be found in Leonhart Fuchs's (1501–1566) *De historia stirpium* (1542).[28] After a long introductory letter,

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[24] Valderas 1988, 281.

[25] Ibid. 281 f.

[26] I follow Hentschel 2010, 19–24, who maintains that metaphors show similarities in just one point, but analogies in several relations between source and target system. It is not always easy to decide whether zoological terms in descriptions of plants are just metaphors or are meant to imply an analogy.

[27] See, e.g., Atran 1990, 224–230; Humar 2019; Bigotti 2021. Anthropomorphization of plants is, of course, not restricted to scientific texts; think, for example, of plant similes in epic or metamorphoses of humans into plants.

[28] On this work, see, e.g., Morton 1981, 124; Pavord 2005, 175–191; Ogilvie 2006, 194–197 and *passim*; Kusukawa 2012, 107–123. There is a commentary and facsimile edition by Meyer et al. 1999 in two volumes. Choate 1917 and Heller in Meyer et al. 1999 I, 220–259 offer an English translation of the glossary.

Fuchs added a *vocum difficilium explicatio* (fol. β3ʳ–β4ᵛ) in which he explained around 130 technical terms in alphabetical order, most of them referring to parts of plants, but 18 were not used as botanical terms by Fuchs, for example, *amuletum* or *cubitus*.[29] Some of these words – Stearn mentions 49[30] – have retained their meaning, the rest have become obsolete or acquired a different meaning. The explanations of the terms are just short definitions. The word *fructus* is explained like this (fol. β3ᵛ): *Fructus, quod carne et semine compactum est. Frequenter tamen pro eo, quod involucro perinde quasi carne et semine coactum est, accipi solet.* – "The fruit is, what consists of flesh and seed. Yet frequently in place of that, is understood whatever is collected in a wrapper in the same way as seed and flesh."[31] Like Ruel, but unlike Theodorus Gaza, Fuchs did not use *pulpa* for the fleshy part of the fruit but *caro*, the common word for flesh. *Pulpa* is also defined by Fuchs (1542, fol. β4ʳ) in the same sense as in Ruel's text: *Pulpa in arboribus est, quod nos in animalium corporibus musculum appellamus.* – "*Pulpa* in trees is what we call muscle in animal bodies."

It is important to note that none of these terms in Fuchs's glossary is newly coined but all are inherited from antiquity[32] or maybe also from his predecessor Ruel.[33] Fuchs did, however, create some new denominations for plants that had not been described in antiquity, most notably for the foxglove that he baptized *digitalis*, a loan-translation from its German name *Fingerhut* (Fuchs 1542, 892).[34] Fuchs only described some 550 plant species, most of them already known in antiquity,[35] so a detailed taxonomy and systematic description was not yet important. This would soon change, since early modern botanists were becoming increasingly aware that there were much more plant species than the ancients mentioned, not only from the Americas but also from Europe. This insight was already expressed by Antonio Musa Brasavola (1500–1550) in his *Examen omnium simplicium medicamentorum* (1536, 103):

> [. . .] *certum vero est centesimam partem herbarum in universo orbe constantium non esse descriptam a Dioscoride, nec plantarum a Theophrasto aut Plinio, sed in dies addiscimus et crescit ars medica.*

> But surely not a hundredth part of the herbs in the whole world was described by Dioscorides, not a hundredth part of the plants by Theophrastus and Pliny, but every day we learn more and the art of medicine grows.[36]

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29 Stearn 2004, 28. Stearn also remarks that three of the initially unbotanical words have meanwhile acquired a botanical meaning: *alabastra, amphora,* and *ligula.* Heller in Meyer et al. 1999 I, 224 identifies 29 'nonbotanical' terms.

30 Stearn 2004, 28.

31 Translation: Choate 1917, 193 with modifications. Cf. also Heller in in Meyer et al. 1999 I, 239.

32 Pavord 2005, 189.

33 Morton 1981, 124.

34 See Meyer et al. 1999 I, 100 f. for further examples.

35 Morton 1981, 124; Meyer et al. 1999 I, 65.

36 Translation: Morton 1981, 118 with modifications.

Caspar Bauhin (1560–1624), for example, could already describe more than 6000 forms of plants in his *Pinax theatri botanici* (1623). This increasing mass of known plant species and the wealth of additional information required a whole new system of categorization and description in a more standardized way.[37] The study of plants within so-called natural history developed into the 'science of describing' with its own and specific ways of identifying, naming, describing, and categorizing natural items as Brian Ogilvie has demonstrated.[38] This in turn fostered the development of new and more specific terms in botany.

2 The Expansion of Botanical Knowledge

The introduction of a new botanical terminology was a largely gradual process to which different authors contributed. We must not assume that there was a single scholar who crafted a newly coined terminology from scratch that was subsequently accepted by his peers. Instead of the coining of wholly new terms in the sense of a neologism of form, we rather see that already existing terms were given a new meaning in a certain context (neologism of sense), for example, by analogy or metaphor, or that some terms acquired a more specific meaning and developed from rather general words into real technical terms. Instead of a full set of new terms, early modern botanists could come up with just one or a few expressions that were subsequently taken over by others if they proved to be helpful. A good example is Fabio Colonna's (1567–1640) linguistic distinction between leaves of flowers and foliage leaves. Interestingly, the two sorts of leaves were not distinguished on a linguistic level until the end of the sixteenth century since both kinds of leaves were mostly referred to as *folium* in Latin and φύλλον (*phullon*) in Greek. Fabio Colonna graduated in laws but became interested in botany and pharmacology through his suffering from epilepsy and other illnesses. These led him to the study of ancient medical texts and resulted in the publication of the ΦΥΤΟΒΑΣΑΝΟΣ *sive Plantarum aliquot historia* (1592) as he highlights in the preface of this work.[39] As the Greek title Φυτοβάσανος (*phutobasanos*) – 'the touchstone of plants' – indicates, Colonna discussed ancient descriptions of plants including their alleged medical properties and assessed them in light of modern findings and observations – among them many of his own. Hereby, Colonna corrected quite a few errors of ancient medical writers. Besides, Colonna used πέταλον (*petalon*) to refer specifically to the leaves of the flower, the petals as they are still called

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37 For example, Morton 1981, 145; Atran 1990, 135; Ogilvie 2006, 222. The inclusion of detailed and realistic pictures constituted another important means for the identification of plants. See Dilg 1980, 122 f.; Kusukawa 2012.

38 Ogilvie 2006, especially 139–208.

39 See also Freedberg 2002, 114.

today.[40] The Greek word πέταλον basically also means 'leaf', though it is mostly used in poetry, not in prose.[41] Thus, *petalon* acquired a new, more specific meaning. Colonna became a member of the so-called Accademia dei Lincei and participated in many of their scientific activities including the publication of the so-called *Rerum medicarum Novae Hispaniae thesaurus*. This work on the natural history of the Spanish colonies in America was originally written by Francisco Hernández de Toledo (1517–1587) in the 1570s but remained in manuscript form and was kept in the library of the Escorial in Spain. This manuscript was later lost in a fire, but an epitome by an Italian physician named Nardo Antonio Recchi (1540–1595) had been produced that came into the hands of the members of the Accademia dei Lincei who published it in 1651 together with supplementary material, including glosses on plants by Colonna.[42] In this part, Colonna explicitly stated (p. 853) that he preferred the term πέταλον for the leaves of the flower to distinguish them from foliage leaves.[43] Colonna's new term helped botanists to specifically refer to a characteristic of plants that can be used to distinguish species from one another.

Some terms were closely linked to a specific concept and therefore did not survive when this concept was abandoned. A good example for this phenomenon is Andrea Cesalpino's reinterpretation of the term *cor* in his work *De plantis* (1583). The word *cor* was used by Ruel (1536, 3, 16) and Fuchs (1542, fol. β3ᵛ) in the sense of heartwood just like Theophrastus (*Historia plantarum* 3.14.1) had already employed the respective Greek word καρδία (*kardia*). The idea that the innermost part of the wood is so-to-say the 'heart' is still contained in the English expression 'heartwood'. Cesalpino introduced a whole new meaning for *cor* in plants in analogy to the heart of animals. He identified the *cor* with the region, especially in the seed, where shoot and root come together and where he localized the seat of the soul just as he assumed it in the case of animals.[44] This meaning of *cor* is no longer in use because the concept of a vegetative soul localized in some kind of heart is, of course, outdated. The respective region in the seed where the embryonic root of the plant embryo in the seed goes over into the axis is nowadays called hypocotyl, referring just to its location below the primordial leaf or leaves, the cotyledon(s).

Cesalpino's work *De plantis* is surely a milestone in the history of botany. It consists of 16 books and discusses about 1,500 plants in ca 1,000 chapters.[45] The first book

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40 Morton 1981, 163 f.; Findlen 2006, 461. Stearn 2004, 31 is, however, not correct in stating that Colonna never used the word πέταλον/*petalum* himself and seems to be unaware of its introduction in the *Phutobasanos* where it appears already in the very first description on page 1.

41 Liddell et al. 1996 s.v. πέταλον.

42 See, e.g., Freedberg 2002, 245–274; de Asúa & French 2005, 93–104; Baldriga 2007, 258–262; Mason 2009, 152–154; Capanna 2009 on the *Thesaurus* and its history.

43 See also Morton 1981, 133; Stearn 2004, 31.

44 For example, Cesalpino 1583, 2, 8. See also Morton 1981, 133; Atran 1990, 225–227.

45 Morton 1981, 129; Pavord 2005, 237.

is special because it is one of the few original philosophical treatises of botany from the sixteenth century, arguably the first since the works of Theophrastus.[46] As we have seen, Cesalpino was influenced by the peripatetic notion of the vegetative soul and used the respective vocabulary. The 15 remaining books are on the macrolevel arranged in the traditional order according to the habitus (trees and bushes in books 2–3, *humilior materia*, i.e., subshrubs and herbs in books 4–16). On the microlevel, Cesalpino grouped together plants with similar fruits and forms of seeds. Thereby, he created the first system of plants based on organs of reproduction; a system based on *differentiae* of the *substantia* of plants, not on *accidentia*, as Cesalpino (1583, 26) stated in an Aristotelian manner.[47] However, apart from his peripatetic influences, Cesalpino's text contains comparatively little technical vocabulary of botany. Most of the terms are, moreover, explained and defined. In this respect, his text is quite accessible. His description of the development of fruits begins like this (1583, 16):

> *Fructum vocamus, quod ex semine et semen continentibus corporibus constat, quamvis proprie secundum nominis appellationem ea pars significetur, qua fruimur in cibis expetentes. Expetimus autem inter cibos aliquando nuda ipsa semina, ut pini, nucis, castaneae et omnium frugum et leguminum, aliquando carnem seminibus circumpositam, quam proprie pericarpium vocant, ut mali, piri, melopeponis. Cum igitur de semine superius dictum sit, relinquitur, ut de circumpositis corporibus dicamus: hinc sumpto initio. Seminibus omnibus inest humor quidam fecundus, quo evanescente, aut per aetatem aut ab externa iniuria, redduntur infecunda. Huius igitur custodiendi gratia natura omnibus corticem quendam circumduxit, qui perpetue haeret, donec germinare coeperint.*

> We call fruit what consists of the seed and the bodies that contain the seed, although in the proper sense of the word it denotes the part that we enjoy when we reach out for it in meals. During meals, however, we sometimes reach out for the seed per se, like of pine tree, nut tree, chestnut tree, and all grains and legumes, sometimes we reach out for the flesh that surrounds the seed, that is properly called pericarp, like of apple trees, pear trees, and melons. As we have already talked about the seed above, we leave it aside so that we can speak about the surrounding bodies and start from here. In all seeds is a fertile sap. If this is lost either through age or an external damage, they become infertile. Thus, in order to protect them, nature has surrounded all of them with some kind of shell that remains there permanently until they start to germinate.

Cesalpino begins his chapter on fruits with a definition of it that resembles the one in Fuchs's glossary. Other technical terms are also explained, most notably *pericarpium*. While Theodorus Gaza, Ruel, and Fuchs found a Latin equivalent, *pulpa* or *caro*, Cesalpino chose to basically transliterate the Greek word (with a Latin ending) and give a short explanation. Otherwise, his text is written in elegant, almost classical Latin without too many technical terms, except for those that cannot be avoided such as the names of fruits. For instance, Cesalpino neither mentioned nor created a technical term for the seed coat, nowadays known as testa, which he just called *cortex quidam*.

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46 For example, Morton 1981, 128–144; Pavord 2005, 228–241; Ogilvie 2006, 54, 223–226 and *passim*.
47 See also Morton 1981, 135 f.; Pavord 2005, 234 f.

Joachim Jungius's (1578–1657) *Isagoge phytoscopica* constitutes an important step toward our modern terminology. This small work was edited and printed posthumously in 1678 or 1679[48] but had already circulated earlier in manuscript form.[49] The content of this introduction to botany stems from Jungius's teachings in private *collegia*, emended and extended by the author himself, and subsequently revised and edited by Johannes Vagetius (1633–1691) after Jungius's death. Inspired by Theophrastus' and Cesalpino's philosophical approach, Jungius offered an analytical assessment of plant morphology based on essential organs and structures.[50] Jungius is better known as a mathematician and in fact his *Isagoge* introduces the reader to the study of plants with short, non-redundant definitions of terms as we would expect it in a mathematical work.[51] There are 28 chapters on parts of plants ordered from general to special, subdivided into parts that serve growth (*augmentatio*) and parts that serve reproduction (*generatio*). Chapter 26 on fruits starts as follows ([1678], fol. F2^v-F3^r):

1. Fructus *dicitur pars plantae annua flori cohaerens et succedens, qui ubi maturuerit, id est ad perfectionem suam pervenerit, sponte a planta abscedit et terra aliave commoda nutrice excepta novae plantae fit initium.*

2. Succedere *dicitur* flori fructus, *quod floris inchoatio, perfectio, defluxio, fructus inchoationem, perfectionem, defluxionem antecedat.*
   Fructus igitur a reliquis plantae annuis[52] partibus differt, quod cum primum absolutus est sive ad perfectionem devenit, pars esse desinit, cum reliquae (uti folia, flores et in nonnullis surculi vel etiam integri stipites), tum demum ubi marcescere, putrescere aliterve corrumpi incipient a planta sua separentur.[53]

3. *Fructus vel semen est vel seminis conceptaculum, vasculum, folliculus, capsula, theca, involucrum seminis.*

1. A *fruit* is an annual part of a plant that is connected to the flower and follows it. As soon as it has ripened, that is, reached its perfection, it falls from the plant by itself and becomes the origin of a new plant after it has been received in the ground or another suitable 'nurse'.

2. *That the fruit follows the flower* means that the beginning, perfection, and discharge of the flower precede the beginning, perfection and discharge of the fruit.
   The fruit is therefore different from the other annual parts of the plant because it stops being a part as soon as it became complete or reached perfection while the other parts (like leaves, flowers, and in some plants twigs or even the whole trunks) are finally separated from their plant when they start to whither, rot, or are otherwise damaged.

3. A fruit is either the seed or the receptacle of the seed, the vessel, pod, capsule, hull, or covering of a seed.

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48 Morton 1981, 168; Stearn 2004, 30.

49 There is no date on the print, but Vagetius's dedicatory letter is dated 28 August 1678.

50 Morton 1981, 168; Stearn 2004, 30.

51 Morton 1981, 168; Stearn 2004, 30.

52 The print reads *annuae*, but the adjective should rather refer to *partibus*.

53 This discussion of fruits, leaves, flowers, etc. as *partes* or μέρη of plants goes back to Theophrastus, *Historia plantarum* 1.1.2 f.

Jungius's language is already very technical and contains hardly any unnecessary words or information. Moreover, we see nominal expressions such as *inchoatio*, *perfectio*, and *defluxio*. While many early modern scholars at the beginning of the sixteenth century tried to avoid such unclassical expressions that were regarded as scholastic and hence shunned, these reservations gradually declined in the course of the sixteenth and seventeenth centuries because – as in scholastic texts – an exact terminology consisting mostly of nouns became not only necessary but also proved to be handy.[54] Although Jungius is in general thorough in his definitions, he neither defined the forms of seed vessels nor distinguished between fruits containing only one seed and those containing several seeds.[55]

The editor Vagetius stated in the letter of dedication that Jungius's work provided not only a good guide to the characteristics (*differentiae*) of plants but also a sound set of terms for these characteristics. Jungius's terminology thus enabled scholars to write down their observations so that an unambiguous identification of plants would still be possible after some centuries.[56] In fact, Jungius introduced a number of new terms that are to a substantial part still valid today and gave already existing terms a very specific, technical meaning.[57] In contrast to earlier authors like Ruel, Jungius used *nervus* together with *costa* ('rib') to denote the veins of the leaf.[58] Jungius's definition prevailed in a certain sense,[59] and this example shows that technical terms did not remain stable and could change meaning.

One reason for Jungius's success is surely his sound and useful approach to describing and naming parts of plants, but the fact that his work was much valued by John Ray (1627–1705) and Carl Linnaeus also played a role. The latter mentioned Jungius and his *Isagoge* as the first example of *institutores* – that is, philosophers of botany who teach how to correctly establish systematics of plants[60] – in his *Bibliotheca botanica* (1736, 123), which contains what he considers the most important works of botanists; the last *institutor* is, of course, no other than Linnaeus himself.

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54 Helander 2014, 43–45. Cf. also Roelli 2021, 439–454 for a general assessment of scientific texts in Latin.

55 Morton 1981, 172 f.

56 [. . .] *inventis apta imposuit nomina, id denique effecit, ut describi observationum istarum ductu planta quaelibet ita possit, ut post quotcumque saecula ex descriptione ista sine errore agnoscere eam liceat* (fol.)o(3^v).

57 Morton 1981, 173; Stearn 2004, 31.

58 *Id, quod inter folia est,* nervus *saepius aut* costa *dicitur* (Jungius [1678], fol. A2^v) – "The same, which is the middle of the leaves, is called most often the nerve or the rib." (transl. Stearn 2004, 30).

59 In English, 'nerve' or more often 'vein' is used for all vascular bundles of the leaves; *costa* ("rib") denotes the midrib, the main vascular bundle of the leaf. See also Stearn 2004, 31 for this and further examples.

60 *Institutores botanici philosophi sunt, qui regulas rite constituendi systemata tradiderunt* (Linnaeus 1736, 123).

John Ray must have already received Jungius's *Isagoge* in manuscript form shortly after his death because Ray frequently cites it in his own works from 1660 onward.[61] Ray was an important predecessor of Linnaeus and developed a system of plants based on shared morphological characteristics (mostly flowers, seed, and seed vessels) and also tried to define 'species' in chapter 20 of the first volume of his *Historia plantarum* (1686, 40–42).[62] The *Historia plantarum* is an *opus magnum* published in three volumes (1686, 1688, and 1704). It not only contains thousands of plant species from all parts of the world, many of them described for the first time, but also a substantial theoretical introduction in the first book.[63] Like in Fuchs's *De historia stirpium* (1542), Ray included an alphabetical glossary of technical terms at the beginning of the first volume (1686, fol. a2^r-a4^v). In Ray's glossary, we find not only the Latin terms and definitions but also English translations.[64] Ray included basically all of Jungius's terms and added some more. Among Ray's additions is *petala* (1686, fol. a3^v) for the petals for which he rightly refers to Colonna; Jungius did not linguistically differentiate between the two kinds of leaves.[65] This inclusion is in line with Ray's focus on the flower for his taxonomy of plants that required a specialized terminology. Cesalpino was another important source for Ray and he also took over Cesalpino's concept of *cor* that can be found in the glossary (1686, fol. a2^v).[66] Ray's Chapter 12 on fruits starts with these words (1686, 22):

> *Fructus a fruendo dicitur estque pars ea plantae qua in cibis fruimur, sive pericarpium sit sive semen. Nomen autem fructus per analogiam ad omnium plantarum partes similes, quamvis nullum nobis usum praestent, nec in cibis neque in medicina, extendi potest.*

> Fruit is derived from *frui* ('enjoy') and it is the part of a plant that we enjoy in meals, be it the pericarp or the seed. The term 'fruit' is by analogy applied to similar parts of all plants, even if they are not useful for us and are neither sought after in meals nor in medicine.

This introduction is clearly inspired by Cesalpino's similar words, although Ray's version is much shorter and lacks, for example, the explanation of *pericarpium*. Immediately following these two sentences are Jungius's definitions to which there is a correct reference. Ray went well beyond Jungius and Cesalpino in the following account on the fruits and distinguished different sorts of fruits according to structure, number of seeds, etc. Moreover, Ray considered the latest microscopic studies by Marcello Malpighi (1628–1694), which will serve as a final example.

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61 Stearn 2004, 31.

62 See, e.g., Morton 1981, 197–212; Pavord 2005, 372–395.

63 See, e.g., Morton 1981, 198.

64 Stearn 2004, 31 states that some of the English terms no longer exist nowadays as they have been replaced by the Latin equivalent they should explain. This demonstrates the importance of Ray's work and the role of Latin in botany.

65 Morton 1981, 207; Stearn 2004, 31.

66 *Cor sive corculum seminis est portiuncula seminis unde tum radix, tum germen enascitur.* – "The heart or little heart of the seed is the part of the seed from where root and shoot grow out."

3 Microscopic Studies

Marcello Malpighi's *Anatome plantarum* (1675–1679) marks another important step in the history of botany. Together with Nehemiah Grew (1641–1712), Malpighi established the field of plant anatomy.[67] With the help of the microscope, Malpighi could describe the microstructure of plant tissues on a cellular level for the first time, although he was not yet aware of the real nature of cells and referred to them metaphorically as *utriculi*, 'small skins (for a liquid)', because of their form.[68] We should note that *utriculus* as diminutive of *uterus* has already been used by Jean Ruel in the quotation above to denote the ovary of plants. Hence, these two *utriculi* are homonyms. Our modern term 'cell' goes back to Robert Hooke's description of pores in cork that reminded him of the cells in a honeycomb as he explains in his *Micrographia* (1665, 113).[69] Although Malpighi's observations of what we can nowadays identify as plant cells are much more accurate than Hooke's, Malpighi's name did not prevail. Apart from this, Malpighi made many more important new findings that needed to be described and named accordingly. But, as Stearn rightly states, also in these cases "few of the words used by Malpighi have survived into modern botanical terminology."[70] This might partly be due to the conceptual framework in which Malpighi conducted his observations on plants that is reflected in his choice of names. Already in the so-called *Anatomes plantarum idea*, a short sketch of plant anatomical studies written in the form of a letter dated 1671 that was also prefixed to his *Anatome plantarum*, Malpighi stated (1675 [1671], 1):

> *Etenim fervente aetatis calore anatomica aggressus licet circa peculiaria fuerim sollicitus, in perfectioribus tamen haec rimari sum ausus. Verum, cum haec propriis involuta tenebris obscura iaceant, simplicium analogismo egent; unde insectorum indigo illico arrisit. Quae cum et ipsa suas habet difficultates, ad plantarum perquisitionem animum postremo adieci, ut diu hoc lustrato mundo gresso retroacto vegetantis naturae gradu ad prima studia iter mihi aperirem. Sed nec forte hoc ipsum sufficiet, cum simplicior mineralium elementorumque mundus praeire debeat.*

> And though when I turned to anatomical studies in the fiery heat of youth, I was eager about peculiarities, I nevertheless dared to examine these in higher animals. But since they lay hidden and covered in their own darkness, they required analogous studies of simpler animals; whence the study of insects seemed immediately pleasing to me in need. When these had their own difficulties, I have finally turned to the study of plants so that after I will have wandered this world for a long time, I might turn my step back and open a path from the stage of vegetal nature to my initial studies. But maybe not even this might be sufficient, because the simpler world of minerals and elements must precede.

