

# Plato, cross-division and the genesis of modelling theory

Chapter 4 of the forthcoming book:

## “In the Beginning was Chiasmus”

### On the epistemology of non-quantified modelling

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Chapter 1: Introduction – On the Science of Cross-classification  
can be downloaded at:

<https://www.swemorph.com/amg/pdf/Ritchey-chiasmus-intro.pdf>

#### Synopsis of Book

*Chiastic order* is an ancient expression for *cross-classification*. Cross-classification, in turn, is one of many terms used for the operation of conjoining or cross-mapping one domain, class or set of concepts with another. As such, it is the primordial form of non-quantified modelling and combinatory heuristics. This book presents an epistemological history of non-quantified modelling: its prehistory in the form of rhetorical and epistemic *chiasmus*; its early (pre-symbolic) use by Plato as a cross-order (*paradigmatic*) modelling method; and its “modern” (symbolic) use by Leibniz as a *calculus of concepts*. It will also be shown how classification theory itself is built on a cross-classificatory construct involving two fundamental logical/structural relationships: subordination and conjunction. Finally, examples of modern computer-aided, non-quantified *modal modelling* are presented in the areas of design theory, operational research and decision science.

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## 4. Plato, cross-division and the genesis of modelling theory

”Plato’s theory of Forms, the earliest metaphysical theory of classification, is still the paradigm of all *typological* classifications.” (Stephan Körner<sup>1</sup>)

### 4.1 The first modelling theorist

Plato’s “Theory of Ideas” (a.k.a. “Theory of Forms”) has served as the foundation for three basic branches of philosophy: ontology, epistemology and ethics.<sup>2</sup> From our modelling theoretical standpoint, we are not concerned with the *ontological* status of universals, or the *ethical* issue of universal norms, but with an *epistemological* “theory of concepts”. Like the Theory of Ideas in general, its epistemological version allows for the spatial metaphor of concepts as bounded spaces or “containers”. As explored in the previous sections concerning chiasmic “squares of opposition” and the “square of classification”, this in turn allows for a diagrammatic representation of certain formal/logical classificatory and cross-classificatory relationships – basic among them being subordination, coordination and disjunction.<sup>3</sup>

The main purpose of this chapter is to show how Plato applies these basic relationships for generating both Linear Hierarchical Classification (LHC – or proper taxonomic structure) and Combinatorial Cross-Classification (CCC or typological structure). Moreover, to the extent that Plato explicitly employs cross-classificatory techniques in order to create complex concepts and relationships, then from the perspective of the minimal definition of a *model* in §1.3, Plato may be regarded as having developed a first (prototype) *theory of modelling*.

This, of course, does not mean that Plato was the first “modeller”. Modelling – in the most general sense of the term – is ubiquitous to the human condition.<sup>4</sup> Moreover, as concerns “scientific” modelling (*episteme*), Plato in fact credits the Pythagoreans for having handed down the basic notion and art of dividing and combining concepts.<sup>5</sup> Furthermore, there are explicit examples of chiasmic modelling pre-dating Plato.<sup>6</sup> However, we can nonetheless credit Plato with being the first (“on-written-record”) to deliberately articulate a theory of classificatory (and cross-classificatory) modelling; of presenting case studies as explicit *pedagogical examples*; and of coining the first general, technical term for a “model”: *paradeigma* (pl. *paradeigmata*) – essentially a *comparative analogous structure*.<sup>7</sup>

Now, the “science” (*episteme*) which is concerned with such classificatory and cross-classificatory relationships – the *communion of kinds* – Plato calls *dialectic* (διαλεκτική).<sup>8</sup> And a person who has the competence to conduct such a science is called a “*dialectician*” (διαλεκτικός).<sup>9</sup> Unfortunately, there is much confusion associated with these terms, an issue which needs to be addressed first.