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67 See, e.g., Adelmann 1966 I, 384–417; Morton 1981, 178–195; Fournier 1996, 55–62, 118–121 and *passim*; Bäumer 1996 III, 28–31; Rebohm 2017, 72–77.

68 Möbius 1901, 159 note 4; Morton 1981, 187; Toepfer 2011 III, 764.

69 *Oxford English Dictionary* s.v. cell.

70 Stearn 2004, 29.

We can see that Malpighi's main motivation for the study of plant anatomy was ulti-mately to understand the anatomy of humans. As the latter proved to be complex, he went down the *scala naturae* so to say and finally arrived at plants, which were per-ceived as the less complex living beings. Thus, we find many terms from the anatomy of animals transferred to plant structures in analogy.[71] We have already seen that the metaphor or analogy of plants as animals was widespread in pre-modern – and partly also in modern[72] – biology, but Malpighi has taken the analogy much further than his predecessors had. In fact, his approach yielded some good results in comparative anat-omy of animals by drawing analogy to the function of similar structures in smaller or more difficult to observe animals from the study of larger and more easily observed animals.[73] However, plants proved too different from animals for his widespread and consequent application of animal terminology to prevail to a significant extent. A nota-ble exception is vascular tissues that are called *trachea* because their structure resem-bles the trachea[74] of humans and especially the spiracles[75] of insects.[76] Trachea in plants are specialized cells or rather dead cells of the vascular tissue, in the so-called xylem, that serve the transport of water and minerals.[77] By contrast, Malpighi's choice of terminology in his chapter on the plant seed (1675, 57–63) that he described as if it were a chick embryo was less successful.[78] It is difficult to decide whether these analo-gies were intended to refer to a factual correspondence or Malpighi just used them met-aphorically in order to indicate a certain similarity. Still, the quotation above gives the impression that Malpighi really had the idea that the anatomy of plants and animals is comparable so that he could gain knowledge on the one by studying the other.

Apart from this feature, Malpighi's text and the style of his writing show further peculiarities that can be demonstrated with his description of the development of the fruit (Malpighi 1675, 64):

De uterorum augmento et ipsorum succedente forma

Expositis incrementis contentum semen in stylo ceu utero debitas subit mutationes, donec perfecta et completa organizatione veluti filius emancipetur. Nec soli semini contingit augmentum, sed Na-tura in pluribus uterum successive auget pluraque circum-turgere iubet foetus gratia. Ita in piro, pomis, cerasis et similibus contingit inducto pericarpio ut plurimum vel osseo cortice vel alio ana-logo tegumento. Varia est Naturae methodus in producendis huiusmodi uteri appendicibus et integ-

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71 For example, Atran 1990, 227; Fournier 1996, 59 f., 120; Rebohm 2017, 61, 76.

72 Humar 2019, 90–92.

73 Micheli 2007.

74 This word is derived from the female form τραχεῖα of the Greek adjective τραχύς ('rugged', 'rough') that is used together with ἀρτηρία to denote the trachea.

75 Their scientific (and also German) name is *trachea* as well.

76 Malpighi 1675, 10, 14, and *passim.* See, e.g., Fournier 1996, 60.

77 See also Humar 2019, 92.

78 See, e.g., Morton 1981, 185; Fournier 1996, 120. A translation of some parts of the chapter together with notes can be found in Möbius 1901, 60–63 (German) and Adelmann 1966 II, 849–855 (English).

umentis. Primo itaque, ubi calyx humilis est et exiguus uterus, in longum producitur styli elongata tuba. Hoc apprime experimur in citris et malis limoniis (Tabula 43, 247), quarum uterina extuberans tuba A sensim contabescere incipit, utriculi autem corticis B, turgidiores redditi, pericarpium exterius augent et circa seminum capsulas C vesiculae avido succo turgidae D emergere incipiunt.

On the growth of the uterus and its subsequent form

When growth became visible, the seed contained in the ovary or the uterus undergoes the necessary changes until it is released into independence like a son after all the structures have formed completely. Not only the seed grows, but nature lets the uterus gradually grow in many species and makes many swell all around because of the fetus. This happens in pears, apples, cherries, and similar fruits as soon as it is covered by the pericarp or a 'bony' hull or another analogous cover. Nature has various ways in producing accessions and coverings of such a uterus. First, thus, where the calyx is low and the uterus small, the elongated style of the ovary is extended. We find this mostly in lemon and lime (table 43, 247, here Fig. 1) whose upswelling style of the uterus A gradually begins to wane, the cells in the hull B, that become more swollen, let the pericarp grow from outside and vesicles swollen with avid juice D begin to emerge around the shell of the seeds C.
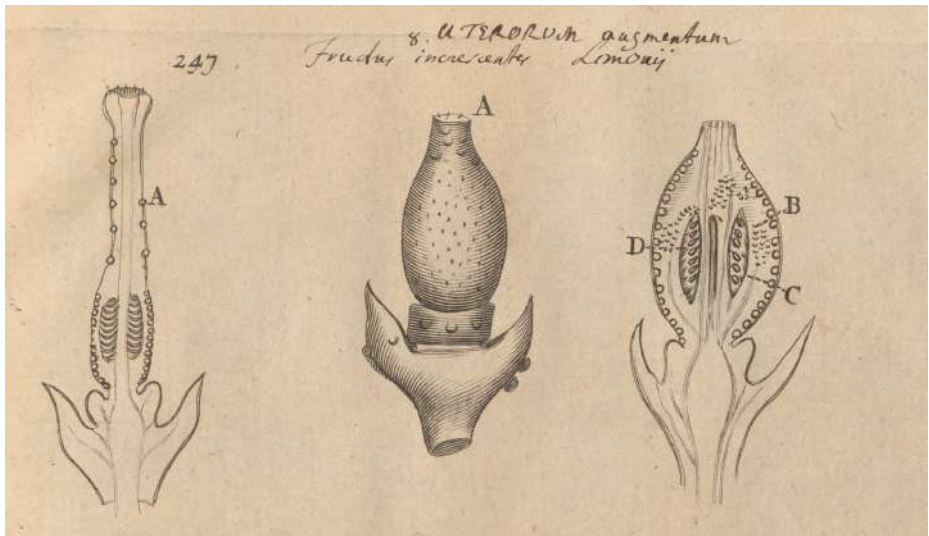
Fig. 1: Table 43, illustration 247 from Marcello Malpighi's *Anatome plantarum* (1675). Zentralbibliothek Zürich, NB 175, https://doi.org/10.3931/e-rara-62547 / Public Domain Mark.

Several points have to be addressed in this short passage with regard to the use of terminology. As has been said, Malpighi tried to describe plants as analogous to animals. Therefore, it comes as no surprise that he preferred the term *uterus* over *stylus* for the ovary. That he regarded these terms as synonyms is clear through the expres-

sion *in stylo ceu utero* in the first line.[79] In the chapter title and in most instances in the text, Malpighi rather uses the zoological term than the botanical. *Stylus* is not equivalent to our modern 'style', that is, the oblong, upward extension of the ovary. This structure is here called *tuba*, a metaphorical term referring to the musical instrument it resembles. Similarly, the seed is not only referred to as *semen* but also as *foetus* and is even compared to a son who is released from parental care (*veluti filius emancipetur*).

Malpighi's text features some subtle semantic changes compared to the earlier usage of a word. The word *calyx* (not to be confused with *calix*) or Greek κάλυξ (*kalux*) has been used since antiquity for basically any covering of flowers and fruits, but in Malpighi's text the term acquired the more specific meaning it still has today, that is, the usually green cover around the flower collectively formed by the so-called sepals.[80] An unclassical word in Malpighi's text is *organizatio.* The verb *organizare* was already used in Medieval Latin for 'playing the organ' or 'to pattern/form'.[81] The latter surely provides the meaning of the noun *organizatio* in this and in other medical or biological texts where it means something like 'the development of organs/structures' or, even closer to its modern meaning, just 'structure', 'arrangement'.[82] Malpighi was obviously not afraid to employ words from Medieval Latin. Moreover, Malpighi used descriptive, but unclassical verbs such as *circum-turgere*.

Besides, Malpighi's text is written in a nominal style that we have already encountered in Jungius's *Isagoge.* We find, therefore, expressions such as *mutationes subit* instead of *mutat* or *semini contingit augmentum* instead of *semen augetur.* Given the fact that Jungius's *Isagoge* was a different kind of text in which the use of nominal style might be less surprising, Malpighi's choice of nominal expressions is even more remarkable, especially as they do not seem to provide any additional or more specific meaning compared to expressions that are more classical.

4 Conclusion and Outlook

Having assessed different texts concerned with botanical terminology, I will now try to draw some general conclusions and to relate them to the overall questions of this volume. In the earliest examples from the end of the fifteenth and the first half of the

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79 Stearn 2004, 29, however, thinks that *stylus* denotes the gynoecium as a whole while *uterus* only covers the ovary.

80 Stearn 2004, 29.

81 For example, Du Cange s.v. *organizare.* It can also be found in Kirsch 1774, 1986: "organīzo, are, *die Orgel schlagen*".

82 The word can also be found in other passages of this work: Malpighi 1671 [1675], 1; Malpighi 1675, 27. There are also earlier instances of this use in English texts. See, e.g., *Oxford English Dictionary* s.v. organization.

sixteenth centuries, we hardly encounter unclassical words. As has been said, this is on purpose because scholars strived to imitate ancient models – in the case of science mostly Pliny – and resorted to neologisms only if they had no other choice. Since ancient scientific texts, particularly pharmacological and medical ones, were to a big part written in Greek, the first Latin translations of these texts in the early modern period proved to be very challenging because Greek had a more developed and extensive technical vocabulary. To find a suitable Latin terminology was not only a question of style and aesthetic but also of authority because early modern scholars aimed at restoring ancient knowledge by carefully editing, interpreting, and commenting authoritative texts from antiquity. The correct understanding and use of terminology were crucial to this end.

By the second half of the sixteenth century at the latest, scholars became aware that ancient authors were missing out on many aspects of scientific knowledge and subsequently emancipated themselves from them. The exponential increase in knowledge on plants and especially of known species from several hundred to several thousand in the sixteenth and seventeenth centuries led to the development of more detailed and standardized descriptions as well as systems of categorization. This fostered in turn the creation of new terms not only for individual plant species but also for general concepts or structures of plants. Since it was no longer feasible to write in a Ciceronian style, these stylistic questions took a backseat and a more technical style developed. The increase in both detailed knowledge and specialized jargon surely also led to a further differentiation of the scientific disciplines that – like in a feedback loop – might have fostered further specialized jargon: If the interested layperson could no longer understand the latest findings and theories anyway, there was no need for a more accessible treatment of one's topic. This is, of course, a gradual process and there are individual differences, but in general, a scientific Latin text from the beginning of the sixteenth century is much closer to classical Latin – and hence, easier to understand for the non-specialist – than a specialized treatise from the end of the seventeenth century. It is also worth noting that the seventeenth century saw an increase in botanical literature written in the vernaculars that could provide information for the interested layperson.

With regard to the creation of new terms we encountered different strategies although most words remain firmly rooted in the classical languages. As can be expected, technical texts tend to be written in a nominalized style and this increased over time as the Ciceronian ideal became less important. Malpighi's text is a particularly good example in this respect.

In many cases, there is no real coinage of new terms, but already existing, rather general words get a more specific meaning as we have seen, for example, in the case of *calyx*. Thereby, expressions that used to be synonyms or at least have a very similar meaning such as *pulpa* and *caro* or φύλλον/*folium* and πέταλον/*petalum* could develop into technical terms with different meanings. Another strategy consists in the transfer of already existing terms from zoology and anatomy to structures in plants. As has been said, this metaphorical or analogical use of zoological vocabulary was already es-

tablished in antiquity, but authors like Cesalpino and especially Malpighi explicitly chose these terms for conceptual reasons, that is, because they perceived structures in plants to be analogous to those in animals. Many of these terms are therefore no longer valid because neither are the concepts behind them. Another danger of this strategy lies in the misinterpretation of certain structures in animals as similar or equivalent to different structures in plants. Hence, such terms taken from zoology are particularly prone to be unstable. Words like *pulpa*, *nervus*, or *cor* were used differently by different authors. The most stable terms are probably those that proved to be easily comprehensible (i.e., deducible from classical languages), descriptive, handy, not too closely connected to specific concepts, and moreover valued by later authorities.

The creation of scientific terminologies in the sixteenth and seventeenth centuries was not done in a single act but it was a gradual process with different – even conflicting – systems side by side. This was surely due to the lack of a single towering authority, be it an institution such as the modern International Botanical Congress or the International Union of Pure and Applied Chemistry (IUPAC) or a single person. Botany actually had such a towering figure in the eighteenth century, Carl Linnaeus. Although he neither created a new terminology from scratch but was influenced by – among others – John Ray, nor was his system undisputed during his lifetime, Linnaeus's reforms had a huge impact and (continue to) shape botanical terminology to this day. With Linnaeus botanical Latin finally developed from an ordinary language to a purely technical means of communication.[83]

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83 See Stearn 2004, 10, 33–41.

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Werner Golder

Terminology and Professionalism in Technologized Medicine

Abstract: For a practical science like medicine, which not only wants to recognize, represent, and interpret but also has to make practical decisions, the reliability of language is at least as important as its professionalism. Medical terminology is the connecting link between scientific propositions, probabilities, standards of action, cost-benefit analyses, and the patients' assessment. Not rarely, the professionalism of medical statements cannot obscure potential deficiencies in their application and implementation. The vocabulary of the apparatus technology determines the further development of medical terminology. In the technocratic idiom of physicians, neither is the primacy of English problematic nor the Greco-Latin heritage called into question.

At first glance, the linguistic format does not play a very important role in medical science, given the conglomerate of genuinely medical, social, ethical, organizational, and economic aspects that influence medical decision-making and action. Thus, until recently, terminology was not a topic of particular interest to practitioners in the field. For a long time, medical and dental students had come to universities with applicable knowledge of Greek and/or Latin and had acquired the *lingua medicinalis* in parallel with the *materia medica* without complaint. It was not until the loss of familiarity with the ancient languages and the introduction of targeted instruction in the acquisition of medical vocabulary in the 1970s that terminology became a distinct, though not independent, branch of knowledge. The associated prospect and hope that it might develop, at least to some extent, into something like a specialized linguistics have remained unfulfilled. The course in terminology has remained the preschool of medical studies to this day. The lessons have been transferred to the institutes for the history and ethics of medicine, where they are generally taught by younger research assistants and endured by the students with their eyes firmly fixed on the final semester paper – a true academic duty for all concerned. This training has hardly anything to do with linguistics in the classical sense. There are, however, some lecturers who present other sources of medical vocabulary to some extent, such as Arabic, the folkloric vocabulary, the many proper names, and the Anglo-Saxon and French reservoir of terms. The textbooks and workbooks of the subject are predominantly pure vocabulary volumes, garnished with sprinkles of grammar and etymology. It is a little-loved subject and, moreover, one without any externally recognizable research activity, although the transfer of medical knowledge via technical language has always had a significant influence on the success

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Note: My sincere thanks go to Brett E. Thompson who has translated this chapter.

of its dissemination and implementation in daily practice, and would have justified the subsequent development of a philology of medicine, however shaped. In this context, the classical philologists must retrospectively allow themselves to be asked why they did not become active themselves in the past and agree to take over the teaching. They would have been in good company. The physicists, chemists, and biologists have been giving lessons to the first-year medical students for decades without complaint, even if it is purely propaedeutics. The philologists could have done the same – not to their disadvantage. Incidentally, it would have been a kind of homage to the great ancient medical writers and originators of classical medical terminology. Nowhere are two dead languages so alive side by side as in medicine; nowhere are Greek and Latin vocabularies so well preserved and at the same time so amenable to innovation as in medical terminology; nowhere do they also coexist so harmoniously as in medicine; and nowhere are they used so naturally in the service of a ubiquitous science as in medicine.

1 Examples from Practice

The analysis of doctors' letters, instructions for use, information sheets, reports of findings, as well as general and scientific publications provides access to an understanding of the relationship between terminology and professionalism in engineered medicine.

1.1 Physician's Letter I

The document (Fig. 1) is an excerpt from a doctor's letter from a hospital department for cardiology and hypertensiology, in which utmost importance is placed on conciseness of the message, restricting it to the essentials without the text being overloaded with technical terms. There is only one term that is not yet in all medical dictionaries, namely that of *renal denervation*, a new form of minimally invasive treatment of hypertension that is currently undergoing clinical trials and has recently been considerably discredited by a qualified comparative study.

The first sentence of the current medical history sounds like a semi-official pronouncement of the physician's therapeutic intention with an impressive escalation in tone toward the end of the line. The prior medical history is very succinct and only partially relevant to the planned procedure.

APAP is used to abbreviate a form of conservative treatment for sleep apnoea syndrome in which the therapeutic ventilative pressure required for each breath is determined and adjusted to the changing needs of the patient, namely 'A' for 'Automatic', 'P' for 'Positive', 'A' for 'Airway', and 'P' for 'Pressure'.

The second paragraph lists the five antihypertensive drugs the patient is taking, namely *Ramipril[R]*, an angiotensin-converting enzyme inhibitor, or ACE inhibitor; hydro-

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ARZTBRIEF I (Auszug)
Männlicher Patient (Jahrgang 1953)

Aktuelle Anamnese

Die stationäre Aufnahme erfolgte zur Einstellung einer therapierefraktären arteriellen Hypertonie unter antihypertensiver 5fach-Medikation mittels renaler Denervierung. Bei Aufnahme war Herr . . . beschwerdefrei. Akute klinische Infektzeichen wurden auf Nachfrage verneint. Eine pulmologische Kontrolle der APAP-Therapie war unauffällig.

Häusliche Medikamente

Ramipril/HCT 5/25 mg 1-0-0
Ramipril 5 mg 1-0-0
Moxonidin 0.4 mg 1-0-0
Carmen 20 mg 1-0-0
Metoprolol 95 mg 1-0-1

Untersuchungsbefund

RR 155/85 mm Hg, HF: 60/min, guter Allgemein-und normaler Ernährungszustand. Keine Dyspnoe, keine Zyanose. Mäßige Beinödeme beidseits. Haut und Schleimhäute feucht. Lunge, Herz und Abdomen unauffällig. Peripherer Pulsstatus unauffällig. Patient wach, adäquat reagierend und orientiert. Kein fokal-neurologisches Defizit.

Fig. 1: Physician's letter I (Dr. E.M., Hamburg 12.11.2012, excerpt (author's archive)).

chlorothiazide, a saluretic; *Moxonidin*[R], an α2-receptor agonist and vasodilator; Carmen[R]; *lercanidipine*, a calcium channel blocker; and *metoprolol*, a β-receptor blocker.

Except for Carmen[R], a trade name with an unmistakably classical root, these are abbreviated names of active chemical ingredients. This means that the substances have been approved and on the market for at least 10 years because otherwise the corresponding generics would not exist, and that the physician has prescribed the generic rather than the original preparations because the former are generally cheaper.

It would be a delightful task for the medical historian to systematically examine the names of drugs in the various modern languages for their ancient elements and to compare them with the terminology of chemists and pharmacologists.

The report on the physical examination of the admitted patient is brief, and the diction indicates that the physician merely wants to fulfill his documentation obligation. In any case, the standard of care for specialists is not met. In the case of a patient suffering from excessively high blood pressure, one does not give only one reading, but one measures at least on both arms and, if possible, also on the legs. 'RR', the abbreviation for systolic and diastolic blood pressure, is derived from the double name Riva-Rocci. Scipione Riva-Rocci, a paediatrician from Pavia, invented the apparatus for the mechanical measurement of blood pressure, which is in principle still used today, and published the method in 1896 when he was 33 years old. However, the abbreviation 'RR' is only used in German-speaking countries. Not even the Italians have adopted it.

Among the other physical findings that were gathered and described, only one is pathological, namely the condition of the legs. They are described as swollen. With such a finding, one must additionally document at least the status of the lymph nodes and veins in order to gain clarification of the pathogenesis of the edema. This addition was criminally missed by the examiner. Likewise, the last statement made (*kein fokal-neurologischer Befund*, no focal neurological findings) indicates that the physician neurologically examined the patient superficially at best. To the initiated, it is recognizably a set phrase.

Today, trainee physicians are generally advised to present the prior medical history in the language of the patient, for example, "The patient says he/she coughed up blood" and not "The patient reports hemoptysis." Only in the epicrisis are the appropriate technical terms then used. In this way, the physician presents himself both as an attentive listener and capable interpreter, then finally as a diagnostic analyst.

The legitimacy of the use of technical language thus varies depending on the level of observation and the addressee of the letter. If the physician's letter is addressed directly or in CC to the patient, one might adapt the choice of technical terms to the expectations of the recipient(s) in order to avoid misunderstandings or to soften the delivery of a shocking message. Conversely, the gap between the so-called experts and the so-called laypersons in the terminological sector can paradoxically flatten out or even be reversed if, for example, a person who has been ill for many years reports on his or her fate to the representative of a specialty that is otherwise not or hardly concerned with the ailment, for example, a chronic diabetic to an ENT specialist.

1.2 Physician's Letter II

The information in the table (Fig. 2) represents an excerpt from a report of an oncology department in which the diagnosis and therapeutic measures are listed in chronological order for a tumor patient who has been treated closely and intensively over a long period of time. If one were to measure the professionalism of a medical communication solely by the density of technical terms, this catalogue would deserve the highest ranking. If one disregards the linking words and banal abbreviations (ED: *Erstdiagnose*, initial diagnosis, AZ: *Allgemeinzustand*, general condition, Z. n.: *Zustand nach*, condition after), about two thirds of the vocabulary are technical terms of Greek and Latin origin wrapped in a German-language cloak. The text memorably depicts the severity of the disease (metastatic bronchial carcinoma), the intensity of treatment (surgery, radiation, chemotherapy, local interventions), and the drama of the course. The abbreviation pT3 pN0 cM0 G3 stands for the so-called tumor formula according to the TNM system, and the abbreviation HAART stands for the HochAktive AntiRetrovirale Therapie (HAART), which is commonly used today in HIV treatment.

The text also contains several lapses, such as in the first sentence the unfortunate tautology of *Filiae* and *metastasiert*, in the second sentence the pleonasm *transarteriell – arteriell* alone would suffice – and in the last sentence the missing organ

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ARZTBRIEF II (Auszug)
Männlicher Patient (Jahrgang 1945)

DIAGNOSEN

– Hepatische Filiae eines metastasierten differenzierten Plattenepithelkarzinoms des linken Lungenoberlappens (ED: 04/12 – pT3 pN0 cM0 G3)
– Z. n. Thorakotomie mit Tumorexstirpation sowie Oberlappenresektion und Lymphonodektomie 05/12
– Z. n. siebenmaliger transarterieller Chemoembolisation/-perfusion, zuletzt am 24.09.13
– Z. n. Radiochemotherapie mit 50.0 Gray in Kombination mit Vinorelbin[R] oral 08/12 (Therapieabbruch bei AZ-Verschlechterung)
– Z. n. systemischer Chemotherapie mit Gemcitabine 11-12-/12
– HIV-Infektion unter HAART-Therapie 1986
– Z. n. zweimaliger Mikrowellenablation, zuletzt am 29.08.13

Fig. 2: Physician's letter II (Prof. Dr. V.N., Frankfurt/Main 25.02.2013, excerpt (author's archive)).

denotation. From the overall context, however, only microwave ablation of liver parenchyma can be meant. The author has also avoided, despite an obvious inclination for technically differentiated expression, naming the location of the primary tumor, namely the lung, in Latin. He artlessly refers to the left upper lobe of the lung rather than the *Lobus superior pulmonis sinistri.*

2 Rote Liste 2013

This excerpt from an entry in the so-called *Rote Liste* (Fig. 3), the official drug directory for Germany, refers to the lipid-lowering drug *Fluvastatin*, an inhibitor of cholesterol synthesis marketed under the name Locol[R], among others. The same text is also found under the heading *Nebenwirkungen* (side-effects) in the package insert, so it is expressly intended to be read by patients and should accordingly be both professionally designed and suitable for an intellectually broad readership. Yet, it is anything but. In the incidence rates of the respective side effects, a distinction is made only between 'frequent', 'rare', and 'very rare'; percentages are not given. This is a serious deficiency. In general, 'frequently' means 1–5%, 'rarely' means less than 1%, and 'very rarely' means less than 0.1%. But these rates must be explicitly stated.

The choice of the term *urticaria* for the only adverse reaction classified as rare is unfortunate and can only be described as a stopgap measure since *urticaria* stands for several dozen different allergic diseases in the broadest sense, ranging from a simple rash to threatening laryngeal edema.

Among the very rare adverse effects, symptoms (e.g., hypesthesia) and closed nosologic entities (e.g., peripheral neuropathy) are listed all at once with no apparent weighting. This is a deficiency in content, not terminology. For most readers, however, the deterrent potential of the paragraph is likely to be more significant than the informational content of the enumeration.

ROTE LISTE 2013
Locol[R] 80 mg Retardtabletten
(Wirkstoff: Fluvastatin)

NEBENWIRKUNGEN

Häufig: Schwindel, Gelenkschmerzen

Selten: Urtikaria

Sehr selten: Parästhesie, Dysästhesie, Hypästhesie, periphere Neuropathie, Hauterscheinungen (z. B. Ekzeme, Dermatitis, bullöse Exantheme), Lupus-erythematodes-ähnliches Syndrom, Thrombozytopenie, Angioödem, Fazialödem, Vaskulitiden, Myositis, Rhabdomyolyse, reversible Hepatitis, akute Pankreatitis

Gelegentlich mäßige Anstiege der Serumtransaminasen (weniger als das 3fache der oberen Normgrenze). Bei weniger als 1% der Pat. Anstiege der Serumtransaminasen auf mehr als das 3fache der oberen Normgrenze. Nach Absetzen von Fluvastatin in den meisten Fällen reversibel. Deutliche Anstiege der CK-Werte auf mehr als das 5fache der oberen Normgrenze bei einer sehr geringen Anzahl der Pat. (0.3 bis 1.0%).

Fig. 3: Rote Liste 2013. Arzneimittelverzeichnis für Deutschland (einschließlich EU-Zulassungen und bestimmter Medizinprodukte). Verlag Rote Liste[R] Service GmbH, Frankfurt/Main, 2013.

In the appendix, laboratory changes are discussed in relative detail and the names of enzymes (namely serum transaminases and CK = creatine kinase) are mentioned whose pathophysiological background is generally unknown to the layman. At most, one person or another will correctly assume that it is the so-called liver function readings behind the serum transaminases and associate the creatine kinase with the heart muscle. On the whole, however, the described deviations from the norm are only an expression of a hepatotoxic or myotoxic effect of the substance fluvastatin and thus merely laboratory signs of the hepatitis and myositis mentioned in the previous paragraph.

At least the presentation is clear and honest and does not try to weaken or disguise unpleasant facts by clever choice of words. Many other package inserts, on the other hand, are veritable treasure troves of rabble-rousing, for example, when they speak of the connection between cause X and effect Y: "X may occasionally lead to Y," or "X may in exceptional cases lead to Y."

3 Documented Patient Information

This document (Fig. 4) contains an excerpt from the basic information for patients who are advised to have a feeding tube inserted through the abdominal wall into the stomach or small intestine, that is, *percutaneous gastro- or intestinostomy*. The entire text is 3½ pages long and includes several schematic illustrations. It is given to patients to read before the pre-operative discussion. Such written instructions about interventions which come with the possibility of severe consequences and complications can be expected to be patient- and situation-oriented and formulated in colloquial language as much as possible.

DOKUMENTIERTE PATIENTENAUFKLÄRUNG

Basisinformation zum Aufklärungsgespräch über:
Einlegen einer Ernährungssonde durch die Bauchwand
in den Magen/Dünndarm

Sehr geehrte Patientin, Sehr geehrter Patient,

bei Ihnen ist die natürliche Nahrungs-/Flüssigkeitszufuhr nicht oder nur zum Teil möglich. Das Einlegen einer Ernährungssonde durch die Bauchwand ermöglicht Ihnen eine ausreichende Ernährung mit allen wichtigen Nährstoffen, Vitaminen und Mineralien.

Der Arzt empfiehlt Ihnen folgende Technik:

Fadendurchzugsmethode

Nach örtlicher Betäubung punktiert der Arzt von außen mit einer Nadel unter endoskopischer Kontrolle die Bauch- und Magenwand.

Durch die Punktionsnadel schiebt der Arzt zunächst einen Faden von außen in den Magen oder Dünndarm vor. Mit einer kleinen über das Endoskop eingeführten Zange wird der Faden von innen gefasst und zusammen mit dem Endoskop über die Speiseröhre und den Mund nach außen gezogen. Die Sonde wird nun an dem aus der Bauchwand herausragenden Fadenende in den Verdauungstrakt geführt und dort verankert.

Fig. 4: Documented patient education (ed. Thieme Compliance GmbH, 91068 Erlangen).

This communication largely meets this requirement. It is factual, professionally arranged, and yet largely manages without technical terms. *Endoskop* (endoscope) and *Punktionsnadel* (puncture needle) are the only two exceptions. The precision of the text does not suffer from this, even if it is poor stylistic choice. The authors also leave no doubt about the seriousness of the situation when they state that nutrition by natural means is not possible or only possible to an insufficient extent for the patient, and they seem to be convinced of the method they propose because possible alternatives – open surgical intervention or parenteral nutrition – are only mentioned on the last page and even then only briefly.

3.1 Conventional X-ray Examination of the Thoracic Organs

Imaging of the thorax is by far the most common radiologic examination. For admission to specialist examination in diagnostic radiology, the assessment of at least 6000 overview images of the heart and lungs must be demonstrated. Despite this massive sum, the examination does not have a uniform name. One says *Thorax p.a.* (p.a. = *postero-anterior*) or *Thorax d.v.* (d.v. = *dorso-ventral*) or *Röntgen-Thorax* (X-ray thorax) or *Rö-Thorax* (abb. X-ray thorax) or also *Herzfernaufnahme* (remote cardiac radiograph). However, the latter designation certainly does not correspond to the facts because

one sees not only the heart, but also the lungs and the bones and soft tissues of the thoracic wall. Of course, the X-ray does not show the heart itself, but its shadow – the shadow of the heart. This is why we speak of shadows on the lungs when solid lesions appear in the otherwise normally ventilated lung parenchyma. Even if the radiograph is without pathologic findings, the constituent anatomic elements are mentioned and briefly characterized in the descriptive portion of the report. In the assessment, the referring physician's question is answered as precisely as possible (Fig. 5).

KONVENTIONELLE RÖNTGENUNTERSUCHUNG DER THORAXORGANE IM P.A. STRAHLENGANG NORMALBEFUND (Beispiel)

INDIKATION
Ausschluss einer frischen spezifischen Infektion. Sonstige krankhafte Befunde?

BEFUND
Beide Zwerchfelle normal hoch, glatt und scharf begrenzt. Beide Zwerchfellrippenwinkel spitz. Herzschatten normal groß, regelrecht konfiguriert. Aortenschatten normal lang, normal breit und normal dicht. Lungenwurzeln und Lungengefäßzeichnung regelrecht. Kein Nachweis knotiger / flächenhafter Verschattungen des Lungenparenchyms. Kein Nachweis umschriebener / diffuser Verdichtungen oder Verkalkungen der Pleura und der Weichteile des Thorax
Kein Nachweis von Läsionen des Thoraxskeletts
Keine metalldichten Fremdkörper

BEURTEILUNG
An Herz und Lungen kein krankhafter Befund, insbesondere kein Nachweis einer frischen spezifischen Infektion, einer Lungenstauung, eines Ergusses oder einer bronchopulmonalen Neubildung.

Unterschrift des Arztes

Fig. 5: Findings report (Dr. A.A., Munich 22.12.2012, author's archive).

The creative performance of the radiologist is measured by the written report of findings, but the quality of the communication is not measured exclusively by the accuracy of the diagnostic statement. Not every communication that contains the correct diagnosis is equally valuable to the client. One and the same finding may be formulated in different ways. Many habitual and accidental factors influence what is said and what is not said, or what is evaluated and how, and what remains unevaluated. The addressee has a fine sense for such variations. Even subtle nuances of wording can influence the appreciation for the report and the recipient's reaction to the outcome of the investigation. The less certain a diagnosis is and the less predictable its potential consequences, the more nuances and paraphrases can be expected in the report. The decision about the nature and extent of the text is not made at the moment of dictation, but is influenced by knowledge of the patient's history and symptoms, clinical examination of the patient, and personal contact with them or their relatives, as well as by a number of circumstances in the viewing of the images. The

investigators translate their professional knowledge and observations into the diagnostic message in different intra- and inter-individual ways. The subjective component of information transfer in diagnostic imaging explains not only the differences in the scope and depth of diagnosis and differential diagnosis but also the range and depth of variance of further diagnostic and therapeutic recommendations.

4 Medical Journalism

A bridge between the continuous professional use of the terms of medicine and medical technology by physicians and their occasional use by laypersons is provided by medical journalism. The reading of paraphrases of academic publications helps the patient, beyond a general acquisition of new knowledge, to better understanding and more skillful expression in dealing with medical personnel. Even Galen of Pergamum demanded basic medical knowledge from the sick so that they could converse with him with at least a rudimentary degree of professional competence.[1] The following excerpt from an article in the *Wissen* (Knowledge) section of the *Süddeutsche Zeitung* of January 29, 2014 (Fig. 6), deals with advances in the production of stem cells. The method described is quite controversial, even though the study in which it is described was published in *Nature*, the natural science journal with the highest impact factor.

MEDIZINJOURNALISMUS

Süddeutsche Zeitung
Ressort: Wissen (30.01.14) – Autorin: Katrin Blawat

SCHNELL UND EINFACH
STAMMZELLEN LASSEN SICH MIT ZITRONENSÄURE HERSTELLEN

Sogenannte pluripotente Stammzellen lassen sich mithilfe einer sauren Lösung herstellen. . .Um sie herzustellen, verändert man bisher ihr Erbgut oder setzt verschiedene Proteine ein. Zumindest bei Mauszellen funktioniert aber auch eine simplere Methode, die Forscher um *Haruko Obakata* von der Harvard Medical School in Boston vorstellen (*Nature, Bd. 505, S. 641 und 676, 2014*).

Sie setzten Blutzellen aus neugeborenen Mäusen einer Zitronensäure-Lösung mit einem pH-Wert zwischen 5,4 und 5,8 aus. Ein kleiner Teil der behandelten Zellen änderte daraufhin seine Identität. Die ehemaligen Leukozyten wurden zu Zellen, die sich zu allen möglichen Gewebetypen entwickeln konnten . . .

Gibt man zu diesen Zellen ein spezifisches Medium, können sich die Zellen immer wieder fortpflanzen, wie es für Stammzellen charakteristisch ist.

Fig. 6: Medical journalism (K. Blawat, Süddeutsche Zeitung 30.01.2014).

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1 *On the Composition of Drugs according to Places* II 1 (Kühn 12.545).

The author first uses the term *Stammzellen* (stem cells) as if knowledge of them were self-evident, but then reflects on her educational mission and explains at the end that the characteristic of stem cells is that they reproduce again and again. In the middle part of the article, terms from medicine (protein, leukocytes) and chemistry (pH value, citric acid) are also used sparingly so that reading is not too difficult. However, behind the terminological restraint lie the danger of trivialization and the risk of conveying knowledge in a way that is not appropriate to the subject. The choice of the right vocabulary is therefore also a political issue in medical publications written by and for the layperson. Stem cells, which are elevated to the status of panacea by modern medicine, cannot be produced as 'quickly and easily' as announced in the headline.

5 Advanced Training Essay

From the Erlangen-based science-theorist Helmut Seiffert comes the statement (1973, 86):

> Wenn ein Arzt etwa von einer 'Fraktur der Patella' oder einer 'otitis media' spricht, so kann sich das jeder, der Latein und Griechisch gelernt hat, in 'Bruch der Kniescheibe' und 'Mittelohrentzündung' übersetzen, ohne dass sich damit am Sachverhalt irgend etwas ändert.

This remark, of course, hardly catches on with the authors of scientific texts. In any case, in the educational article on the complications of liver cirrhosis written by Tilman Sauerbruch, Emeritus Professor of Gastroenterology at the University of Bonn, and colleagues for the *Deutsches Ärzteblatt*, there is an extraordinary concentration of technical terms from all the fields involved (*anatomy: portosystemic shunts, physiology: formation of reactive oxygen and nitric oxide radicals, pathology: astrocyte swelling*).

Nevertheless, the presentation is reasonably easy to understand even on first reading, although this is mainly because it is textbook knowledge for a revision course rather than a research paper. The terms are always used in the right place, none too much – it is expressly called intestine and not intestinum – but also none too little – for the pathophysiology of hepatic encephalopathy it is actually endogenous neurotoxins which are responsible and not externally supplied nerve toxins. The reference to ammonia being only a surrogate marker should be taken as an additional indication that this is a professional presentation. In a less serious text, one would have rather tried to distract from this aporia.

6 Original Article: Clinical Research

In 2012, the journal *Spine* published an original paper comparing open spine surgery with so-called minimally invasive spine surgery from the standpoints of cost-effectiveness and clinical rehabilitation success. The section dealing with surgical technique in the nar-

FORTBILDUNGSAUFSATZ

Konservative und interventionelle Therapie
der Komplikationen bei Leberzirrhose

Sauerbruch T, Appenrodt B, Schmitz V, Spengler U

Die hepatische Enzephalopathie (HE) entsteht über portosystemische Shunts bei reduzierter hepatischer Entgiftung des Portalvenenbluts von neurotoxischen Substanzen aus dem Darm, die im Zusammenspiel mit Ammoniak neurochemische Veränderungen bewirken.

Neben einer Astrozytenschwellung und gesteigerter Bildung reaktiver Sauerstoff- und Stickoxidradikale, die dann Proteine und RNA in der Zelle verändern (20), sind auch zentralnervöse Entzündungsprozesse bedeutsam (e17).

Die beteiligten Neurotoxine und Entzündungsmediatoren sowie die Rolle der intestinalen Bakterienflora sind nur unvollständig verstanden. Ammoniak stellt den wichtigsten Surrogatmarker der HE im Blut dar. Allerdings korrelieren die Blutammoniakspiegel nur schlecht mit den gestörten psychomotorischen Funktionen.

Fig. 7: Further education essay (Deutsches Ärzteblatt 110.8 (22.02.2013), S. 126–132).

ORIGINAL ARTICLE – CLINICAL RESEARCH

A Comparison of Perioperative Costs and Outcomes in Patients
With and Without Worker`s Compensation Claims Treated With
Minimally Invasive or Open Transforaminal Lumbar Interbody Fusion

Pelton M A, Phillips F M, Singh K:
Surgical technique

With the open TLIF (transforaminal lumbar interbody fusion) procedure, a midline incision followed by subperiosteal muscular dissection to the facet joints bilaterally was undertaken. A unilateral facetectomy was performed followed by a single intervertebral cage and bilateral pedicle screw fixation. Bilateral neural decompression was also performed. For the minimally invasive TLIF procedure, a unilateral approach was undertaken through a paramedian skin incision using the WILTSE technique under fluoroscopy. Unilateral pedicle screws were placed percutaneously over a guide wire. The laminectomy, bilateral decompression, and TLIF were performed *via* a 21-mm nonexpandable tube. Midline muscular and ligamentous structures were all preserved during the procedure.

Fig. 8: Original article: clinical research (Spine 2012.37: 1914–1919).

rower sense (Figs. 7–8) impressively demonstrates the universality and timelessness of the Greco-Latin thesaurus of medical terms, and above all their flexibility when it comes to correctly describing and designating novel interventions.

First, six classical surgical techniques are mentioned, namely decompression, dissection, facetectomy, fixation, incision, and laminectomy. In all six cases, the ancient vocabulary has long served well in the naming of the techniques. And it is also – almost – sufficient for the designation of the recently developed *TLIF* (Transforaminal Lumbar Interbody Fusion). Again, only Latin nouns, adjectives and prepositions are found – with one exception: The fusion is characterized here as *interbody* (body from Old English *bodig* 'trunk, stem') and not as *intercorporal* as usual. The ancient vocabulary is thus also needed in distinctly technology-oriented medical texts and is successfully used with surprisingly little modification and little blending.

7 Terminology and Reliability

For a practical science like medicine, which not only wants to recognize, represent, and interpret, but also has to change and shape, the reliability of language is at least as important as its professionalism. Reliability of a statement means the evidential demonstration of the findings, but not conclusions in the sense of setting norms, only the proof of the facts in adequate language. The statements are not an end in themselves but have functional significance within contexts of medical treatment. Medical action cannot be justified by reference to theoretical knowledge alone. Nevertheless, both general and specific propositions of theoretical sciences are interwoven in the legitimization and thereby assume functions otherwise alien to them. Terminology, then, is the point of interchange between scientific propositions, probabilities, consequences that cannot be definitively verified, and standards of action whose reliability is modified by a greater or lesser probability of error, the cost-benefit ratio, and the patient's evaluation.

8 Terminology and External Effect

It is possible to speak in general language about a specialty without embarrassing oneself. Sometimes this method is both a more challenging one and the better choice. One should assume that an expert group, for all its scientism, is interested in isolating itself as little as possible linguistically in order to be heard and understood outside its own territory. A linguistic structure that serves the purpose of communication within a group and strengthens its cohesion should not become a burden, nor should it discriminate against those who use it by revealing their membership in a particular group or stratum through its use. Moreover, the greater the external impact of the discipline, the more attempts will be made to appropriate its language, albeit perhaps in a plainer form. In addition, although the philological aspect of medicine is less pronounced than the cognitive one, there is nevertheless a universal call for the promo-

tion of so-called speaking medicine, although this does not refer to the appropriation and use of technical language.

In scientific medicine, the methodically assured assignment of symptoms and findings to a nosological entity is mandatory. The terms used for this purpose are indispensable as pragmatic abbreviations, central means of communication, classificatory terms for teaching, learning and research, and as instruments for information processing, statistics, and documentation. In medical practice, on the other hand, scientific diagnoses do not correspond to the multidimensionality of the disease, nor to the reality of the life of the sick person, nor can every examination result be necessarily associated with a fixed concept of disease. Every result of scientific research in medicine is afflicted with the systematic error of unpredictability in its implementation and individual practical application.

9 Terminology and Situational Justice

At least as important as conceptual criteria and their scientific reliability are situational justice and operational characteristics, above all the restriction of the medical statement to the respective context of meaning. The formulation may vary depending on whether the diagnosis/suspected diagnosis or prognosis is intended to justify therapeutic action per se, hospitalization, a social assistance measure, or an insurance claim, or whether it is intended to change the patient's behavior or influence his or her role in school, family, or the workplace. Any of these uses can limit the validity of a diagnosis without changing the underlying scientific claims. The main reason for the lack of stringency in diagnostic labels is that there are no universally accepted criteria for distinguishing between health to be experienced and illness to be suffered. In many cases this also results in the uncertainty as to whether decision-making and action are mandatory – no matter how hard one may try in the interest of the patient: the uncertainty of diagnostic and prognostic statements cannot always be eliminated by a structured, terminologically incontestable norm-finding process. Even in individual cases, the scientific nature of the statement cannot hide potential deficiencies in obtaining and applying it. From the point of view of the person concerned, the individual course of events can prove the current state of understanding to be wrong, no matter how aptly it is formulated. In the reality of the patient's life, the problems of understanding are overlaid by the emotional pressure of suffering, behind which lurk infirmity and death. The more the sick person is frightened by this, the less rationally she can inwardly process the information offered, the less her decision arises from unrestricted self-disposal. The irrationality of illness and the absurdity of death relativize not only medical progress but also the authority of medical statements. Not infrequently, therefore, the doctor-patient conversation fails in its mandate to recognize, formulate, and enforce reality – despite all the terminological disciplining that therapists strive to do.