- **The D-word**

The terms “dialectic” and “dialectical” are among the most abused and corrupted concepts in the history of science.<sup>10</sup> Authors have thrown the concepts around indiscriminately, often

without even attempting to inform the reader what they think that they mean by them. The classical scholar J.D.G. Evans expressed this tactfully:

”The notion of dialectic is a piece of intellectual currency which ... is more used than understood. Most of those who use it are aware of it only in its more recent cultural forms and are unfamiliar with its historical genesis among the philosophers of ancient Greece.”<sup>11</sup>

Nicolas Rescher is less diplomatic:

“Modern discussions of dialectics often exhibit a lamentable indifference regarding exactly what is at issue here: what dialectic is; how it works; the procedural methodology of the ways and means of proceeding dialectically – all these are matters of unconcern. ... The ancients, to their credit, do not open themselves to this complaint. Plato provides ample examples of dialectical procedure – quite sufficient to indicate what he sees to be at issue.”<sup>12</sup>

As concerns the epistemological “theory of ideas” Plato uses the term *dialektiké* both in a very general way and in two more specific ways.<sup>13</sup> In its most general sense, *dialectic* is about the *analysis and synthesis of concepts* and the different possible types of relationships between concepts. This most general expression of *dialectic* has been considered as having almost meta-epistemological status as a “philosophical underpinning of science” as a whole.<sup>14</sup>

Within this general notion, Plato also uses the term in two more specific methodological contexts associated with the two different *modes* of analysis and synthesis<sup>15</sup>: 1) the *Method of Hypothesis* (laid out in *Phaedo* and *Republic*) describes analysis and synthesis as a *reciprocal sequential* (progressive-regressive) process of abductive-deductive reasoning, i.e. of hypothesising first causes or principles, and then evaluating their consequences; and 2) the *Method of Divisions and Collections* (laid out principally in *Sophist* and *Statesman* and usually referred to simply as *diairesis*) which describes analysis and synthesis as a *reciprocal compositional process*, i.e. of de-composition and re-composition, and a method for classifying and cross-classifying concepts. Thus in both cases, “dialectic” is characterised by an on-going *reciprocal process* between adjacent conceptual levels of abstraction.

It is this second “mode” – *compositional* analysis and synthesis – which is our main point of interest: i.e. the notion of how concepts can be decomposed in order to support definition by classification, and then re-composed and re-combined to facilitate conceptual integration – literally the “combining of ideas” (*symploke eidon*).

## 4.2 *Diairesis* and the three basic logical operators

As was discussed earlier concerning the “logical square of opposition” (§2.2, *supra*), the *elements* of “the syllogistic” include certain basic logical relationships or “operators”. Such operators are heavily incorporated in the Platonic dialogues in general, and especially in the four “late” Platonic dialogues (*Parmenides*, *Sophist*, *Statesman* & *Philebus*), where they are central to the *diairetic method*: i.e. the “method of divisions and collections”<sup>16</sup>. Fig. 4.1 shows the three unitary (or “atomic”) logical operators involved:

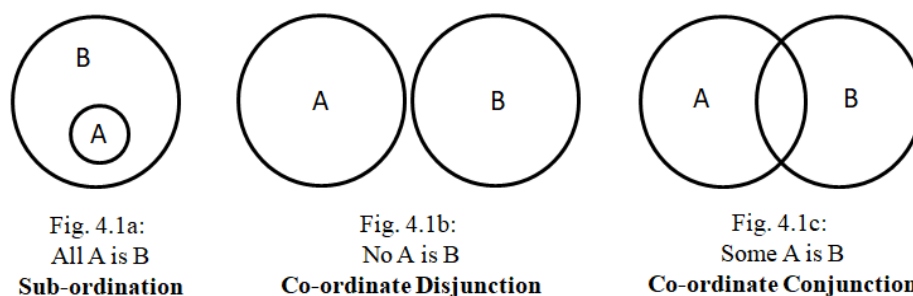


Figure 4.1: Three “atomic” logical relationships:

Now, there has been some disagreement among scholars as to what is, and what is not, to be included under the rubric of the *diairetic method*. Does it 1) consist only of Linear-Hierarchal Classification (LHC) or does it 2) *also* include the boarder notion of the “communion of kinds” as involving cross-division or Combinatoric Cross-Classification (CCC). That is to say, does it *only* include *sub-ordinate* (Fig. 4.1a) and *disjunctive* (Fig. 4.1b) relationships, or does it *also* include *conjunctive* relationships (Fig. 4.1c)?

As interesting as this question may be for historical reasons, this is not an epistemological issue, but a matter of (nominal) definition. It makes no difference to the subject addressed here. What is important is that we find both of these classificatory structures (LHC and CCC) being employed in the Platonic dialogues, and in the *Sophist* and *Statesman* in particular.