10 Terminology and Conversation

The vertical stratification of the level of expertise within which the medical professional communicates, that is, the ladder of steps from the first contact with the patient, through the doctor's letter or an expert opinion, to the scientific publication in the native language or another language, has led to some accusations against doctors, which, from a sociocultural perspective, is understandable. Some are worth serious consideration, others less so. Among the latter is certainly the reproach that the technical language is sometimes used by those working in medicine to distinguish themselves and to give the appearance of special erudition. Whenever a physician tries to impress a patient once or severally with her choice of words and thereby limits the possibility of conversational involvement from the one seeking advice and assistance, the patient is perfectly within her rights to point out this error and ask for a reduction of the technical language in the conversation. If necessary, she can also inquire elsewhere for a description and explanation of the factual context which bears both the necessary precision as well as an adapted choice of words. On the other hand, it is serious when the physician, as an interpreter of what her colleagues and she herself have done and still want to do, uses the linguistic advantage to conceal uncertainty and to look for excuses, that is, when she turns the instrument of the intellect into a tool of encoding or concealment. One exposes oneself to this danger, for example, when such indefinite terms as atrophy, degeneration, infiltration, organopathy, and the proper name constructions from the arsenal of syndrome theory are used, although one could select much more precise terms from the thesaurus of technical language that are better suited to the individual situation. An expert is not someone who has just acquired a special competence, but someone who is also verbally able to make it clear that she has it.

11 Terminology and Stylistics

All cultures have introduced knowledge and linguistic elements into the medical system of thought. The fact that Greek and Latin still dominate today is due to the fact that they shaped the fundamental sciences, especially anatomy, and were common as educational languages for a long time. In today's medicine, changes and innovations in language are determined by the progress of technology and imported from neighboring sciences, sometimes even imposed by them. The progress of medicine is a technical-mechanical one, and the development of the language that goes with it is a borrowing from the engineering sciences and not medicine's own contribution. The vocabulary of the manufacturers determines the terminology of apparatus medicine and thus shapes the technocratic vocabulary of the physicians. One would not speak of robotic surgery if there were no robots, one would not speak of laser keratoplasty

if there were no laser devices, and one would not speak of monoclonal antibodies if the biotechnical industry did not offer the laboratories the corresponding apparatus equipment for their production. The so-called auxiliary sciences of medicine also provide the tools for the accompanying linguistic progress in the form of innovative hardware and software. This changes the relation between the genuinely medical and the interdisciplinary terms. In medicine, which has been technologized in this way, neither is the primacy of English problematized nor is the Greek-Latin heritage called into question. Nor is it a matter of the beauty of the terms, but solely of their appropriateness and unambiguity. In medicine, the aesthetics of language play at best a secondary role to the content and novelty of the message. Even for peer-review decisions in medical journals, questions of style are of marginal importance at best.

12 Terminology and Viability

According to the theory, the language of science in medicine should help to communicate and consolidate constructs and thus ensure quality. Thus, it should be a sympathetic tool. In practice, however, it has increasingly become an advertising medium because by introducing, adopting, and developing the words and names provided by industry, the physician makes herself its mouthpiece and thus its agent in the vast market of new machines and drugs. The combination of terminology and professionalism has degenerated through the mechanization of medicine into a liaison of new word creations and profit-oriented presentation.

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Matthias Schemmel

Everyday Language and Technical Terminology: Reflective Abstractions in the Long-Term History of Spatial Terms

Abstract: This chapter discusses the origin of technical terminology in everyday language by outlining stages in a long-term history of technical terminology marked by increasing degrees of reflexivity. It uses the examples of spatial terminology in an ancient Chinese theoretical text, in Newtonian mechanics, and in relativity theory, and attempts to explain the increasing distance of the meanings of technical terms from their everyday counterparts by relating it to historical processes of knowledge integration.

1 A Paradox and a Question

Let me start with a paradox. We usually think that, in technical language, terminology holds a key role. We usually think that it is primarily the technical terms that make the language technical. Let me contrast this view with an alleged quote of the turn-of-the-century mathematician David Hilbert (1862–1943):

> One must be able to say each time – instead of 'points', 'straight lines', and 'planes' – 'tables', 'chairs', and 'beer mugs'.[1]

Hilbert supposedly said this in the context of a discussion about the foundations of geometry, about which he would later write a groundbreaking work, *Die Grundlagen der Geometrie*, first published in 1899.[2] In that work, Hilbert reformulated Euclidean geometry in such a way that it became independent from geometrical intuition and the everyday meaning of terms such as 'point', 'straight line', and 'plane'. The meaning of the terms is fixed solely through their use in the axioms, and it therefore becomes arbitrary what words are used. This is what is called *implicit definition*.[3]

Hilbert's quote thus argues that, in axiomatic theories, the meanings of technical terms should be fixed by means of implicit definitions and therefore be completely independent from the meanings of the words of everyday language. Euclid, by con-

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1 "Man muß jederzeit an Stelle von 'Punkte, Geraden, Ebenen' 'Tische, Stühle, Bierseidel' sagen können" (Hilbert 1970, 403). The statement is found in the section *Lebensgeschichte* written by the mathematician Otto Blumenthal (1876–1944).

2 Hilbert 1899.

3 For an introduction to the concept of implicit definition and its relation to Hilbert's *Foundations of Geometry*, see Schlick 2009, 205–217.

trast, defined many of his terms *explicitly*. A point, for instance, is according to his *Elements*

> that which has no part.[4]

This definition reflects the intuitive idea that a point is so small, and it cannot be further divided into parts.

The disparity between Hilbert's and Euclid's cases gives rise to a fundamental question with regard to theoretical terms in the exact sciences: What is the relation between everyday language and intuition on one hand and scientific terminology on the other? As I shall argue in this chapter, this relation changes over history and depends on the types of theoretical knowledge considered and their relation to experience. In particular, I shall argue that theoretical terms may have different degrees of reflexivity, i.e., they may embody different, and differently progressed, histories of reflection.

As befits the wider context of this contribution,[5] I shall particularly discuss examples of theoretical terms related to spatial knowledge. My examples relate to the following three historical episodes:

– the origins of theoretical science in antiquity (Section 2);
– the emergence of classical mechanics in early modern times (Section 3); and
– the transformation of physics in the early twentieth century (Section 4).

These are all well-studied episodes, which are widely considered turning points in the history of the exact sciences. While I do not argue for a linear, let alone predetermined, development connecting the three episodes, we shall see that one may understand them as displaying progressively higher degrees of reflexivity in the theoretical terms they bring about. This overall result will be summarized in the concluding section.

2 Technical Terminology at the Origins of Theoretical Science

Technical terminology predates the rise of theoretical science. Technical terms may form whenever specialized knowledge is communicated. This may happen in the context of joint action within a group of experts, in the context of teaching to apprentices, or in the context of communicating knowledge to an appropriately informed audience

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4 Euclid 1956, 153 (I, Def. 1).
5 The project cluster TOPOI, which provided the framework of the workshop at which this text was first presented, was devoted to the study of *the formation and transformation of space and knowledge in ancient civilizations*.

outside the group of experts. The formation of technical terminology may thus occur in the fields of various cultural practices such as tool-making, construction, navigation, surveying, administration, or astronomical observation and record-keeping. All these practices have developed prior to the emergence of theoretical science, which is marked by a reflection on the linguistic or otherwise material representations of the more practical forms of knowledge.[6]

The earliest evidence for this type of theoretical knowledge stems from antiquity. Aristotle's *Physics* and Euclid's *Elements* present prominent examples of theoretical reflections on spatial knowledge and are part of an intellectual tradition that reaches back to Pre-Socratic times. Less known is the fact that similar reflections are documented in sources from ancient China. In particular the so-called *Mohist Canon*, a text from around 300 BCE and one of the most formal and most rigorously argued texts from ancient China, contains passages that define and discuss spatial terms.

Thus, parallel to the Euclidean definition of a point we find, in the *Mohist Canon*, a definition of an 'end-point':

> *duān* 端 'end-point' is the element that, having no magnitude, comes foremost.[7]

The everyday word 'duān' 端, which denotes an extreme, or an end of an elongate object, is here turned into a technical term. How do we know that it is to be understood as a technical term? Not only is it defined, but, most importantly, it is part of a network of defined terms. Thus, 'element' and 'magnitude' are both defined in other sections of the text. Let us here take a closer look at the definition of 'magnitude'.

> *hòu* 厚 'having magnitude' means that there is something in relation to which it (i.e., the thing that has magnitude) is bigger.
>
> *hòu* 厚 'having magnitude': Only an end-point has nothing in relation to which it is bigger.[8]

Hòu 厚 in everyday language means 'thick' (in the sense of a material, physical dimension). Here it is turned into an abstract term that implies spatial magnitude and can be used in other definitions or explanations. A later section, for instance, reads:

> *yíng* 盈 'being filled out' is nowhere not having something.
>
> *yíng* 盈 'being filled out': Where there is no filling out there is no magnitude (*hòu* 厚). On the measuring rod there is no place to which it extends such that you do not get both (i.e., filling out and magnitude).[9]

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6 See Schemmel 2016 and further references given therein.
7 This is Canon A 61, following the enumeration by A.C. Graham (1978). The translations from ancient Chinese have been done in cooperation with William G. Boltz, see Boltz & Schemmel 2016; Schemmel & Boltz 2022.
8 Canon and Explanation of Section A 55.
9 Canon and Explanation of Section A 65.

Thus we have a pair of terms, *hòu* 厚 'having magnitude' (being extended) and *yíng* 盈 'filling out', that consistently differentiate the material and the spatial aspects of bodies.

Taking into account all the sections on spatial, temporal, and material concepts, we obtain a network of terms which is presented in Fig. 1.

Although the terms form a network, they are not implicitly defined, as in Hilbert's axiomatic geometry. Rather, their meaning is partly derived from their everyday meaning. The everyday language terms reflect everyday structures of cognition. The material and the spatial aspects of bodies, for instance, are aspects of everyday intuitive thinking and form part of what may be termed *anthropomorphic knowledge*.[10] Anthropomorphic knowledge is studied by developmental psychology and its structures are prior to any theory. Furthermore, owing to the similar biological make-up of all humans and the similar experiences they make in a shared environment whose fundamental physical features are the same everywhere, large parts of this anthropomorphic knowledge are universal.

But the universality of anthropomorphic knowledge structures does not generally translate into a universality of their linguistic representations. This is because, in language, the universal aspects of cognition may become mixed up with, and modified by, other, culture-specific parts of cognition and with culture-specific aspects of their representation. This holds, in particular, for the linguistic representation of anthropomorphic knowledge structures provided by theoretical terms.

The meaning of theoretical terms is set apart from that of their everyday counterparts by an act of explicit reflection in the medium of representation. This may be a definition or any other use of material means of representation designed to delineate meaning. As a consequence, terms referring to real-world objects and events now become themselves objects of reflection and are considered with respect to their mutual relations. This may be understood as a process of reflective abstraction: The reflection abstracts from the particular contexts of the terms in their everyday use. On the higher level of reflection, new meaning is constructed by concretization, i.e., by explicitly establishing relations to other terms of the theory.[11]

Thus, when 'filling out' is taken out of all practical contexts of filling something out and considered regardless of such contexts and applied to material objects, attributes, and times and spaces (as happens in the *Mohist Canon*),[12] this is a process of abstraction and generalization. Anthropomorphic knowledge structures remain effective but are

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[10] On the gradual differentiation of the corporeal and spatial aspects of the environment in the process of ontogenesis, see, for instance, Piaget 1959 (in particular 97–101).

[11] The concept of reflective abstraction is taken over from the work of Piaget (1985), but we follow here the enhancement of the concept of reflection proposed by Damerow (1996, 1–27), according to which the object of reflection consists not only of the actions of the reflecting subject but also crucially includes the material means of action.

[12] Sections A 65 (see above), A 66, and B 15; see Boltz & Schemmel 2016; Schemmel & Boltz 2022.

Fig. 1: Terminological relations between sections on space, time, and matter. Definitions are represented by squares, propositions by ovals. A bold arrow indicates that a defined term is used in the Canon of another section, and a thin arrow indicates that it is used in the co-ordinated explanation. Dotted arrows indicate that the occurrence of the term is only conjectural.

modified in their reconstruction on the theoretical level of reflection. The shifts in the meaning of terms may, in particular, bring about what may be called *artifacts of theory*: Owing to their generalization and absolutization, the meaning of terms may now involve typically theoretical properties, like those relating to infinity, which are alien to their everyday counterparts, and which are often at the core of philosophical-mathematical problems. Thus, while a 'point' is intuitively understood as something very small like a dot of very small size, it is now claimed to be infinitely small, thereby forcing the reconsideration of notions such as composition, extension, and motion.

That the results of such abstractions are not universally the same is already indicated by this example. While in the Greek context the abstract term is the point (ση-μεῖον), in the Chinese case it is the end-point (*duān* 端).[13]

Besides the sections on spatial terms, there are sections of the *Mohist Canon* that reflect on knowledge structures related to mechanical and optical phenomena. The following section, for instance, documents the occupation with unexpected effects when mechanical devices are involved:

> The beam (*héng* 衡): If you add a weight (*zhòng* 重) to one of its sides [that side] will necessarily drop down. This is due to the effectiveness (*quán* 權) and the weight matching each other. If they are made level with each other, then the base is short and the tip is long. Add equal weights to both sides, then the tip will necessarily go down. This is due to the tip having gained effectiveness.[14]

The section deals with a situation in which a lever is involved so that equal weights may have different effects on its two ends. The puzzle is theoretically resolved by complementing the term *zhòng* 重 'weight' with a term *quán* 權 'effectiveness', to account for the different behavior of weights in different distances from the fulcrum. This differentiation of the term 'weight' may be understood as a theoretical response to instrumental knowledge, namely knowledge obtained in the handling of cultural artifacts, in this case instruments involving a lever.[15]

We may thus distinguish between anthropomorphic and instrumental knowledge, the first obtained through experiences with respect to universal features of the physical environment, the latter obtained through experiences in handling culture-specific artifacts. Theoretical knowledge emerges from the systematic reflection on these more elementary types of knowledge. While there are marked differences in the spe-

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13 Note, however, that there are alternative definitions of a point in ancient Greek texts, in particular, one defining the point as the extremity of a line; see Euclid 1956, 155–158. This similarity between the Greek and Chinese cases (which have to be considered independent with regard to the theoretical layer of knowledge) may be taken as indicative of the shaping force of materiality even on the choice of our theoretical abstractions.

14 Explanation of Section B 25b. The translation resulted from joint work in the context of a working group on the history of mechanics at the Max Planck Institute for the History of Science, which included William Boltz, Jürgen Renn, and the author.

15 This interpretation has first been given in Renn & Schemmel 2006.

cific theoretical terms that form in the case of ancient Greek and ancient Chinese theoretical sciences, the phenomenon itself turns out to be a cross-cultural one. Let us formulate general characteristics of the formation of technical terminology at the origins of theoretical science.

Origin: The technical terms at the origins of theoretical science are taken from everyday language, possibly including the specialized language of practitioners.

Knowledge structures: Their meaning reflects structures of anthropomorphic and instrumental knowledge. At the same time, their meaning is distinguished from that in everyday language by the decontextualization from concrete action and the recontextualization within theory. Theoretical demands such as consistency, comprehensiveness, and the resolution of paradoxes give rise to differentiations and fixations of the terms that are alien to their everyday counterparts.

External representation: The system of theoretical terms is transmitted and stabilized through external representation in texts. The theoretical texts may be handed down orally, but most often a written component plays a crucial role. This written component entails the possibility of communicating theoretical knowledge to later generations even after the oral tradition in the context of which it emerged has ceased.

The last point brings us to the question of the fate of Mohist science. The *Mohist Canon* originated in the Warring States period when China was politically fragmented into many smaller states, often at war with each other. At the time, a variety of aristocratic thinkers strove for an appointment to high office and offered their services as advisors to the various rulers and governments. A vivid culture of disputation flourished and we even see the emergence of the *bianzhe*, who became famous for framing paradoxes and are sometimes compared to the Greek Sophists.[16] In this environment, it seems, the later Mohists strove to show that consistent reasoning is possible and that paradoxes could be avoided or resolved by reflecting on language and delineating the meaning of terms. In this context, they dealt with a variety of subjects ranging from matters of conduct, government, and ethics to subjects that we would today classify as geometry, mechanics, and optics, as is documented in the *Mohist Canon*.

The theoretical tradition of the later Mohists did not last long, however. It probably ceased under the changed socio-political conditions of the unified empire and centralized administration of the Qin dynasty in the third-century BCE. The text was garbled in its transmission, and although it was handed down to the present, it did not become effective in Chinese intellectual history for a long time. When it was commented on again starting at the end of the eighteenth century, it had become an object of historical and philological interest rather than a source informing an actual tradition of theoretical thinking.

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16 Graham 1989, 75.

Greek theoretical texts on geometry, mechanics, and optics, by contrast, did have an impact on later European and Near Eastern knowledge traditions (albeit after long gaps in reception) and served as models for representing theoretical knowledge well into modern times.

3 Technical Terminology in the Emergence of Classical Mechanics

Turning to early modern Europe, one may ask what the main difference is between the ancient theoretical reflections discussed in the previous section and their early modern counterparts. Concerning the science of mechanics, one major difference is clearly the challenge to integrate a vast body of systematically expanded experiential knowledge.

The modern science of classical mechanics resulted from the integration of the cumulated astronomical knowledge embodied in Kepler's laws of planetary motion and the cumulated mechanical knowledge embodied in Galileo's laws of free fall and projectile motion. The integrative reflection on these bodies of knowledge brought about a fundamental change of the concept of force which lies at the heart of classical mechanics.

There is an anthropomorphic knowledge structure that we may refer to as the motion-implies-force model.[17] Whenever we want to set something in motion, we have to exert a force. And the more force we exert, the quicker moves the mobile. This intuitive relation was, in medieval science, mathematically quantified by the statement that the moving force is proportional to the velocity of the mobile.

The aspect of mathematization is important in this context. It provides an additional way of relating terms in a network: the relations may not only be semantical, as in the case of the Mohists, but also mathematical. Now, classical mechanics is distinguished from pre-classical mechanics by a reconceptualization of force which only made possible the integration of terrestrial and celestial mechanics: In classical mechanics, force is conceived of as proportional to acceleration, rather than velocity. Inertial motion, i.e., uniform motion in a straight line, is not in need of a causal explanation in terms of forces, and only change of velocity (acceleration) is. The deep structure of the anthropomorphic relation between motion and force is preserved, but the modified structure relates acceleration to force, while uniform motion in a straight line is equivalent to rest.

Let us take a look at the terminology in Newton's *Philosophiae naturalis principia mathematica*, first published in 1687. The book is usually considered the first consis-

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17 Renn & Damerow 2007.

tent exposition of the conceptual framework of classical mechanics. In analogy to Euclid's *Elements*, Newton begins with a series of definitions of technical terms such as 'quantity of matter', 'quantity of motion', 'inherent force', and 'impressed force'. Definition 3, for instance, reads:

> Inherent force of matter is the power of resisting by which every body, so far as it is able, perseveres in its state either of resting or of moving uniformly straight forward.[18]

Newton thus introduces an *inherent force* (*vis insita*) to explain inertia. He does exactly what we have just stated is wrong in classical mechanics! To introduce a force for maintaining a motion is compatible with the medieval conception of force and motion, not with the classical one, which Newton pioneers in this book. This means that, despite the new mathematical-conceptual structure of classical mechanics, Newton, in choosing his technical terms, is influenced by a theoretical tradition that directly relates to our intuitions and their reflection in everyday language.

Similar reminiscences of earlier cognitive structures are found in Newton's understanding of *space*, a term he does not define, because it is 'familiar to everyone',[19] but discusses in a long *Scholium*. Space, according to Newton, is in a state of absolute rest and does not move. But in classical mechanics absolute rest is indistinguishable from uniform motion in a straight line!

Yet Newton's understanding of *force* and *space*, which is at odds with the mathematical structure of the science he pioneers, is not his individual blunder. Rather, it is indicative of how conceptual development proceeds in the exact sciences. Newton's integration was possible only on the basis of available conceptual frameworks, which informed the meaning of the technical terms. At the same time, the knowledge integration employed mathematical means, and the reorganization of the mathematical-conceptual structure led to changes in the meanings of the terms. This created the tension within the conceptual framework that we witness in Newton's writings.

Let us summarize the characteristics of theoretical terms in the emergence of classical mechanics:

Origin: The technical terms are part of a theoretical tradition, which itself relates back to everyday language. A disciplinarily fixed system of technical terminology is only emerging and controversies over the meaning of terms show that terminology is to a certain extent still a matter of individual system-building.[20]

Knowledge Structures: The meanings of the theoretical terms reflect the cognitive structures of previous theories (which themselves incorporate anthropomorphic and

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18 Newton 1999, 404.

19 Newton 1999, 408.

20 As examples consider the Leibniz-Clarke correspondence (Alexander 1970), or the vis viva controversy (see, e.g., Szabó 1976, 47–85).

instrumental knowledge structures), modified as to integrate systematically accumulated empirical knowledge. But tensions between established meanings and new mathematical-conceptual structures exist.

External Representation: The system of terms is transmitted and stabilized through external representation mostly by means of written text, diagrams, and symbolic formalisms. The mathematical formalism plays a crucial role in integrating new empirical knowledge and serves as a medium between experience and conceptual structure. It is a means by which new experiences are translated into concepts that create tensions within the existing conceptual structures.

In the case of classical mechanics, it was only in the context of later reflections on a mathematical-conceptual framework that had, not least owing to its empirical success, become firmly established, that the tension between the traditional meanings of terms anchored in intuitions and everyday use and the new mathematical structure could be resolved. Thus, it was only with the development of the concept of 'inertial frames' in the late nineteenth century that the mathematical-conceptual structure of space in classical mechanics found an adequate terminological expression. At around the same time, however, the distinguished status of mechanics as a fundamental theory for all of physics became increasingly disputed.

4 Technical Terminology in the Transformation of Early Twentieth-Century Physics

In the late nineteenth century, fields of physics other than mechanics, in particular, thermodynamics and electrodynamics, had developed their own mathematical-conceptual structures and technical terminologies, partly overlapping with mechanics, but partly independent of it. The conceptual revolutions of early twentieth-century physics occurred at the borderlines between these subfields of physics.[21] The theory of special relativity, for instance, resulted from considerations about electromagnetic phenomena involving components in relative mechanical motion and can thus be viewed as having emerged at the borderline between electrodynamics and mechanics.

The conceptual revolutions of early twentieth-century physics are notorious for having rendered that science more 'abstract', to have removed it even further from everyday intuition and everyday language as had previously been the case. And in fact, central terms of modern physics, such as 'energy-stress tensor' or 'quantum state', seem hardly relatable to everyday knowledge. Are then the terms of modern

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physics to be implicitly defined without reference to everyday meanings, as Hilbert's axiomatic method suggests?

Hilbert himself attempted an axiomatization of physics.[22] To this end he combined Einstein's nascent theory of general relativity with a theory of matter, which is nowadays only known to historians of science.[23] But besides the transient character of the ingredients of Hilbert's axiomatic program for physics, Einstein had some more fundamental reservations concerning the idea of an axiomatic foundation of modern physics. In his essay *Geometry and Experience* of 1921, he says with respect to the application of Hilbert's axiomatic geometry to physics:

> It is clear that the system of concepts of axiomatic geometry alone cannot make any assertions as to the behavior of real objects [. . .]. To be able to make such assertions, geometry must be stripped of its merely logical-formal character by the coordination of real objects of experience with the empty conceptual schemata of axiomatic geometry.[24]

In fact, in order to re-interpret central terms of classical physics related to space and time, Einstein had to disentangle the different layers of knowledge that contributed to their meaning. On the one hand there was the layer of the operations of measurement. This layer is clearly rooted in practical knowledge and involves concepts such as measuring rods and clocks. In order to apply this knowledge, Einstein had to make basic assumptions concerning the existence of rigid bodies and the possibility to synchronize clocks, all rooted in anthropomorphic and instrumental knowledge structures and all in accord with classical physics. On the other hand, there is the layer of theoretical assumptions about the comparison of space and time measures in systems in relative motion, which implies general statements about the structure of space and time. While these assumptions may appear intuitively obvious, Einstein noticed that they are not implied by the assumptions about measurement operations. Giving up the ideas of the independence of length, duration, and simultaneity from the state of motion, Einstein arrived at a new geometrical framework for physics, later described with technical terms such as 'space-time' and 'chronogeometry'.

Accordingly, Einstein further explains:

> The idea of the measuring-rod and the idea of the clock coordinated with it in the theory of relativity do not find their exact correspondence in the real world. [. . .] But it is my conviction that in the present stage of development of theoretical physics these concepts must still be employed as independent concepts; for we are still far from possessing such certain knowledge of the theoretical principles [. . .] as to be able to construct solid bodies and clocks theoretically from elementary concepts.[25]

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22 Hilbert, *Die Grundlagen der Physik*, first published as Hilbert 1915, 1916.

23 This is Gustav Mie's unifying theory. For discussions of Mie's and Hilbert's theories, and for translations into English of their original writings, see the corresponding sections in Renn & Schemmel 2007.

24 Einstein 1921. The translation is taken from Einstein 1982, 234–235.

25 Einstein 1921. The translation is taken from Einstein 1982, 236–237.

This means, the theory of (general) relativity still relies on everyday concepts such as a measuring rod (which we encountered with the Mohists!), although from the viewpoint of modern physics these objects are idealizations. The crucial point here is that, in order to identify the corresponding mathematical structures within a new theory as physical space (or space-time), they must be connected to former theoretical or pre-theoretical knowledge, from which they derive their spatial (or spatio-temporal) meaning.[26]

Let us again summarize some of the characteristics of theoretical terminology in the transformation of early-twentieth-century physics.

Origin: Technical terms are part of various expert traditions organized in a disciplinary hierarchy.

Knowledge Structures: Their meaning is partly fixed by the mathematical structure of a particular theory, but relations to knowledge outside this structure and even to pre-theoretical knowledge are needed to provide physical meaning. This multiple relation constituting meaning also explains how the same term may have different but overlapping meanings in different theories and (sub-)disciplines.

External Representation: The system of terms is transmitted through external representation mostly by means of written text, diagrams, and symbolic formalisms. These representations stabilize the system of terms within a field, but tensions may occur at the borderlines where fundamental conceptual changes take their start.

5 Reflective Abstractions in the Long-Term History of Spatial Terms

In this chapter we have discussed the relation between everyday language and the technical terminology in theoretical texts related to spatial knowledge. In this context we conceived of everyday language as externally representing anthropomorphic and instrumental knowledge structures, i.e., knowledge structures built up in the mind of any individual in the process of ontogenesis, which comprise universal aspects of sensori-motor intelligence as well as knowledge related to culture-specific practices such as the handling of instruments and other cultural artifacts.

We have described the spatial terminology that arose at the origin of theoretical science in antiquity as resulting from a process of reflective abstraction. In this context, the medium of reflection is linguistic expressions, in particular, spatial terminology. In theoretical texts from antiquity, the meanings of terms are explicitly reflected

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26 See Blum et al. 2016.

in the medium of written language, bringing forth a reconstruction of anthropomorphic and instrumental knowledge structures on a theoretical level. At the same time, this reconstruction modifies these knowledge structures since it abstracts from the concrete contexts of action from which they derive their original meaning and re-contextualizes them within a network of theoretical terms, which aims at fulfilling theoretical demands such as generality and consistency. While it is this network that makes the terms theoretical, the network is not closed in the sense that the meaning of terms would be sufficiently fixed without reference to knowledge outside it, as would be the case in a completely axiomatized theory of the kind of Hilbert's foundations of geometry.

The theoretical terminology related to space that formed in the emergence of classical mechanics may also be viewed as resulting from a process of reflective abstraction. In addition to the semantic relations between terms encountered in Mohist science, relations expressed by means of mathematical formalisms play a central role in this context. These mathematical relations in particular serve the integration of huge corpora of experiential knowledge on celestial and terrestrial motions, experiential knowledge that was mathematically and conceptually pre-processed, as documented in earlier writings like those of Kepler and Galileo. The reflection on the meaning of terms now takes place in the medium of such mathematical-conceptual writings. The mathematical relations between theoretical terms are reconfigured as to allow for the integration of the experiential knowledge to be captured. At the same time, the terms inherit their meanings from theoretical traditions, which are themselves, as we have seen, rooted in anthropomorphic and instrumental knowledge. The ensuing tensions within the network of terms were only resolved centuries after the pioneering work of Newton and his contemporaries. The result was a further step of reflective abstraction separating theoretical knowledge structures from the knowledge structures represented in everyday language: a further modification of these structures by rebuilding their relations in the context of a mathematical-semantic structure able to integrate the relevant (pre-processed) experiential knowledge.

In the radical conceptual transformations of early twentieth-century physics we can identify yet another step of reflective abstraction, removing physical spatial terminology even further from its origins in everyday language, without, however, cutting the connection. The new reordering of knowledge that brings about the changes in the meanings of terms (and the creation of new terms) is again imposed by knowledge integration. This time, however, it is knowledge pre-processed in developed sub-disciplines. Its integration again demands abstraction: aspects of the existing representations that do not correspond to structures of experiential knowledge, but are relics of the cognitive history of theory, are up for re-negotiation. An example is the constancy of lengths, durations, and simultaneity under transformations between inertial frames in relative uniform motion, which is assumed within classical mechanics, but not implied by the operations of space and time measurements. By abstracting from such aspects, generalizations are possible that enable the integration of knowledge from different disciplines.

The new concretization is guided by the properties of borderline objects, whose treatment demands knowledge structures from more than one discipline to be taken into account.

From the above it becomes clear that historical processes of reflective abstraction build one upon the other. Not in a linear or a predetermined way: the example of Mohist science and its fate clearly shows that the occurrence of reflective abstractions does not imply the progression to further ones. But the external knowledge representations resulting from instances of collective reflection serve as the preconditions for later reflective abstractions that build on them since each process of reflective abstraction is the transformative reconstruction of an existing knowledge structure. The reflection on disciplinarily structured knowledge at the beginning of the twentieth century, for instance, was only possible in the medium of the mathematical-conceptual structures that originated in early modern times. Our emphasis on the three turning points in antiquity, early modern times, and the early twentieth century does not mean to deny the importance of the developments between these turning points, of course. The mathematization of Aristotelian philosophy in medieval times and the formation and advancement of analytical mechanics in the course of the eighteenth and nineteenth centuries are important examples for such developments. The turning points are characterized by fundamental conceptual reorganizations of knowledge. The process of knowledge reorganization is, at the same time, a process of knowledge integration, in which experiential knowledge – be it different parts of anthropomorphic knowledge, be it the knowledge of practitioners, or be it knowledge systematically accumulated in scientific traditions and disciplines – is assimilated to theoretical structures, while these structures are accommodated to the new knowledge. The theoretical terms thereby become increasingly abstract in the sense that their meaning becomes increasingly removed from the meaning of the terms in everyday language.

Will the succession of reflective abstractions eventually remove our spatial concepts so far from their origin in everyday language that they may become implicitly defined within an axiomatic theory such as Hilbert's geometry? Was Einstein referring to such a development when he stated that *at the present state* of the development of theoretical physics we are still in need of concepts establishing a relation to everyday, practical, or operative knowledge? Will theoretical physics eventually become independent from such concepts? In Hilbert's foundation of geometry, the meanings of the central terms are decoupled from all exterior knowledge whereby the theory becomes purely structural. It is no longer a theory of physical space, but one that may be applied to it. From this it becomes clear that a physical theory of space must always retain a relation to knowledge exterior to its mathematical structure by the very demand that it be a theory of *physical* space. On the other hand, there are indications that in future theories of physics, space may no longer play the fundamental role it still does at the present. The role of pre-theoretical knowledge in constituting the meaning of the central terms of a theory may thereby become even

more mediated. Physical space may, for instance, turn out to be a phenomenon emerging from more fundamental non-spatial entities. The meanings of the technical terms by which these entities are described would then also stand in an emergence relation to the more traditional concepts and could accordingly have little or nothing in common with the meanings of everyday language terms.

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Epikhartika: About Language on Maps with Special Reference to Colonial Matters

Abstract: The two new terms 'language on maps' and *epikhartika* are introduced to make it possible to refer to not only linguistically meaningful notions, which hitherto have been ignored in those disciplines that investigate the semiotic nature of texts and/or maps. It is shown that maps constitute a sub-genre of text, whose properties can systematically be described. The focus is on the manifestation and specific traits of written language on maps. On the basis of evidence resulting from the comparative analysis of colonial maps, it is argued that language on maps serves discursive functions, whose adequate evaluation requires an interdisciplinary approach, in which structure-oriented linguistics, discourse linguistics, cartography, and related disciplines collaborate.

1 Introduction

On the basis of Hockett's (1958, 1–3) sketch of the sectors of life for which language is of central interest, we understand linguistics as the science of language that should ideally aspire at systematically addressing and evaluating all phenomena that fall under the rubrics of structure, use, dynamics, and functions of human language(s), including (*pace* Dixon 2010, 1) their philosophical, social, cultural, neuro-biological, and further entailments. Moreover, all kinds of manifestations of language, be they spoken, written, impaired, elaborated, on stone, paper, or other material, etc. form part of the domain of linguistics. This integrative program circumscribes a vast field of potential research objects, many of which have yet to be discovered, especially if we consider that the historical and situational dimensions of language use expand the object of research considerably. In this chapter, we venture into linguistically uncharted territory, in a manner of speaking, by way of characterizing language on maps (= LOM) as a category of its own, whose particulars cannot be described adequately and understood fully on the basis of the extant models and taxonomies of our discipline. We argue that LOM displays properties that justify the coining of a specialized terminology. Since we are still in the initial phase of the project that is supposed

to ultimately provide a comprehensive account of LOM in the future, we focus on the most basic concept of our approach, viz., the *epikhartikon* (plural: *epikhartika*).[1] What this term is meant to refer to, how we came to shape it, and why we feel that there is a need for it, in the first place, are questions we try to answer in the subsequent sections.

Before we turn our attention to this task, it is necessary to give the reader a first clue as to the nature of the phenomenon we are investigating. To this end, we present Map 1 and comment on those elements thereon that are of interest for the topic of this study. In Section 2, we explain why (not only) this initial example takes us back in time to the heyday of colonialism. The data presented in the following paragraph will be referred back to throughout the remainder of this chapter. The systematic properties connected to these and other data will be unveiled stepwise from Section 3 onward.

The appendix contains a number of maps that bear evidence of LOM. Map 1 features the town Lüderitzbucht[2] (formerly: Lüderitzort, today: !Nami‡Nûs/Lüderitz) and part of the neighboring area on the southern coast of the former German colony Deutsch-Südwestafrika (today: Namibia) as of the pre-World War I period. On the map, there is ample evidence of LOM. Most (but not all) of the cases of LOM have a clear German origin. Beside the title of the map itself (*Plan von Lüderitzbucht* 'map of Lüderitzbucht'), we find names of maritime geographical objects (= GEO-objects) such as

- harbors and bays (*Lüderitz-Hafen* 'Lüderitz-Harbour',[3] *Robert-Hafen* 'Robert-Harbor', and *Radford*[4]*-B[ucht]*[5] 'Radford-Bay'),
- reefs (*Haifisch-Riff* 'Shark Reef'), and
- islands (*Haifisch-Insel* 'Shark Island').

There is also an oronym (*Diamant-Berg* 'Diamond-Hill'). On the outskirts of the town, there is the train station *Bhf. [= Bahnhof] Burenkamp* 'train station Burenkamp'. In the town, we notice several hodonyms such as *Hafen-Str[aße]* 'Harbour-Street', *Bismarck-Str[aße]* 'Bismarck-Street', *Diaz-Str[aße]* 'Diaz-Street', *Berg-Str[aße]* 'Hill-Street', *Bai-weg*[6] 'Bay-Lane', etc. Note that, by far, not all streets on the map bear names. At the bottom of Map 1, the road that is directed to a place beyond the limits of the map is

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1 In the remainder of this chapter, the new term and derivations thereof will appear in small caps.

2 For the information on Lüderitzbucht under the German colonial rule, we rely on Schnee 1920, 465.

3 Throughout this study, we provide English translations of all examples of LOM that reflect the internal structure of the original as closely as possible.

4 The initial constituent of this toponym is the English family name *Radford* (probably the last name of the captain of an English ship).

5 EPIKHARTIKA are frequently realized as (conventionalized) abbreviations. Since not all of them are self-explanatory, we spell them out in square brackets.

6 The initial constituent of this hodonym is the Afrikaans common noun *baai*, 'bay'.

marked as going *n[ach] Keetmanshoop*[7] 'towards Keetmanshoop', i.e., to another town in the hinterland of Lüderitzbucht. All of these cases are *bona fide* examples of the second most important subcategory of proper names, namely that of toponyms (Van Langendonck 2007, 202). As our choice of terms – oronyms vs. hodonyms – suggests, there is a rich taxonomy of toponymic (sub-)classes that are differentiated terminologically, according to the ontological class the named GEO-object belongs to (Nübling, Fahlbusch & Heuser 2015, 206–265).

In addition to these genuine toponyms, Map 1 also gives evidence of the use of further items that defy being classified as proper toponyms, on par with those mentioned above. We allude to the common nouns listed under (1).

(1) Common nouns (Lüderitzbucht)
Bahnhof 'train station', *Eingeborenen-Werft* 'kraal', *Elektriz[itäts]-Werk* 'power station', *Friedhof* 'cemetery', *Kapelle* 'chapel', *Kirche* 'church', *Landungsbrücke* (twice) 'pier', *Lazarett* 'military hospital', *Leuchtturm* 'lighthouse', *Mission* 'mission', *Schule* 'school', *Signalstation* 'signals', *Sportplatz* 'sports field', *Telefunken-St[ation]* 'radio station', and *Zoll* 'customs.'

In contrast to the GEO-objects that are individualized by a toponym of their own, these latter 15 instances of LOM, at least superficially, do not mark out their referents as individuals but as local representatives of classes of entities. Simplifying, proper names are usually assumed to be mono-referential, i.e., there is a one-to-one relationship between the name and its referent. Common nouns differ from proper names insofar as a common noun like *Kirche* 'church' can refer to any referent that belongs to the class of churches, whereas a toponym like *Lüderitz-Hafen* 'Lüderitz-Harbour' is restricted to a unique referential relation (Nübling, Fahlbusch & Heuser 2015, 32–33), with a set of individual coordinates to locate the GEO-object in space. What we have to bear in mind is that toponyms and common nouns appear side by side on Map 1. Linguistically, toponyms, and common nouns belong to two different word classes, with different morpho-syntactic properties.[8] On maps, however, both toponyms and common nouns are EPIKHARTIKA, which realize LOM. This classification does not put the usual word-class distinction at stake. As will be defended below, the notion of EPIKHARTIKON is necessary to access a functional domain of language that has hitherto been neglected in linguistics.

The co-presence of toponyms and common nouns on maps is problematic in the sense that onomastics only accounts for the former whereas the latter fall outside the scope of this discipline. Accordingly, the extant handbooks, such as Hough (2016), and introductions to the science of names, like Nübling, Fahlbusch & Heuser (2015), tacitly

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7 *Keetmanshoop* 'Keetman's hope' is an Afrikaans toponym.
8 The word-class membership and/or word-class status of proper names is still controversial in linguistics, which sheds an interesting light on their special status. According to a relatively common opinion, proper names can straightforwardly be subsumed under nouns, i.e., no structurally relevant differences are assumed to exist between proper names and common nouns (Anderson 2007, 15–17). However, we subscribe to the opposing view (Van Langendonck & Van de Velde 2016), according to which, proper names (and their different sub-classes) give evidence of a grammar of their own.

pass over instances of LOM, like those in (1). The situation is similar in the case of linguistics. From a systematic perspective, this is perfectly understandable; one can even say that a systematic taxonomy demands this distinction, but from an empirical perspective, the omission of nouns in the context of name occurrences proves to be problematic, which is especially true for EPIKHARTIKA. So, we can already point out that an investigation of LOM also has consequences for the system of linguistics as a discipline.

There is a plethora of terminological dictionaries, most of which dedicate an entry to toponyms (such as that by Hough (2005) in Brown's monumental encyclopedia), whereas further elements of LOM are never mentioned. This striking silence about LOM results from the absence of maps from the acknowledged genres of text. From the point of view of multimodal linguistics, Bateman (2008, 130–142) shows, however, how maps can be interpreted as a text genre. On the basis of their discourse-oriented approach to language, Spitzmüller & Warnke (2011, 160) argue for a very general definition of text genre ('Textsorte') so that there are no insurmountable obstacles to adding maps to the inventory of genres. This is not least due to the fact that discourses can be grasped in a semiotic continuum, and that discipline-limited systematics, resulting from the isolated consideration of sign types, are empirically inadequate; this even refers to the materiality of language. Following Spitzmüller (2018, 523–529), we assume that it makes a difference at least in terms of the connotations invoked, whether written language is represented on a map or on a materially different carrier object. Traditionally, proper names have been considered to be semantically empty and have even been termed 'non-connotational' (Anderson 2007, 16). According to Nyström (2016, 41–44), however, proper names may not only have connotations just like common nouns (Nübling, Fahlbusch & Heuser 2015, 34) but, in case of (supposedly) transparent connections to co-existing common nouns, they can be associated with meaning. We are confident that applying the frame-semantic approach propagated by Busse (2012) to the analysis of toponyms and LOM in general, will reveal that there is a semantic layer that remains inaccessible to models, which do not take discourse functions into account. The necessity to study the discourse functions of proper names is the topic of De Stefani (2016). To our minds, what counts for proper names probably also holds for LOM. We therefore strongly recommend that maps that give evidence of LOM are admitted to the typology of text types to be studied by linguists. Thus, if we want to comprehensively describe the specific nature of LOM, the restriction to toponyms is by no means sufficient. Toponyms claim a sizable part of the phenomenology of LOM, but do not exhaust it.

Cartographers conceive of maps as semiotically loaded communicative means, with an internal structure that can be described in terms of categories, which, at least outwardly, resemble those of linguistics, namely cartographic syntax, cartographic semantics, and cartographic pragmatics (Hake, Grünreich & Meng 2002, 10–13). Map language and map symbolism are central concepts. Within this framework, toponyms (the cover term for geographical and extra-terrestrial names) always interact with non-linguistic symbols on maps in order to convey the intended message (i.e., the geo-

graphical information). In support of the idea that maps have semantics, Monnier (1996) provides ample proof of the possibility to lie with maps, i.e., maps can be used to manipulate the minds of their users.

Standard dictionaries of cartography (Großer & Sievers 2001) and geography (Großer 2002) boast partly identical entries for geographical names too. Moreover, cartography employs the term *lettering* to refer to all those elements of written language (including numbers) that appear on maps in order to explain or complement the non-linguistic graphic symbols (Imhof 1972, 235–244). Orientation and, in the case of toponyms, denotation are mentioned as major functions of lettering (Großer 2001). The cartographic literature on lettering overwhelmingly addresses practical questions of map design, i.e., the size, density, colors, and position of LOM on a given map.

For the purpose of our project, the purely technical functions of LOM tell only half of the story. We repeat that maps do not only constitute a genre of text, but LOM is also provided with a discursive function of its own, which cannot be captured by the otherwise well-founded concept of lettering. Lettering is a concept that is adequate for the purposes of cartography. However, we doubt that it can be put to service in the context of linguistics. In what follows, we will put special emphasis on the discourse-related aspects of LOM to demonstrate that it makes sense to introduce the ΕΠΙΚΗΑΡΤΙΚΟΝ, not only as a new term but also as a new concept in linguistics.

This chapter is moderately interdisciplinary in the sense that, time and again, we feel impelled to refer to cartography, especially when it comes to making statements about maps. These references to a different discipline notwithstanding, we situate our study primarily within the domain of linguistics. Wherever the taxonomy and terminology of onomastics[9] come into play, we rely on Nübling, Fahlbusch & Heuser (2015) and Hough (2016). Our own theoretical background is sketched in Section 2. In Section 3, we define the ΕΠΙΚΗΑΡΤΙΚΟΝ and discuss the problems posed by the typology of maps. Section 4 looks at a selection of examples of LOM from a variety of historical contexts to substantiate the definition empirically. We start with cases that resemble that of Lüderitzbucht above, and complement these data with more complex and non-toponymic instances. Section 5 is dedicated to the discourse-linguistic evaluation of the ΕΠΙΚΗΑΡΤΙΚΟΝ and LOM. The conclusions are drawn in the final Section 6.

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9 The relation between onomastics and linguistics is controversial insofar as there are claims that proper names do not belong to language at all and thus onomastics does not meet the necessary criteria to claim the status of a linguistic sub-discipline (Anderson 2007, 15). We oppose this reductionist standpoint because we assume that proper names form part of the mental lexicon of humans – probably in the shape of a network/continuum between the lexicon *tout court* and the onomasticon (Nyström 2016, 44–45) – so that the study of proper names cannot be excluded from the domain of linguistics.

2 Colonial Linguistics

The notion of EPIKHARTIKON is not an ad hoc invention. It has taken shape in the course of the projects we have been conducting within the framework of the research program *Koloniallinguistik / Colonial Linguistics*. Warnke's (2009) paper initiated this research program, which is meant to identify, describe, and evaluate the entire set of interrelations that exist between language and colonialism. The agenda of *Koloniallinguistik / Colonial Linguistics* is presented in Dewein et al. 2012. How this approach integrates aspects of discourse is explained in Warnke & Stolz 2013. Warnke, Stolz & Schmidt-Brücken (2016) discuss the possibilities of adding a post-colonial component to the research program.[10]

In Stolz & Warnke 2015, the foundations are laid for the long-term project *Comparative Colonial Toponomastics (CoCoToP)*. One of the primary tasks of CoCoToP is systematically taking stock of all pieces of evidence of colonialism in the toponomasticons of colonies (and colonizer countries). To achieve this, different kinds of sources must be exploited. We work, among other things, with gazetteers, administrative documents, travelogues, journals, reports, autobiographic accounts, and last but not the least, with maps. We exclusively accept sources, whose date of publication (or creation) coincides with the (stipulated) period of colonialism (1492–1992). This means that we extract information to a considerable extent from historical maps. The necessity of interpreting these historical maps has ultimately guided us to coining LOM, in general, and the EPIKHARTIKON, in particular.