However, there are good grounds for regarding both of these structures as being part of the *diairetic method*, since they *both* employ *division* and *collection* (i.e. of compositional *analysis* and *synthesis*), although their priorities are reversed. LHC is mainly focused on compositional (analytical) division. The “collection” side is downplayed almost to obscurity. “Collection” seems to consist mainly of identifying a generic concept which can be used as a starting point for hierarchal division. CCC, on the other hand, emphasizes classification on the basis of combinatorial synthesis. Its initial “division” is simply the single-level *compositional analysis* of two or more concepts (thus creating two or more category variables), which are then *dimensionally coordinated* (cross-classified) to produce a matrix of complex concepts.

Furthermore (and as was noted §3 supra), LHC – which is used by Plato as a method of “definition by classification” – results in a *sylogistic*-like structure which can express deductive inference: i.e. *ars demonstrandi* (*ars judicandi*) or the art of justification. (This is why Aristotle mistakenly – or deceitfully? – misrepresented *diairesis* as “weak syllogism”.) CCC, on the other hand, results in a combinatorial matrix which acts as a *heuristic search space* for conceptual integration and *ars inveniendi*: i.e. the art of discovery.

Although linear-hierarchal classification has tended to dominate the Platonic literature as concerns *diairesis*, the importance of Plato’s use of cross-classification was already pointed out by Neoplatonic scholars of late antiquity (e.g. Porphyry (234-305), Proclus (412-485); Damascius (c. 462-538) Simplicius (480-560), see below). It has likewise been pointed out by modern classical scholars, among them Benjamin Jowett (1892), Robert Brumbaugh (1952),

Kenneth Sayre (1969) and J.M.E. Moravcsik (1992).<sup>17</sup> More recently, a number of scholars have begun to consider Platonic *diairesis* as consisting of a whole variety or range of methods.<sup>18</sup> Smith (2020) regards the famous “dialectician passage” at Sophist 253d1-e3 as involving both hierarchal division and conjunctive “communion of kinds” (see §4.3, *infra*). Pavani (2023) bases different variations of *diairesis* on their *functions* or *goals* – e.g. whether it is being used to *define* a concept (“definition by classification”), to construct a full *taxonomy*, or to explore the possibilities of combining concepts and generating new compound concepts. Liu (2021, 2024) has explored in detail Plato’s use of both *dichotomous* or *polychotomous* cross-divisions. These “variations” are summarized in Fig. 4.2.<sup>19</sup>

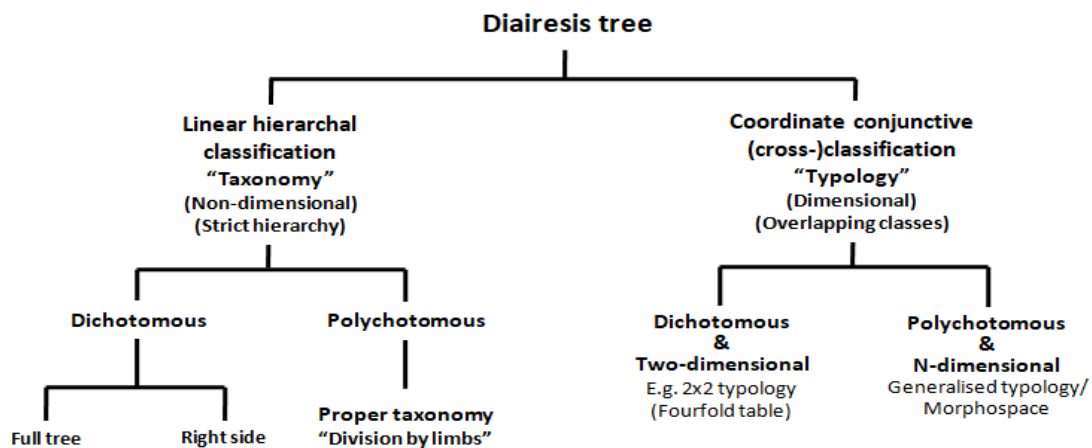


Fig. 4.2: Diairesis tree

However, simply *employing* such relationships is not the same as proposing an outright *theory* of their use. Firstly, it would be nice to find a concise passage in which Plato describes all three of the logical relationships (Fig. 4.1) *together* – as a complete *operational toolbox* so to speak. Secondly, we also need to find text where he explicitly – and *didactically* – presents a combinatoric “model” in the form of a cross-classificatory matrix. Fortunately, we have a good candidate for the former (§4.3) and explicit examples of the latter (§4.4). We begin with the “operational toolbox”.