The output of CoCoToP, in terms of papers and books, is too big to be recapitulated in this study. We therefore choose only a small number of milestones, which mark important steps toward LOM and the EPIKHARTIKON. For an extended initial phase, the focus was exclusively on toponyms, especially those that are exonymic or hybrid formations, to name places in the colonies. Exonyms are toponyms that consist exclusively of elements taken from the language of the colonizer[11], whereas hybrids combine elements from the language of the colonizer with elements stemming from

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10 Especially, though not exclusively, in the context of decolonization, the frequent processes of replacing toponyms coined by a colonizer with those of a new colonizer or of an independent ex-colony clearly show that there is a heavy dose of connotations triggered by the incriminated toponyms (Stolz & Warnke 2016).

11 Such as the Dutch toponym *Nieuw Oranje* 'New Orange' (a temporary name for what later became New York) involving the Dutch adjective *nieuw* 'new' and the name of the Dutch ruling dynasty *Oranje* of the seventeenth century (Stolz & Warnke 2017, 208).

the language of the colonized[12] (Stolz & Warnke 2018a, 53–54, with further sub-categories).[13] As to the exonyms, certain patterns recur with a strikingly high type frequency and across practically all European colonialisms, so that it is possible to speak of the *Canonical Colonial Exonym (= CCE)* (Stolz & Warnke 2018b, 28).[14] The CCE is a binary compound-like construction, whose constituents are in a modifier-head relation, i.e., the modifier semantically modifies the structurally more basic head. Our initial example *Lüderitzbucht* illustrates this pattern in Fig. 1.

$$[\{\textit{Lüderitz}\}_{\text{MODIFIER}}\text{-}\{\textit{Bucht}\}_{\text{HEAD}}]_{\text{TOPONYM}}$$

Fig. 1: Binary structure of the CCE.

Potentially, there are many bays so that *Bucht* 'bay' alone remains referentially vague. The modifier *Lüderitz* singles out a particular bay from the multitude of GEO-objects belonging to this class. The genuine toponyms on Map 1 are all instances of the CCE, with *Lüderitz, Robert, Bismarck, Haifisch* 'shark', *Bai* 'bay', and *Diamant* 'diamond' functioning as fillers for the slot of the modifier, whereas *Bucht* 'bay', *Riff* 'reef', *Insel* 'island', *Berg* 'hill', *Straße* 'street', and *Weg* 'lane' occupy the position of the head. *Hafen* 'harbour' is special insofar as it is used both as modifier and head. In the case of *Bahnhof* 'train station', the head function is uncontroversial but in contrast to the bulk of the toponyms on Map 1, which reflect a right-headed construction, *Bhf. Burenkamp* is an example of left-headedness. Alternatively, constructions of this kind (in German) could be categorized as appositions. Thus, there is variation, in the sense that beside the CCE, further patterns are employed for the coining of colonial toponyms that do not conform fully to the schema given in Fig. 1.

   Table 1 impressionistically gives the reader an idea of the ubiquity of the CCE across the European colonial toponomasticons. The data are taken from Stolz, Warnke

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12 Such as the *Poelau Vlaming* 'Vlaming-Island' in Netherlands New Guinea (as of 1955), which contains Malay *pulau*, 'island', and the Dutch family name *Vlaming* (Stolz, Levkovych & Warnke 2019, 196).

13 Endonyms, i.e., toponyms that consist exclusively of elements taken from the language(s) of the colonized, such as *Umba-Nyika* 'Umba steppe' (*Umba* = hydronym, *nyika* '(dry) steppe') in Deutsch-Ostafrika, today's Tanzania, normally outnumber exonyms and hybrids by far. They pose several problems that render them a category hard to handle, without sufficient experience in the indigenous languages of the colonies. Furthermore, it is by no means always clear whether these endonyms are pre-colonial local coinings or imposed by the colonial administration. In the case of Umba-Nyika, the toponym is the creation of the Austrian geographer Oskar Baumann (Rieger 2020, 59).

14 Corbett (2005, 25–26) has introduced the concept of canon into linguistics. The canon must not be mistaken for the most frequent or optimal realization form of a given phenomenon. The sole purpose of postulating a canon is to provide an abstract yardstick for the calibration of attested cases. With reference to the CCE, we confirm that it is realized far too often to be filed away as a marginal phenomenon.

Tab. 1: Examples of CCE across European colonizers.

Colonizer	Toponym	Head	Location
Austria	Fort **Benjowski**	fort 'fort'	Madagascar
Belgium	**Albert**ville	ville 'town'	Congo
Brandenburg-Prussia	**Dorotheen**schanze	Schanze 'redoubt'	Ghana
Courland	**Jacobus**stadt	Stadt 'city'	Tobago
Denmark	**Christians**havn	havn 'harbour'	Virgin Islands
France	Port **Louis**	port 'harbour'	Goudaloupe
Germany	**Moltke**-Spitze	Spitze 'peak'	Togo
Italy	Monte **Umberto**	monte 'mountain'	Eritrea
Netherlands	**Maurits**stad	stad 'city'	Brazil
Portugal	Vila **Salazar**	vila 'town'	Timor Leste
Russia	Archipelag **Aleksandra**	archipelag 'archipelago'	Alaska
Spain	Punta **Vidal**	punta 'peak'	Equatorial Guinea
Sweden	**Carolus**borg	borg 'castle'	Ghana
United Kingdom	**Grahams**town	town	South Africa

& Levkovych 2016.[15] Boldface marks out anthroponymic constituents. The head is translated separately.

The different orders of modifier and head are unproblematic because they can be explained with reference to the general word-order rules of the language under scrutiny. One of the traits these examples share is the use of an anthroponym as modifier. The name of a representative of the colonizer nation forms part of the toponymic construction.[16] The function of this modifier is easy to determine. The anthroponyms serve as markers of possession, in the sense that they create a direct link to the culture, history, politics, and society of the colonizer nation and thereby claim the place for exactly this colonizer nation (Stolz & Warnke 2019). The fact that this can obviously be done most directly via persons, i.e., anthroponymic name constituents, is also an indication of an anthropocentricity of colonial naming practices, which deserves its own investigation, but is already mentioned here as a descriptive category for EPIKHARTIKA. Many colonial toponyms are cognitive conflations of personal referents of designations for GEO-objects and thus akin to an abstract mapping of aspects of colonization, in general. The anthroponym *Lüderitz* in *Lüderitzbucht* and *Lüderitz-Hafen*, for instance, commemorates Adolf Lüderitz, an influential actor of the German acquisition of territories in Africa in the 1880s (Schnee 1920, 465). On account of the

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15 In stark contrast to the European colonial toponomasticons, the Japanese case is characterized by a pronounced preference for hybrids, for which Japanese usually provides the head (Otsuka 2018, 340–341), although the CCE is also attested (Otsuka 2018, 344).

16 The modifier *Carolus* in *Carolusborg*, 'Charles' Castle' for instance, commemorates *Karl (= Carolus) X Gustav*, who ruled as king of Sweden from 1654 to 1660 (Stolz, Warnke & Levkovych 2016, 320). For the other historic personalities commemorated by the toponyms in Tab. 1, the reader is referred to the detailed explanations in Stolz, Warnke & Levkovych 2016.

wide distribution of the CCE and the recurrent properties of the modifiers, it is possible to formulate hypotheses and put forward generalizations about formal and functional aspects of colonial toponyms.

Owing to the transparency, especially of anthroponymic modifiers, this constituent of the CCE remained in the foreground of many studies of ours such as Stolz, Levkovych & Warnke 2019. Only relatively recently has the head constituent begun to attract more of our attention. In the original version of the CCE, the head is analyzed as a geographical classifier (= GEO-classifier), i.e., the element that ideally assigns a given GEO-object to its appropriate ontological class. This interpretation holds for cases like *Diamant-Berg* 'Diamond-Hill' because the GEO-object bearing this name is indeed a hill. However, *Lüderitzbucht* 'Lüderitz-Bay' is one of many counter-examples since the GEO-object is a town and not a bay. There is thus a referential mismatch between a GEO-classifier and a GEO-object class, which leads Döschner (2018) to rebut the category *Gattungseigenname* 'proper-name appellative', which has been a bone of contention for a long time in German onomastics (Nübling, Fahlbusch & Heuser 2015, 44–45). In point of fact, GEO-classifiers constitute a colorful category that is connected on a continuum to both common nouns and grammatical classifiers (Stolz & Levkovych 2020a). Moreover, recent studies show that the classifiers are not at all exempt from colonialist connotations. In Warnke et al. 2020, the distinction between GEO-classifiers and function classifiers (= FUNC-classifiers) is introduced. FUNC-classifiers highlight certain aspects of the place, which might be economically or strategically useful for the colonizers. In this sense, *Hafen* 'harbour' in *Robert-Hafen* 'Robert-Harbour' is a FUNC-classifier because it characterizes the place as being accessible by sea. The discovery of the FUNC-classifier calls for a revision of the CCE, to the extent that now both constituents of the binary pattern convey colonialist connotations.

What is important about both kinds of classifiers is that, except in cases of diachronic fossilization, they are identical to co-existing common nouns. This co-existence is obvious in the case of the common noun *Bahnhof* 'train station' in (1) and the FUNC-classifier *Bahnhof* in *Bhf. Burenkamp* 'train station Burenkamp'. All GEO-classifiers and FUNC-classifiers on Map 1 also exist as common nouns in German. On what grounds can it be justified that one instance of *Bahnhof* counts as (constituent of) a toponym, whereas the other is denied a similar classification? The difficulties that arise when it comes to defining the exact dividing line between common nouns and toponyms on maps have induced Miccoli (2020), for the Italian colonial toponomasticon, and De Bloom (2023), for the German and Swedish cases, to suspend the solution of this problem by way of lumping together common nouns, like those in (1) and genuine toponyms in a common macro-class, labeled, toponyms. In doing so, the two authors have anticipated a necessary step toward the EPIKHARTIKON. The decisions taken by Miccoli (2020) and De Bloom (2023) are in line with the findings of typological linguistics, according to which, in many, if not all, languages that give evidence of a *Special Onymic Grammar* (Nübling, Fahlbusch & Heuser 2015, 64–92), there is a set of common nouns that behave

parallel to proper names, morphosyntactically (Handschuh & Dammel 2019, 455–458), which Haspelmath (2019: 322) baptized, toponouns.

Subsuming common nouns and toponyms under one umbrella category suggested itself to the above authors because their databases include not only macro-toponyms but also micro-toponyms. Macro-toponyms are supposed to be widely known whereas micro-toponyms are normally only known locally (Nübling, Fahlbusch & Heuser 2015, 206–207). Accordingly, *Bahnhof* 'train station' may have had the value of a micro-toponym for inhabitants of Lüderitzbucht[17] since there was only a single GEO-object of this kind within the town (the other train station on the city limits needed to be specified by adding a modifier to yield *Bhf. Burenkamp*). Beyond this restricted local context, speakers of German – not only in Deutsch-Südwestafrika – would not share the associations of those living in Lüderitzbucht. In contrast, *Lüderitzbucht* was certainly more widely known, not only in colonialist circles in Germany, between 1884 and 1919 so that it can be taken for granted that we are dealing with a macro-toponym.

We agree that to reach the ultimate goals of CoCoTop and *Koloniallinguistik / Colonial Linguistics / Postcolonial Language Studies*, it makes perfect sense to evaluate macro-toponyms as well as micro-toponyms. The findings of Stolz & Warnke 2017 further support the idea that there is a gray zone between genuine toponyms and common nouns. The authors observe the use of de-individualizing patterns for the names of certain (hard to access and/or economically unimportant) GEO-objects. The modifier is either an ordinal numeral (e.g., in Italian East Africa: *Cima quarta* 'Fourth peak' ← Italian *cima* 'peak' + *quarto* 'fourth') or a letter of the alphabet (e.g., Netherlands New Guinea: *B-rivier* 'River B' ← Dutch *B* '(letter) B' + *rivier* 'river'). In both cases, there are extended lists of parallel formations. The classifier cannot be told apart formally from its common-noun equivalent. The distinction between a toponym and a common noun is blurred.

We even venture a step further. In contradistinction to macro-toponyms, micro-toponyms and, much more often, toponymically re-interpreted common nouns that appear on maps fail to show up in the index of colonial atlases (or in gazetteers, for that matter). If being printed on a map is the only reason for including common nouns like those in (1), in the same category as genuine toponyms, then nothing keeps us from treating analogously other absentees from the indexes that are nevertheless represented graphically on the maps. This is the point at which we leave the domain of toponomastics for good and enter the realm of LOM.

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17 However, one has to be very careful with such functional assignments (in the colonial context), because the function of map-bound toponyms does not give direct conclusions about name use and functions in everyday life. The small alley behind the childhood home may have had a name, let us suppose *Lüderitzweg*, which may not have been known at all; it was and remained *the alley*. This already indicates that the materialization of toponyms and EPIKHARTIKA on maps entails a specific classification of their function; see the *esse-est-percipi-principle* in Section 5.

3 Toward Defining the EPIKHARTIKON

The foregoing paragraphs have revealed the long and winding process that has led us to create new terms. We noticed that there was a terminological gap only after widening the scope of the types of data we consider worthwhile accounting for. There was no established cover term for toponyms and common nouns on maps. In different linguistic contexts, it might make sense to label the latter, pseudo-toponyms or the like. For the purpose of CoCoTop, however, nothing much would be gained because, as shown in Section 4, maps may also give evidence of elements of LOM that cannot be related to (pseudo-)toponyms in any way. Thus, how can the EPIKHARTIKON be defined? To define the EPIKHARTIKON and explain our choice of term in Section 3.2, we take a detour via the world of maps in Section 3.1. In both sections, arguments are put forward to narrow down the list of phenomena and sources that are relevant for the notions under inspection.

3.1 Maps

It is clear that EPIKHARTIKA are instances of written language. They presuppose a certain carrier object on which they are visible, namely maps. However, there are different kinds of maps. For CoCoTop, it is crucial to compare like with like. In cartography, experts speak of thematic maps and thematic cartography, in the sense that maps are created for special purposes, with the aim of focusing on certain topics such as demography, administrative organization, mineral resources, etc. (Imhof 1972, 12–13). It is to be expected that different thematic maps also differ from each other with regard to LOM, which means that only maps with a common theme can be compared to each other. A small number of the European colonialisms are privileged insofar as at least some of the colonies have been the object of different thematic maps. In other cases, the only type of map that is available is that of the topographic map. In cartography, topographic maps form the basic or unmarked type, albeit with a wide margin for variation as to its formal parameters (Buziek & Koch 2002, 371–373). Historically, topographic maps precede thematic maps (Stams 2002, 10). It is therefore recommendable to start comparing LOM on the basis of topographic maps.

In contemporary cartography, there is a strong tendency to create internationally valid principles and regulations for map making, as is manifest in the activities of the *International Cartographic Association* (*ICA*, founded in 1959) (Neumann 2002). This means that cartography is undergoing standardization that also affects what is permitted to be printed on maps. In terms of practicality, this is a welcome process. To a project like ours, however, artificial homogeneity is detrimental because variation is no longer tolerated, which means that there remains hardly anything worth comparing in the first place. If we go back in time, the leveling in the domain of cartography was not as pronounced, and thus map making still allowed for variation and creative

solutions. This is especially true for the long period preceding the age of decolonization. The goals of CoCoTop can only be reached if we search for evidence of colonialist concepts in documents that predate decolonization and postcolonial ideology. For a start, only those maps are taken account of that have an official or semi-official status, that is, which appeared in print, either on orders of or with the consent of the colonizer's government.

The maps of the colonizer countries themselves constitute fertile ground for the investigation of manifestations of the colonialist mind, as has been shown in several studies (e.g., Ebert 2021) dedicated to micro-toponyms (mostly hodonyms and dromonyms) in European urban contexts. We opt for researching the cartographic representation of the colonies because what distinguishes the maps of the colonies from those of the colonizer countries is the scarcity of certain kinds of LOM on the latter.

The scale of the maps varies considerably so that it is hardly possible to impose strict criteria for the selection of colonial maps. For the time being, we make do with requiring that the maps feature similar entities topographically, viz., settlements, districts, entire colonies, islands, coastlines, mountain ranges, etc. This means that Map 1 is comparable only to other maps that also feature a settlement and its immediate surroundings. Now that we have delimited the kind of maps on which we expect to find EPIKHARTIKA, we can proceed to the definition of the notion.

3.2 The Term and its Definition

3.2.1 Word-formation

The term EPIKHARTIKON has not shown up out of nowhere. The reason for coining it should be clear by now. We had looked in vain for an adequate label in the extant terminologies of linguistics and cartography to attach to the phenomena we discovered while working with colonial maps and which called for further inspection. As mentioned in the introductory paragraph of Section 3, a term like 'pseudo-toponym' would not do since it excludes all non-toponymic elements of LOM. Thus, we decided to become terminologically creative. The putative Ancient Greek impact on the terminology of onomastics is strong. For most types of names, there are supposedly Ancient Greek terms such as *zoonym* (= animal name), *ergonym* (= object name), *praxonym* (= event name), etc. (Nübling, Fahlbusch & Heuser 2015, 104). Similarly, the higher-order class of toponyms (= place names) is subdivided into several layers of lower-order classes, for most of which, an Ancient Greek label is in use (often in competition with a synonym stemming from a contemporary language), such as *anoikonym* (= name of an uninhabited place), *potamonym* (= river name), *helonym* (= swamp name), etc. The head constituent

of these compounds is the truncated Ancient Greek noun ὄνυμα[18] / *onyma* (~ ὄνομα / *onoma*) 'name'. In point of fact, not all of these and further terms go back to antiquity. We were unable to confirm their presence in Ancient Greek on the basis of Montanari's (2014) dictionary. At least some of the terms seem to be more or less recent creations on the basis of the structural patterns of Ancient Greek word formation. The terms come almost exclusively in the shape of determinative compounds, which is the major type of compounding in Ancient Greek. If not all of the terms are attested in Ancient Greek texts, the terms are nevertheless possible Ancient Greek compounds.

The onomastic predilection for Ancient Greek, as a resource for the creation of new terminology, induced us to follow the same path to fill our own terminological gap. However, as mentioned repeatedly above, LOM is not only a matter of genuine toponyms and pseudo-toponyms, but also involves non-onymic elements. Therefore, the use of the pattern *X-onym* was blocked. Ancient Greek has further types of compounds on offer, amongst which we find prepositional compounds such as ἐγκέφαλος / *egkephalos* 'brain' = preposition ἐν / *en* 'in' + common noun κέφαλος / *kephalos* 'head' (Bornemann & Risch 1978, 320). Since it is exactly the location of the elements of LOM on maps that makes them special, we consider the type of the prepositional compound to be the best option for creating the new term. Finding the most adequate preposition posed no serious problems because Ancient Greek ἐπί / *epi* 'on' is a polysemous spatial preposition, which is also frequently involved as prefix ἐπ(ι)- / *ep(i)-* in word-formation (Bornemann & Risch 1978, 202) such as ἐπικρηπίς / *epikrēpis* 'overshoe' = ἐπί / *epi* 'on' + κρηπίς / *krēpis* 'shoe (worn by men)'. The empty slot in the pattern *epi-X* needed to be filled by a suitable noun. Our noun of choice was χάρτης / *khartēs* 'sheet of (papyrus) paper' – a masculine noun of the first declension class – from which we extracted the root χαρτ- / *khart-* and added the derivational suffix -ικός / *-ikos* for relational adjectives (Bornemann & Risch 1978, 308), which then was nominalized in its neuter form to yield EPIKHARTIKON.

In terms of semantic compositionality, the term EPIKHARTIKON suggests a meaning '(related to) what is on paper'. Markus Asper (personal communication, July 1, 2019) suggests alternatives, such as ἐπιγραφή / *epigraphē* 'inscription' or ὑπόγραμμα / *hupogramma* 'inscription on a column/pillar'. We have opted against these terms because they belong to the established terminology of a different discipline – epigraphy – and thus invoke a carrier-object material (stone), which is different from that of the kinds of maps we are interested in (paper). Markus Asper mentions a third possibility. One of the meanings of Ancient Greek πίναξ / *pinax* 'table, board' is indeed 'map', whereas πινακογραφία / *pinakographia* refers to the art of map making. Thus, if one wants to express the idea of 'what

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18 Only for words that are attested already in Ancient Greek do we provide the original graphic representation. Neologisms are presented exclusively in transliterated form. Modern Greek examples are given in original orthography and Latinate transcription.

is on a map', a neologism like *epipinakion* comes to mind. This alternative notwithstanding, we keep the term EPIKHARTIKON as is, because the primary meaning of Modern Greek χάρτης / *khartis* is 'map', whereas πίνακας / *pinakas* 'table, catalogue, painting' is no longer associated with cartography. Moreover, we believe that, especially for those who are not familiar with Ancient Greek, the component *khart-* might trigger associations with English *chart* 'nautical map', German *Karte* 'map', French *carte* 'map', etc. Terminologically, EPIKHARTIKON constitutes a compromise between the antiquity-oriented traditions of onomastics and today's meanings attached to words of Ancient Greek origin in the modern languages of Europe.

The reconstruction of the term-finding process indirectly characterizes our procedure as the usual strategy of innovating one's terminology in onomastics and linguistics. Having recourse to the seemingly unlimited reservoir of the lexicon and the transparent word-formation patterns of Ancient Greek is certainly one of the most popular ways in the domain of terminological neology.

3.2.2 Definition

The new term needs content (or more precisely, the new content called for a new term). What exactly does EPIKHARTIKON stand for? The previous sections have given us a rough idea of the notion at hand. We complement this still incomplete picture by way of referring to the usual practice of cartography, to exclude the map legend, the map title, and everything that is located outside the map frame from the category of lettering (Imhof 1972, 245–254). We provisionally adopt this practice for our purpose. Future studies must clarify whether this decision should be revised. Since the concept under scrutiny arose from our investigations in the domain of *Koloniallinguistik / Colonial Linguistics*, it is clear that we are referring more narrowly to the COLONIAL EPIKHARTIKON, which, stripped of its associations with colonialism, might also turn out to be useful beyond the limits of CoCoTop. In (2), we present a concise definition of the COLONIAL EPIKHARTIKON.

(2) The COLONIAL EPIKHARTIKON – definition(s)

(a) The COLONIAL EPIKHARTIKON is any single-word instance of written language on colonial maps within the limits of the map frame.

(b) Cases of multi-word instances of written language on colonial maps within the limits of the map frame consist of n EPIKHARTIKA.

(c) Depending on their internal syntactic structure, multi-word instances of written language on colonial maps can constitute EPIKHARTIC phrases or propositions.

(d) Each case mentioned in (a)–(c) counts as realization of (colonial) LOM.

The definition in (2) tells us what the COLONIAL EPIKHARTIKON is. At the same time, the definition keeps silent about the usefulness of the notion. What does linguistics, what does onomastics gain from integrating the concept, and what does an interdisciplinary study of colonization gain from it? We try to answer these questions in two steps.

For a start, Section 4 sketches two types of EPIKHARTIKA (other than genuine toponyms) on the basis of comparative empirical data, to underscore the point that we are not dealing with a marginal phenomenon. In Section 5, we address the issue of the discourse function of the EPIKHARTIKON and LOM in general.

4 Different Kinds of EPIKHARTIKA

This section is divided in two. In Section 4.1, we present a parallel case to our initial example Lüderitzbucht, i.e., a colonial city map is scrutinized for evidence of EPIKHARTIKA. Section 4.2 inspects maps of more extended territories, where we find numerous instances of non-toponymic LOM.

4.1 Port d'Obock

In terms of the kind of attested EPIKHARTIKA, Lüderitzbucht (as represented on Map 1) is not unique. It may even be claimed that it is a typical example of colonial city maps across the European colonialisms in the first half of the twentieth century. It suffices to glance at the case of Port d'Obock in Northeast Africa.

Port d'Obock (today's Obo(c)k) was a major harbor (and erstwhile capital) of the French colony Côte Française des Somalis (today's Djibouti). Map 2 represents the settlement and its immediate surroundings, as of 1929. In contrast to Map 1, there are no hodonyms. It is even difficult to make out any streets on Map 2. Port d'Obock is depicted like an open country in lieu of being presented as an urban center. This deurbanized impression fits in with the information given in the Atlas Colonial Français (Pollacchi 1929, 196) that

> *Obock*, ancien chef-lieu de la colonie, a perdu de son importance depuis que la résidence et les services administratifs ont été transférés à Djibouti; à côté de cette agglomération de 300 indigènes, il ne reste plus que les vestiges de l'ancienne ville administrative.[19]

Except *Obock* (of Arabic provenance) itself, all of the EPIKHARTIKA are of French origin and realize the expected left-headed binary structure, with the modifier coming in the shape of a possessive prepositional phrase, as in [{*Plateau*}$_{HEAD}$ {[*des*$_{PREP}$ *Gazelles*$_N$]$_{PP}$}$_{MODIFIER}$]$_{TOPONYM}$ 'Gazelles-Plateau'. The genuine toponyms refer to maritime GEO-objects, such as *Ilot Nord* 'Northern Small Island', rivers such as *Riv[ière] d'Obock* 'Obock-River', or mountains (like *Buttes aux Cailles* 'Quails-Heights'), plateaus (like

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[19] Our translation: "Obock, the old capital of the colony, has lost its importance since the seat and the services of the administration have been transferred to Djibouti; beside the settlement of 300 natives, there remain only the relics of the old administrative town."

Plateau des Aigles 'Eagles-Plateau'), valleys (like *Vallée des Jardins* 'Gardens-Valley'). The names of the banks *B[an]c du Laclocheleterie* and *Banc du Surcouf* involve the names of two French men-o'-war. The other modifiers are either zoonyms (such as *Plateau du Lièvre* 'Hare-Plateau'), directions (as e.g., *Port du Sud* 'Southern Harbour'), or refer to fishermen (= *Anse des Pêcheurs* 'Fishermen's Hook') or pearls (= *Banc des Perles* 'Pearls-Bank').

In addition to these genuine toponyms, there are 11 types (with 13 tokens) of EPI-KHARTIKA that are common nouns, to which three adjectives have to be added. We present the data in (3).

(3)   Common nouns and noun phrases (Port d'Obock)
cimetière 'cemetery', *factorerie* 'trading post', *gouvernement* 'government', *hôpital* 'hospital', *jardins* 'gardens', *mission catholique* 'Catholic mission', *penitencier* 'penal institution', *poste* 'post-office', *puits* (twice) 'well; pit', *s[our]ce sulfur[eu]se* 'sulfur source', *village indigène* (twice) 'indigenous village'

Three of the cases in (3) are especially interesting because they represent binary noun phrases, with a common noun as head that is modified by a postnominal attributive adjective. Examples like *mission catholique* 'Catholic mission', *s[our]ce sulfur[eu]se* 'sulfur source', and *village indigène* 'indigenous village' suggest that in terms of morphosyntactic structure, the phenomenology of LOM is not restricted to isolated EPIKHARTIKA. The absence of phrasal cases on Map 1 is partly explicable with reference to the different possibilities of compounding in German and French, with the latter language preferring syntagms over compounds. However, the different structural preferences of the two languages do not explain why Map 1 registers a further unspecified common noun, *Mission* 'mission', whereas on Map 2, the denomination of the mission is made explicit as *mission catholique* 'Catholic mission'. This is especially striking because in the German colony, Protestant and Catholic missionaries competed with each other, whereas normally a mission in a French colony would be run by a Catholic order. Meaning: it would have made much more sense to tell the map user whether the mission in Lüderitzbucht was Catholic or Protestant, than to state the obvious for the mission in Port d'Obock.

Both Lüderitzbucht and Port d'Obock were the home of indigenous villages, which remain anonymous. The absence of an individualizing name for the *Eingeborenen-Werft* 'kraal' on Map 1 is interesting in itself. The parallel case in Port d'Obock is even more interesting because there were two indigenous villages. According to Map 2, one *village indigène* was situated north of the *Riv[ière] d'Obock* and the *Valée des Jardins.* The location of the other *village indigène* was at about 2 km to the south of its namesake on the other side of the river and the valley. If there are two indigenous villages, it is to be expected that one needs to distinguish them by name. It seems, however, that this practical necessity was not reason enough for the map makers to disclose these names on the map, if they existed at all. What is represented on Map 2 by the majority of the pseudo-toponyms in (3) belongs to the domain of (urban)

infrastructure. To the French colonizers, it was important to know where the hospital, the post office, and the trading post were located. In contrast, it was largely unimportant to them to put distinct names to the indigenous villages. The lesson we learn from this still sketchy comparison of two colonial city maps is that EPIKHARTIKA of the common noun and phrasal types cater for the interests of the colonizers.

4.2 From Pseudo-toponyms to Landscape Painting

In this section, we present cases from French, Dutch, and German colonialism. The maps from which we extract certain grid squares represent larger territories so that we do not expect to find evidence of hodonyms. What we find instead are structured chains of EPIKHARTIKA that characterize parts of the territory as to its (economic) value, history, accessibility, etc.

Map 3 zooms in on the north-western sector of the French colony Guyane Française on the Atlantic coast of northern South America. For the sake of brevity, we skip discussing the presence of ethnonyms on Map 3, which circumscribe the settlement area of certain ethnic groups such as Boschs, Paramaca, and Boni along the Maroni-River. Even the *Territoire pénitentiaire* 'penitentiary district' in the north-westernmost corner of the colony is not as interesting to us as two further instances of LOM situated in the center of the colony. Both of these cases are noun phrases involving postnominal adjectival attribution, namely *Région inexplorée* 'unexplored region' and *Plateau peu accidenté* 'slightly hilly plateau'. We assume that *Région inexplorée* 'unexplored region' is similar to the pseudo-typonyms we are familiar with from the previous discussion. No other region in *Guyane Française* of the times is characterized as unexplored on the map. In the absence of namesakes, one might consider *Région inexplorée* 'unexplored region' to be a pseudo-toponym, similar to *Bahnhof* 'train-station', in the case of Lüderitzbucht, in the sense that the unique expression can be used to individualize a GEO-object. What about *Plateau peu accidenté* 'slightly hilly plateau'? Since no other plateau is mentioned on the map, the situation seems to be the same as with *Région inexplorée*, 'unexplored region'. However, the three EPIKHARTIKA together form a relatively complex noun phrase with two modifier-head relations: the noun *plateau* 'plateau' takes the binary modifier *peu accidenté* which in turn consists of the (participial) adjective *accidenté* 'hilly' and its adverbial modifier *peu*, 'little'. The question arises whether one would refer to the GEO-object as the place called *Slightly Hilly Plateau*. As a matter of fact, neither *Région inexplorée* 'unexplored region' nor *Plateau peu accidenté* 'slightly hilly plateau' are cross-referenced in the index that accompanies the atlas, which means that they are not classified as toponyms.[20] We

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20 The reference to *plateau (légèrement ondulé)* '(slightly uneven) plateau' in the same index (Pollacchi 1929: 306) does not impair our argument since what is indexed belongs to a thematic map that focuses on the physical properties of the terrain in Soudan Français (Carte 12bis).

doubt further that *Plateau peu accidenté* 'slightly hilly plateau' is a pseudo-toponym. It has more of a phrasal description that informs the map-user about the local topographic conditions without putting any names to GEO-objects. Similarly, *Région inexplorée*, 'unexplored region', tells the map user that no information is available for this stretch of land.

Map 4 covers a mid-western grid square of the Dutch colony Suriname, as of 1938. Map 4 features part of the border region between Suriname and British Guyana. There are numerous genuine hydronyms (some of them English-Dutch or Saramaccan-Dutch hybrids) referring to rivers (e.g., *Lucie-R[ivier]* 'Lucie-River'), falls (e.g., *Tijger-val* 'Tiger-Fall'), and rapids (e.g., *Umuru-stromversnelling* 'Umuru-Rapids'). On Map 4, there is also *Zeven Broeders*, 'Seven Brothers', which is registered as *Zeven-Broeders-vallen*, 'Seven-Brothers-Rapids', in the index of the *Atlas van Tropisch Nederland* (Koninklijk Nederlandsch Aardrijkskundig Genootschap. 1938). Several hills, with heights of 104 m, 116 m, 150 m, and 170 m, stand out from the otherwise flat country side but remain anonymous. What strikes the eye most, however, is the dotted red line, indicating a path that leads from the *Lucie-[Rivier]* inlands. At the terminus of this path, we find the indication of a rather short river, next to which we read *Vermoedelijk de Kabalebo-R[ivier]* 'probably the Kabalebo-River'. The margin of doubt that transpires from this example of LOM is dropped in the index, where only the hydronym *Kabalebo-rivier* is mentioned. It is clear that *Kabalebo-rivier* is a genuine geographical name so that the adverb *vermoedelijk* 'probably' and the definite article (common gender) *de*, 'the', are outside the properly onymic construction. Similar to the adjectival EPIKHARTIKON *inexplorée* 'unexplored' in the above case from Guyane Française, the adverbial EPIKHARTIKON *vermoedelijk* 'probably' does not describe properties of the GEO-object, but makes a statement about the knowledge the colonizers possess with regard to the GEO-object. Where *inexplorée* 'unexplored' declares the region to be terra incognita, *vermoedelijk* 'probably' is suggestive of the existence of certain clues that allow the geographers to put forward a hypothesis.

It is interesting that Map 4 features something, whose existence was not yet definitely confirmed – so the information must remain speculative. *Vermoedelijk de Kabalebo-R[ivier]* 'probably the Kabalebo-River' has the character of an assumption or suggestion, but not that of a statement of facts. This and similar cases of LOM prove that EPIKHARTIKA contribute to the discursive potential of maps. The subsequent paragraphs address evidence of this potential from the cartographic presentation of three German colonies.

To cut a long story short, we only comment on those cases of LOM that involve chains of two or more EPIKHARTIKA. The more EPIKHARTIKA combine, the more chances that a function other than that of toponymic reference applies. Map 5 shows the Astrolabe-Bai and the hinterland in Deutsch-Neuguinea (the northern part of today's Papua-New Guinea). There are seven types (with nine tokens) of chains of two or more EPIKHARTIKA, as shown in (4).

(4)   Chains of two or more Epikhaptika (Astrolabe-Bai)
ausgezeichn[etes] Kulturland, 'excellent cropland', *bewaldete Ebene*, 'wooded plains', *fruchtbare Ebene* (three times), 'fertile plains', *Korallengebirge mit Eingeborenengehöften*, 'coral mountains with indigenous farmsteads', *Rhein[ische] Miss[ion]*, 'Rhenanian Mission', *senkrechter Felsen*, 'vertical rock', *wilde Bananen*, 'wild bananas'

Six of the seven types in (4) reflect the same syntactic pattern because they have the shape of noun phrases, with the head noun occupying the rightmost slot, preceded by an attributive adjective as modifier. In contrast to the vague *Mission* 'mission' on Map 1 and *mission catholique* 'Catholic mission' on Map 2, *Rhein[ische] Miss[ion]* 'Rhenanian Mission', helps to identify the missionary society. Except *senkrechter Felsen* 'vertical rock', all other data in (4) make statements about agriculturally interesting aspects. In all likelihood, Epikhartic noun phrases like *ausgezeichn[etes] Kulturland* 'excellent cropland' and *fruchtbare Ebene* 'fertile plains' were meant as information (or even incentive) for potential settlers, farmers, and investors who considered Deutsch-Neuguinea as their future destination. We assume that the prepositional attribute in *Korallengebirge mit Eingeborenengehöften* 'coral mountains with indigenous farmsteads' served the same purpose, albeit indirectly, by telling the map user that there is cultivated land available.

This instance of LOM leads us to a comparable case in Togo. Map 6 shows the north-eastern corner of the German colony and the border region to the neighboring French possessions. On the German side of the border, we find several instances of Epikhartika, like *Steppe* 'steppe', *Buschsteppe* 'bushland', *Baumsteppe* 'wooded steppe', which are not particularly interesting for the topic at hand. Much more striking, however, is the chain of Epikhartika *viele Felder aber keine Dörfer* 'many fields but no villages' in the center of Map 6. This is a syntactically rather complex specimen of LOM. The complexity arises from the combination of two propositions that are in an adversative relation. The leftmost noun phrase *viele Felder* 'many fields' is an example of quantification; propositionally, the existence of numerous fields (at a given place) is asserted (*There are many fields*). The second noun phrase *keine Dörfer* 'no villages' involves the negative quantifier *keine* 'no', and thus the second noun phrase replicates the internal structure of the first one. The use of the negative quantifier turns the proposition into a negative existential, with the meaning *There are no villages*. What renders the case even more special is the presence of the adversative conjunction *aber*, 'but'. The relation of adversativity can be decomposed as follows: the existence of many fields invokes the idea that humans must dwell in their vicinity; this inference is not corroborated by the facts since there are no villages, in the first place. It is remarkable that the map makers felt impelled to explicitly tell the map users that a potential presupposition of theirs does not hold. It is probably too daring to speak of a proto-form of an interactive map, but it cannot be denied either that this example from Togo illustrates some elements of the communicative and discursive nature of LOM.

To close this section, we take a final look at Map 7, which features a sector of the northern triangle in Kamerun (today's Cameroon) (to the south of Lake Chad). The maps of this colony in the *Großer Deutscher Kolonialatlas* are rich with intriguing cases of LOM that call for an in-depth study in the future. We only mention in passing the frequent use of the qualitative adjective *schöne(r)*, 'beautiful', as an attribute of different head nouns, as in *schöner See*, 'beautiful lake', *schöne Weidegründe*, 'beautiful pastures', *Teiche und schöne Vegetation*, 'ponds and beautiful vegetation', and *Wiesen und schöne Bäume*, 'meadows and beautiful trees.' These and similar chains of ΕΠΙΚΗΑRTIKA are outstripped – not only in terms of complexity – by a chain, which, on Map 7, is broken up into several lines, cf. (5).

(5)   EPIKHARTIC paragraph (Cameroon)
große Wildnis von den Fulbe Fili 'Obádja' genannt, hauptsächlich bedeckt von dichtem Wald mit großen Elephanten- und Giraffen-Herden, hier und da Wiesen-Flächen, die von den wandernden Fulbe mit ihren Rindern besucht werden. Reis wächst wild.
'huge wilderness called 'Obádja' by the Fulbe Fili, mainly covered with dense forest, with big herds of elephants and giraffes, patches of meadow here and there, which are frequented by the nomadic Fulbe with their cattle. Rice grows wild.'

In (5), we are told that there is an endonym *Obádja*, which refers to the region under inspection. The acknowledged existence of this endonym does not, however, induce the map maker to position it appropriately as a toponym on the map. This refusal to accept *Obádja* as a regular toponym suggests that local toponyms were not automatically officialized. Moreover, in (5), the indigenous inhabitants of the region are talked about in a way that they can be ruled out as addressees of the conveyed information. The expected map user is a member of the colonizer nation, who is still unfamiliar with the colony.

The paragraph in (5) is not only densely packed with information about local ethnic groups, their livestock, their nomadic life-style, and the flora and fauna, but it consists of two (grammatically almost complete) sentences. The complex first sentence involves a relative clause with a finite verb (the passive auxiliary *(besucht) warden*, 'are (frequented)'). Everything that precedes the relative clause has the format of noun phrases; the absence of finite verbs bars the possibility to analyze these syntagms as fully blown clauses. Therefore, it is not entirely correct to speak of a proper sentence. The much shorter second sentence, however, deserves this designation because even in context-free usage, *Reis wächst wild*, 'rice grows wild' would still be an acceptable, albeit marked German sentence (for instance, as a generic statement about rice). The syntactic structure involves a subject (*Reis*), a finite verb that agrees with the subject (*wächst*), and an adverbial modifier (*wild*). These sentential/clausal properties distinguish (5) from all our previous examples that display phrasal traits at best. At the same time, the use of clauses and sentences in the domain of LOM lends further credibility to our hypothesis that maps are texts.

5 Discourse Functions of EPIKHARTIKA

We have justified the fundamental necessity of transcending the solely onomastic interest of linguistics in LOM, and we still want to establish the relevance of the study of EPIKHARTIKA here by marking out its discourse-functional aspects. To this end, we will (i) underline and draw inference from the dimension of the materiality of EPIKHARTIKA as symphysical signs; (ii) relate the already described discourse function of toponyms to what we call the *esse-est-percipi principle* of EPIKHARTIKA; and (iii) focus on the commentary function that is particularly relevant for EPIKHARTIKA. The aim here is to extend the discourse-functional description of toponyms already established in research to EPIKHARTIKA and to add an important function that we have overlooked so far when dealing with toponyms, but which may be relevant, at least for colonial toponomastics in the narrower sense.

First, we outline what we mean by a discourse function. Function is a central linguistic term, whose theoretical embeddings are strikingly broad. Function is often juxtaposed with the concept of form to emphasize that language, in its formal appearance, is bound to purposes and effects of its use.[21] Function is a concept of relation that relates systematically describable forms of language to extra-systematic matters, such as to a situation, to persons, etc. Accordingly, every use of language has a functional side. To speak of discourse function means, in a narrower sense, to consider language in relation to social knowledge orders, that is, in relation to what is shared, dominated, and controlled as knowledge at a certain time. When we ask about the discourse function of EPIKHARTIKA, we ask about its purposes and effects in social knowledge orders, which may legitimize or question actions from the individual, up to the political sphere. By discourse, we mean, in general, the way a society – wherever one can draw boundaries here – talks about matters.[22] Of course, functions are always context-bound. For practical reasons, we consider only the colonial context in more detail. Another equally conceivable perspective would be a postcolonial recontextualization, that is, the function of historical data in contemporary perception. A demarcation is not always easy; therefore, we focus primarily on the question of which discourse functions EPIKHARTIKA possess in the context of their historical situatedness – thus identifying ourselves as linguists interested in historical data.

Ad (i): In a quotation from Jäger (2007, 21) that is not exactly easy to read, we encounter a conception of language mediality that seems absolutely apt for our concern with EPIKHARTIKA:

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21 Beside other conceptualizations of function in linguistics, sociologist Robert Merton's (1949/1968, 117) distinction between 'manifest' and 'latent' functions in the sense of purpose and effect is of particular interest here.
22 We refer here, in particular, to a formula by Wichter (1999, 274), who understands discourse as social talk.

> Die semantischen Gehalte von Sprachzeichen gehen [. . .] ihrer Übermittlung durch Zeichenaus-drücke nicht einfach voraus, sondern sie werden im medialen Modus performativer Vollzüge konstituiert.[23]

What sounds somewhat technical is ultimately trivial but also essential for understanding EPIKHARTIKA as a phenomenon, with the status of material deployment indicated by the prefix ἐπ(ι)- / ep(i)- (cf. also Warnke 2013). What EPIKHARTIKA *mean* and also what *can be meant* by them results not least from their materialization itself. Now, one might object that this says nothing other than that every meaning is always established in materially manifest contexts; but this is not only what is meant in our context. It is obvious to recall a fundamental distinction of sign types, which Karl Bühler already makes in his *Sprachtheorie* in 1934. Accordingly, there are signs that become intelligible, primarily in the context of action – those that establish their meaning primarily in the environment of other signs, and those for which material fixation is particularly characteristic. Bühler (1934/1999, 159) speaks here of the symphysical environment of language signs for the material attachment of 'isolierter, d. h. kontextfreier Namen' ('isolated, i.e., context-free names'). For toponyms on maps, this is immediately obvious, but we also assume for EPIKHARTIKA, in general, that their connectedness to the carrier material and their specific medialization as constitutive of a map is a crucial characteristic. This corresponds to our definition in (2). However, a specification also follows from this, because the connectedness (symphysis) of EPIKHARTIKA with the map is precisely not linked to the space itself, represented in the map. This again strictly indicates to us that EPIKHARTIKA are to be considered as a specifically medialized language on maps and must by no means be confused with their use outside of them, just as the space of the map is a map space and not the represented space.

This leads to a reversal of a conditionality of mapping itself: The descriptive principle

> P1 If a space is colonially occupied, colonial maps of that space are created.

is crucially to be supplemented by another descriptive principle:

> P2 If colonial maps exist, space is colonially occupied.

Colonial maps are thus much more than descriptive instruments, which has also been claimed for maps, in general, and by Critical Cartography, in particular, to which we also refer here and there in the following. For colonialism, therefore, we can already note a discourse-related basic function of EPIKHARTIKA:

> Discourse function 1 – basic function
> EPIKHARTIKA *are instruments of claiming space in colonialism, their purpose is the linguistic occupation of space in the space of the map.*

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23 Our translation: "The semantic contents of language signs do not simply precede their transmission through sign expressions, but are constituted in the medial mode of performative enactments."

For this reason alone, it is essential to consider ᴇᴘɪᴋʜᴀʀᴛɪᴋᴀ in the linguistic analysis of colonial maps, and do so both system-linguistically and discourse-linguistically, as is the case for colonial toponyms. A toponomastic analysis of maps alone would by no means adequately capture the complexity of colonial spatial claims.