### 4.3 The “dialectician passage” in Sophist 253d-e

The dialogue *Sophist* is a pivotal work in ancient philosophy of science. It includes some of the most inspiring – and enigmatic – passages in the Platonic dialogues and has fascinated classical scholars and philosophers for centuries.<sup>20</sup> The so-called “dialectician passage”<sup>21</sup> (*Soph.* 253b-e) is one of the most famous of these. It has been an object of debate for centuries and is still a hot topic. It seems to describe – in terms of Platonic forms – four different ways that “ideas” (or concepts) can and cannot combine. Now, modern scholars have pointed out that this passage obviously concerns more than *merely* describing “four different kinds of relations between Ideas”.<sup>22</sup> It is seen as being part of a more complex and sophisticated account of ontological relationships taken up later in the dialogue involving the so-called “five great kinds”.<sup>23</sup>

I totally agree with this and fully appreciate the fact that Plato had bigger fish to fry than simply describing “four different kinds of relations between Ideas”. However, to state that the dialectician passage does not “merely” concern itself with describing such relationships does not preclude the possibility that the passage nonetheless *does – also –* describe them. For, regardless of what fish you are frying, you will be in need of certain basic utensils for the job and in the case of the “communion of kinds” (or the “co-mingling of forms”), these utensils include the use of the three basic “logical (relational) operators” (Fig. 4.1 *supra*). And such operators are clearly present in the conceptual structures that Plato is describing in this passage, whatever the wider purpose.

The dialectician passage starts off at 253b-c by stating that, if we agree that “kinds” (forms, classes or concepts) can “co-mingle” or “join together” (συμμίγνυσθαι), then the dialectician has to have the expertise to discern between such “kinds”, and how they can and cannot combine.<sup>24</sup> Then comes the famous sub-passage at 253d5-e2:

“*Visitor*: Then he who is able to do this has a clear perception

**(R1)** of one form extending entirely through many individuals each of which lies apart, and

**(R2)** of many forms differing from one another but included in one greater form,

... and again [αὖ]

**(R3)** of one form evolved by the union of many wholes, and

**(R4)** of many forms entirely apart and separate.

This is the knowledge and ability to distinguish by classes how individual things can or cannot be associated with one another.”<sup>25</sup>

This passage has been examined, interpreted and bandied about in scores of studies during the past century. It has been subject to many various translations and, at the same time, to different interpretations, even within one and the same translation. My aim here is neither to evaluate translations nor their interpretations – which I am definitely not competent to do – but to look at the possible classificatory relationships being treated in these statements from a purely modelling theoretic perspective.

The four relational structures are usually partitioned into two groups R1+R2 & R3+R4, separated by the seemingly significant “αὖ” (“and again”):

- **R1+R2: Subordinate relationships**

R1 and R2 have been interpreted in two different ways (Figs. 4.3 and 4.4 respectively) as describing subordinate-superordinate relationships:

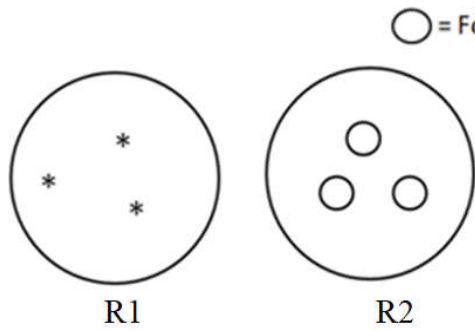


Figure 4.3: Particulars vs. forms

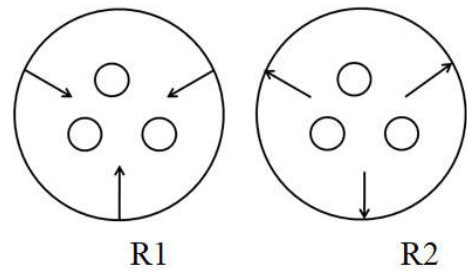


Figure 4.4: Divisions vs. Collections

- I. **(Figure 4.3: Particulars vs. Forms):** The subordinate entities contained in R1 are *particular instances* of the superior form; whereas in R2 the subordinate entities are themselves (sub-) *forms*. This is justified on grammatical grounds, i.e. that the gender of the terms used to denote the subordinated entities in R1 points to them being particular “things”.
- II. **(Figure 4.4: Forms only):** Both R1 and R2 concern *forms*. R1 proceeds from a superior form to the subordinate forms, indicating (compositional-analytic) “division”; whereas R2 proceeds from subordinate forms to a superordinate form, indicating (compositional-synthetic) “collection”. This is justified on the grounds that it is generally accepted, that Plato is only concerned with “forms” in *this account* in the Sophist, not “particulars”.

I prefer the second alternative but, for our present purposes, either explanation will suffice.

- **R3+R4: Co-ordinate relationships**

We take R4 first, which is relatively straight forward, before tackling the truly enigmatic R3. R4 seems to represent a group/set of free-range *disjunct concepts* (or genera) within a particular universe of discourse [U] (Fig 4.5). If this set is exhaustive, it can be rendered as a *partition* of that universe (Fig. 4.6). In any event, it corresponds to Fig. 4.1b (supra), i.e. *disjunct coordinate concepts*. There is no sub-ordination or hierarchy involved here.

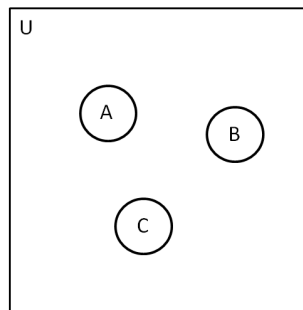


Figure 4.5 Disjunct genera

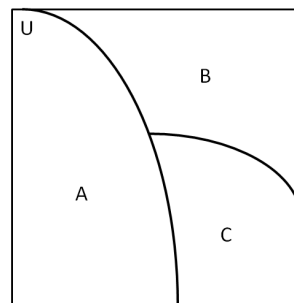


Figure 4.6: 3-Partitioned U.

Finally, the case of **R3**. Let us cite it again in Fowler’s translation.

(R3) ...one form evolved by the union of many wholes... (Fowler (1921))

The Greek text is: καὶ μίαν αὖ δι’ ὅλων πολλῶν ἐν ἐνὶ **συνημμένην**. The word *sunemmenen* (*sunemmenen*) is generally translated as “join together” or “combine”. To get a better perspective on this we can look a number of other translations:

- (R3) “ a Form passing through several ‘wholes’ ... combined to form a ‘unity’” (Gomez-Lobo (1977)).
- (R3) “ one unified [Form] composed of many wholes (Smith (2019)).
- (R3) “ a single form that’s connected as a unit throughout many wholes. (White (1997))
- (R3) “ one [Form] through many wholes gathered into a one (Smith (2020))
- (R3) “ a single [form] [running] through many wholes that is gathered into a one (Miller (2016))
- (R3) “ one form knit together into a single whole and pervading many such wholes: (Jowett (1892))

All of these, taken together, reek of “conjunction”. Indeed, many classical scholars – especially in connection with the Sophist and Statesman – frequently refer to cross-division and “overlapping” concepts (or forms), although usually they do not go into much further detail (see §4.4, *infra*).

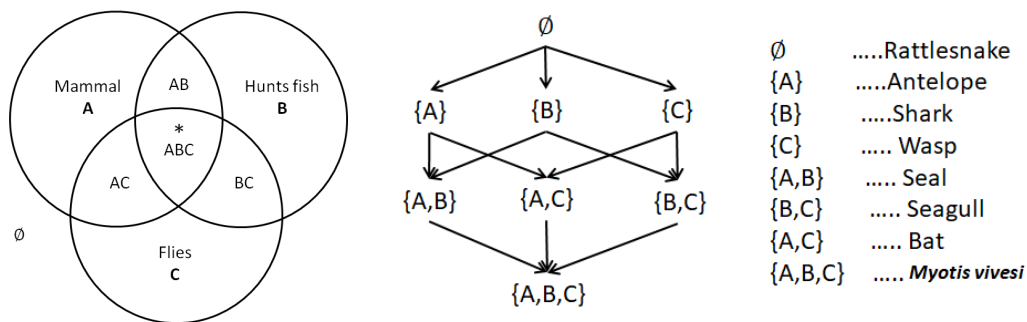


Figure 4.7: Three-property conjunction with its lattice diagram and example list.