Ad (ii): this brings us to the further discourse functions of ᴇᴘɪᴋʜᴀʀᴛɪᴋᴀ, whereby these correspond, in part, to the discourse functions already described for toponyms in Stolz & Warnke (2018b). However, in light of our preoccupation with ᴇᴘɪᴋʜᴀʀᴛɪᴋᴀ, we want to be more precise about the functions already discussed elsewhere (see Stolz & Warnke 2018b, 47–51), before outlining one more function in (iii). The discourse functions already described for colonial toponyms are:

Discourse function 2 – referential function
ᴇᴘɪᴋʜᴀʀᴛɪᴋᴀ *refer to sections of space through place identification and assert them as distinct from others; their purpose is the isolated perception in a spatial continuum of the map;*

Discourse function 3 – contextualizing function
ᴇᴘɪᴋʜᴀʀᴛɪᴋᴀ *enrich spatial perception with language-bound information and contextualize spatial excerpts in a specific way; their purpose is the semantic charging of map space;*

Discourse function 4 – epistemic function
ᴇᴘɪᴋʜᴀʀᴛɪᴋᴀ *are expressions of knowledge claims and connect spatial sections with epistemic assumptions; their purpose is the fitting of maps into time-bound knowledge formations.*

The discourse functions 1 to 4 are all intertwined with the so-called *Evidenzeffekt* 'evidence effect' (Glaze 2009, 184) of maps, that is, their supposed representational status, which is supposed to result in an assumption of authenticity with a convincing effect. The evidence effect as a media-bound effect supports the function of ᴇᴘɪᴋʜᴀʀᴛɪᴋᴀ to lay colonial claim to space, to identify space in distinct sections from a colonizing perspective, to linguistically enrich its perception, and to fit it into knowledge orders. In this respect, ᴇᴘɪᴋʜᴀʀᴛɪᴋᴀ *make* places in space (of the map).

We want to call this very basic place-constructing function, the *esse-est-percipi-principle*.[24] The world perceived on maps (its *esse*) is the form of its perception through the map (*est percipi*). ᴇᴘɪᴋʜᴀʀᴛɪᴋᴀ's *esse-est-percipi-principle* corresponds to what Glaze (2009, 182) in the project of a Critical Cartography considers maps to be: producers of social realities. The sub-questions associated with such an understanding (see Glaze 2009, 186) about *hierarchies of representation* in maps, the question of what is not mentioned on maps, the so-called *cartographic silence*,[25] about the *geometries* used, and the *symbolism and embellishments* employed are close to a linguistic project of investigating ᴇᴘɪᴋʜᴀʀᴛɪᴋᴀ in colonial map works. Last but not least, the importance of actor-network theory, long considered in Critical Cartography, for under-

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24 Cf. also Schwarz-Friesel & Chur (2014, 93); we use *esse-est-percipi* here without further reference to the philosophy of Georges Berkeley and corresponding conceivable implications.
25 In two recent studies, Stolz & Levkovych (2020b, 2021) investigate into the absence of toponyms on the colonial and postcolonial maps of the Gani islands in the Northern Marianas.

standing the reality-constructing function of maps, in terms of actants, opens up a large horizon of interdisciplinary dialogue for a linguistics of EPIKHARTIKA that has not been outlined before (cf. Glaze 2009, 186).[26]

Ad (iii): So far, the functions of EPIKHARTIKA are consistent with what we have already presented elsewhere for colonial toponyms, albeit weighted and elaborated somewhat differently (see especially Stolz & Warnke 2018b). But let us return to the examples of the adjectival EPIKHARTIKON *inexplorée*, 'unexplored,' the adverbial EPIKHARTIKA *vermoedelijk*, 'probably' (see 4.2), which – like the chain of EPIKHARTIKA *viele Felder aber keine Dörfer*, 'many fields but no villages', in the center of Map 6 – have a discourse function that we have not yet captured, at least not specifically. Something has to be considered here, which seems to us, to be dominant: cartographic perception is itself thematized as such. We quickly see this in the fact that a person who would label our everyday environment with appropriate indications through signs (*unexplored, probably . . ., many X but Y*) would, at best, be perceived as a conceptual artist. Within the medium of the map, however, this seems far more acceptable and common. This leads us to the question of exactly what discourse function such entries have; again, we continue to assume colonial data, but our considerations can certainly be applied to broader contexts of maps. We see a fifth discourse function here, which we call the commentary function:

> Discourse function 5 – commentary function
> EPIKHARTIKA *intervene in disordered space by commenting on this space and fit it into a hierarchizing discursive ordering framework; their purpose is the evaluation of map space.*

Now, *commentary* can be understood in an everyday sense: Someone (a cartographer) says something (through EPIKHARTIKA) on a map; thus comments on a cartographically recordable so-called specificity. But the function of commentary is much more complex, and in colonial data, it is also closely related to the coloniality of EPIKHARTIKA. We understand *commentary* as a way of ordering discourse, and we refer here to Foucault's *L'ordre du discours*. For Foucault (1971, 23), "le commentaire" ('commentary') belongs to the "procédures de contrôle et de délimitation du discours."[27] In EPIKHARTIKA's commentary function, the controlling, ordering intervention in colonial space through the instrument of the map is particularly evident. In Foucault, *commentaire* refers to texts in the narrower sense of the word, especially with regard to a gradation of texts into primary and secondary texts. One of the discourse-ordering performances of commentary in this understanding of text, however, corresponds to what we also observe in *inexplorée*, 'unexplored,' *vermoedelijk*, 'probably,' and *viele Felder aber keine Dörfer*, 'many fields but no villages'. The cartographer is not satisfied with what is found (the primary text, so to speak), but puts it in order and adapts it to their ex-

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26 Turned linguistically, and that means pragmatically substantiated, with reference to Searle's (1976) taxonomy of illocutionary acts, EPIKHARTIKA can overall be understood as declarative, i.e., world-making.

27 Our translation: "the procedures of control and delimitation of the discourse."

pectations and experiences shaped by discourse: *X is unexplored* (i.e., still needs to be explored), *X is probably a Y* (clarity is needed here), *but here X is not Y* (one expects otherwise). EPIKHARTIKA also order space by commentary, "le commentaire conjure le hasard du discours"[28] (Foucault 1971, 27), or the randomness of the space. The commentary function is about fitting the supposed disorder of space into an order:

> La multiplicité ouverte, l'aléa sont transférés, par le principe du commentaire, de ce qui risquerait d'être dit, sur le nombre, la forme, le masque, la circonstance de la répétition[29] (Foucault 1971, 28).

Paraphrasing Edward Said, the book by Castro Varela, do Mar & Dhawan (2015, 124) speaks of a scholarly failure

> die Bedeutung der geographischen Notierung, das theoretische Kartographieren und Verwalten von Territorien innerhalb westlicher Erzählungen (. . .) anzuerkennen[30]

In our understanding, the analysis of EPIKHARTIKA's commentary function is absolutely and centrally part of this.

Summing up, the discourse functions of EPIKHARTIKA, up to this point, can be said to share basic functions with toponyms, with the comment function being an important addition to the previous functional-analytical parameters in COCOTOP. However, we do not want to simplify this, but still address a problem of the commentary function, namely, that of the demarcation between commentary and description. To what extent do entries like *ausgezeichn[etes] Kulturland*, 'excellent cropland', *bewaldete Ebene*, 'wooded plains,' or *fruchtbare Ebene*, 'fertile plains', serve a commentary function, and not that of a description? First of all, it can be stated in principle that there are no disinterested descriptions and that every form of description also carries evaluative dimensions, even if this is because something is considered worth describing in the first place. In a completely different context, here in art communication, Hausendorf (2011, 521) rightly points out in a general sense that describing is already 'highly knowledge-dependent and presupposition-rich'.

When one takes a closer look at colonial maps, one quickly recognizes that numerous entries of the type *ausgezeichn[etes] Kulturland*, 'excellent cropland', concern the usability of or obstacles to the cultivation of land. The colonial project cannot achieve its goals without accounting for the function of the corresponding instances of LOM. Even if commentary and description are not distinct, it can be stated that they are located on an axis between the denoting pole (with descriptive function) and the evaluative pole (with commentary function). Figure 2 is based on Sprigade & Moisel (1909; Map 5):

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28 Our translation: "the commentary banishes the randomness of the discourse."
29 Our translation: "the open multiplicity, the randomness are transferred, by the principle of the commentary, from that which threatens to be said, onto the number, the form, the mask, the circumstance of the repetition."
30 Our translation: "to acknowledge the importance of geographical notation, the theoretical mapping, and management of territories within Western narratives."

denoting pole //
descriptive function

Quellen 'springs'
bewaldete Ebene 'wooded plains'
fruchtbare Ebene 'fertile plains'
ausgezeichn[etes] Kulturland 'excellent cropland'

evaluative pole //
commentary function
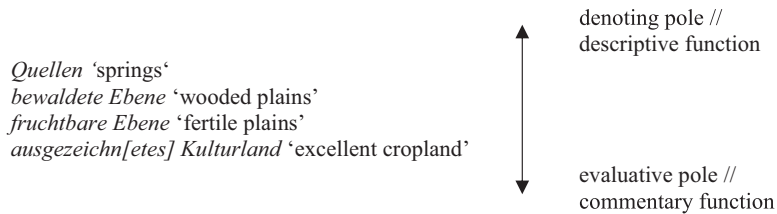
Fig. 2: Continuum of the commentary function of EPIKHARTIKA, taking the example of Astrolabe-Bai (Sprigade & Moisel 1909; Map 5).

For all the impossibility of an absolute distinction between description and comment, between denoting and evaluating, all examples in Fig. 1 are relate-*able* to questions of usability and usefulness; and it is this modality that is at stake here. The closer EPI-KHARTIKA are to the evaluative pole, the more obvious such a reading becomes, as *ausgezeichn[etes] Kulturland*, 'excellent cropland', shows. Here, we should also refer again to the LOM *Région inexplorée*, 'unexplored region', discussed above, which is also close to the evaluative pole. In the context of the colonial map, the negative prefix in *in*explorée suggests that something is to be discovered, or that the discovery of land is one of the tasks to be accomplished. *Région inexplorée* is thus not only a commentary on the landscape, but also a commentary on the colonization project itself.

One example, which we have already introduced in 4.2, we want to consider separately here again: *viele Felder aber keine Dörfer,* 'many fields but no villages.' We have already dealt structurally with the adversative relation. Particularly striking in this LOM, in terms of discourse function, are neither the descriptive, denotative expressions *Felder* 'fields' and *Dörfer* 'villages' nor the quantification with *viele* 'many' and the negative quantifier *keine* 'no,' but the adversative conjunction *aber* 'but.' The conjunction refers to a background of knowledge from which an evaluation is made. In German grammar, this is called an *Erwartungshintergrund* ('expectation background', Zifonun et al. 1997, 2404): When there are many fields somewhere, then one also expects villages. Exactly such expectations are the source of evaluation on colonial maps (cf. also Karg 2018); expectations are nothing less than adjustments of the perceived environment into an ordering, hierarchizing discursive framework.

Foucault's concept of commentary is based on a distinction between discourses that disappear in everyday life and discourses that are passed on, transmitted, transformed, etc. through commentary. He speaks of the 'dénivellation entre les discours'.[31] This translates well into our subject matter. There are such sections that remain without LOM on colonial maps and those that are either marked by toponyms or annotated by more or less pronounced evaluative EPIKHARTIKA. The cartographic gradient we observe here is one between spatial representation and discourse incorporation. This

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31 Our translation: 'gradient between discourses.'

dénivellation is, of course, not only observable on colonial maps. Any thematic map, for instance on natural resource deposits, can have corresponding functions, even without language. However, we focus on LOM in colonial maps where the comment function cannot be overlooked. As we have shown, there is even a group of LOM that is essentially characterized by the commentary function.

6 Conclusions

We have attempted to show that instances of LOM are important data in the study of media-bound language occurrences. We have thus recognizably extended our previous interest in colonial toponyms, focusing here on the most basic concept of our approach, the EPIKHARTIKON. Our dual perspective of system-oriented and discourse-oriented linguistics shows how complex the relevant data are and how much they demand from a systematic analysis. In this study, we have laid the necessary groundwork for this. We conclude that the long-term project of CoCoTop has to be extended by an equally extensive comparative project on colonial EPIKHARTIKA. A comprehensive description of their constructions, grammar, and discourse functions is a desideratum. We recognize the special importance of such a project, also because it can build a bridge to an even more far-reaching project: It can link the linguistic study of map data to the analysis of large corpora, such as the *Digitale Sammlung Deutscher Kolonialismus* / *Digital Collection German Colonialism*.[32] If, for example, evaluative construction patterns on maps are linked to analyses of colonial text corpora, one will have taken a significant step forward in a linguistics that historically investigates the medial complexity of script-bound coloniality. However, this first requires an in-depth study of colonial EPIKHARTIKA.

Abbreviations

CCE	Canonical Colonial Exonym
CoCoTop	Comparative Colonial Toponomastics
LOM	Language on maps

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32 https://brema.suub.uni-bremen.de/dsdk.

Appendix

Map 1: Lüderitzbucht and its immediate surroundings (Schnee 1920, unpaginated separate map).
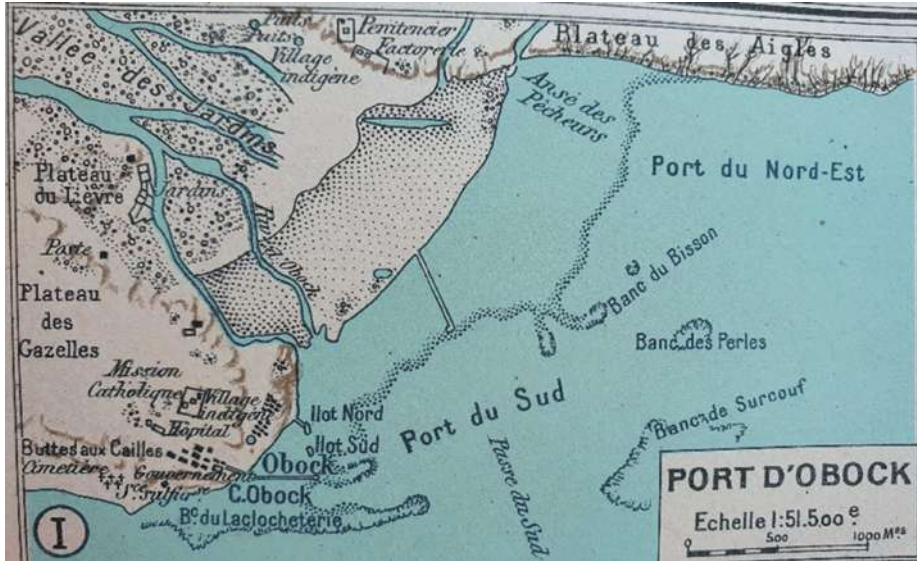
Map 2: Port d'Obock and its immediate surroundings (Pollacchi 1929, 197).

Map 3: Guyane Française (north-western sector) (Pollacchi 1929, 265).
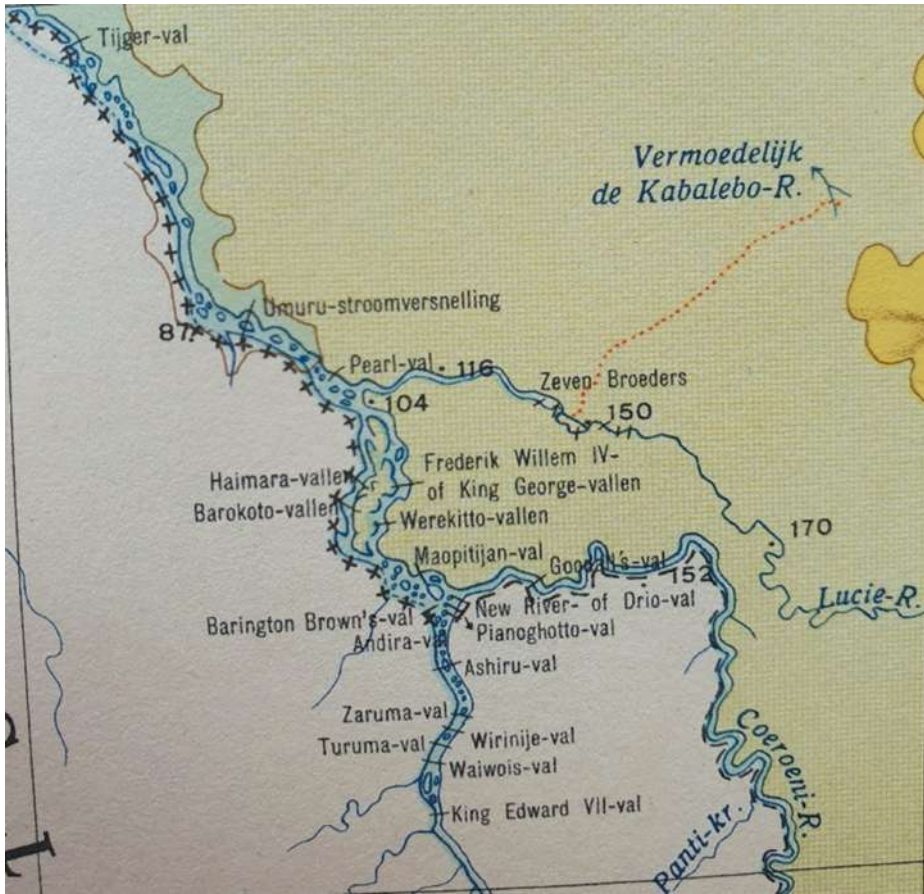
Map 4: Suriname (mid-western sector) (Koninklijk Nederlandsch Aardrijkskundig Genootschap 1938, blad 30b).

Map 5: Astrolabe-Bai (Sprigade & Moisel 1909).
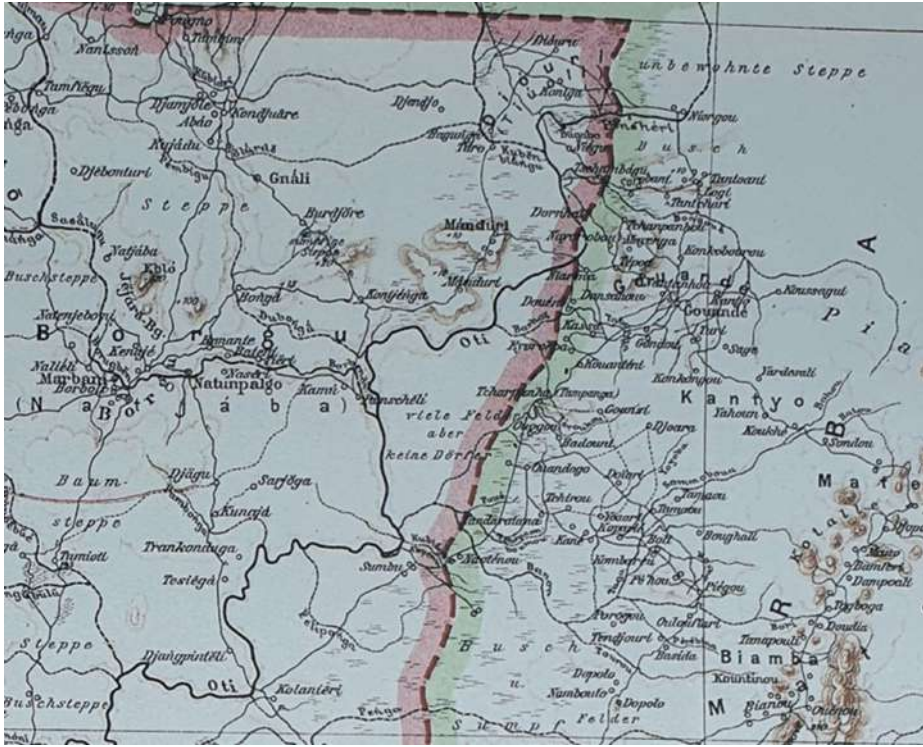
Map 6a: Togo, border region (north-eastern sector) (Sprigade & Moisel 1907).

Map 6b: Togo, hinterland (north-eastern sector) (Sprigade & Moisel 1907).
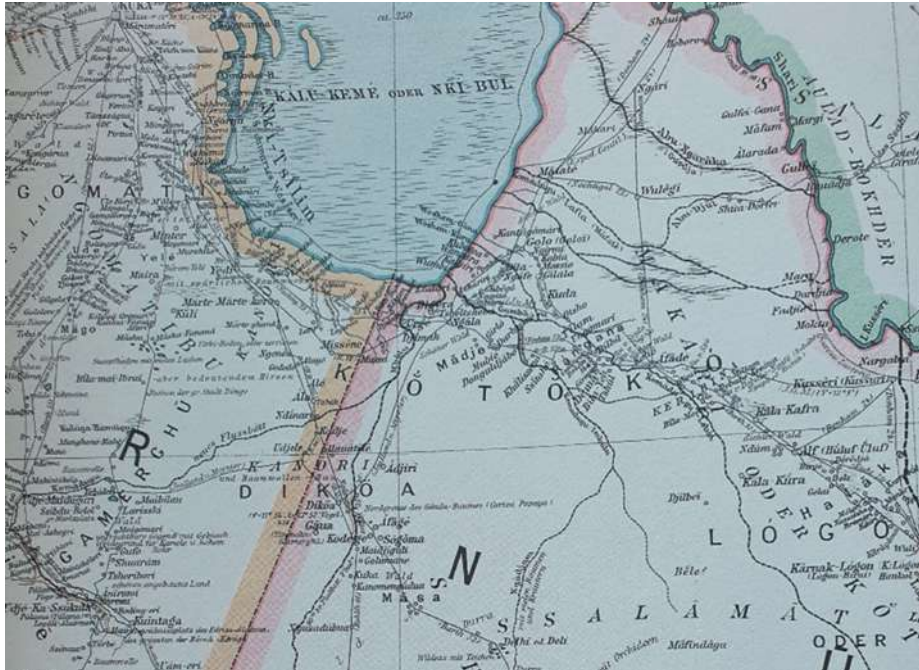
Map 7: Kamerun (mid-northern sector) (Sprigade & Moisel 1901).

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Thomas Stolz has held the chair of general and comparative linguistics at the University of Bremen since 1998. Together with Ingo H. Warnke, he has initiated the new research paradigm *Postcolonial and Colonial Linguistics*. Within this framework, Stolz and Warnke collaborate especially in the domain of *Comparative Colonial Toponomastics* (CoCoTop). In addition, Thomas Stolz conducts research in language typology, language-contact studies, areal linguistics, phonology, morphology, and morphosyntax. He has published extensively on languages such as Chamorro, Maltese, Nahuatl, and Welsh. He is the director of the Malta-Centre at the University of Bremen and the president of the *International Association of Maltese Linguistics* (GHiLM) as well as editor in chief of the journal *Language Typology and Universals* (STUF) and its companion series *Studia Typologica*.

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Note: Abbreviations of Greek works follow Liddell–Scott–Jones rev. 1996.