Consider Figure 4.7 – a rather mundane but nonetheless functional example of “overlapping concepts” or “co-ordinate conjunction”. The three properties (A: mammal; B: hunts fish; C: can fly) are fully co-ordinate, i.e. they generate a full 3-dimensional combinatorial lattice or “blend”. This is a simple three-(binary)-variable cross-classification creating  $2^3 = 8$  species.

If the four relationships in the “dialectician passage” (R1-R4) can be interpreted as being based on the three logical operations in Fig. 4.1 (R1 & R2 being two ways to approach *subordination*), then we can present the “dialectician passage” as in Figure 4.8.



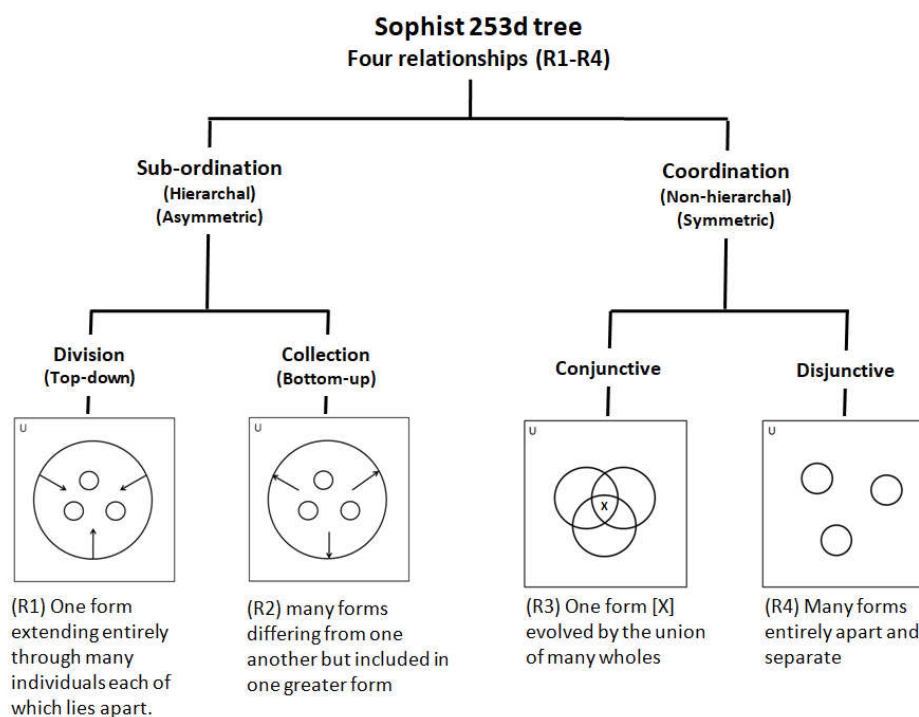


Fig. 4.8: Dialectician-Passage Taxonomy

*Summa Summarum*: The four relationships in the “dialectician passage” have been classified here according to a taxonomy split along two main branches: (1) asymmetric linear hierarchal *sub-ordination* vs. (2) symmetric non-hierarchal *co-ordination*. (1) is further divided into top-down *division* (R1) vs. bottom-up *collection* (R2); and (2) is further divided into *conjunctive* (R3) vs. *disjunctive* (R4) *co-ordination*. To what extent this is a possible (alt. plausible) interpretation of the “dialectician passage”, I respectfully leave to the classical scholars.<sup>26</sup>

However, I do not believe that this interpretation is actually anything essentially new – not even in the case of **R3** as expressing *intentional conjunction*. Indeed, this seems to be alluded to by several classical scholars, even if they do not express it outright. Furthermore, since Plato explicitly – and in a clear pedagogic manner – constructs cross-classificatory “typologies” elsewhere in *Sophist*, as well as in *Statesman* (see §4.4, *infra*), then we know that he was already familiar with this type of chiasmic modelling, to which we now turn.

#### 4.4 Cross-classification and typological modelling in the late dialogues

“... Plato’s divisions are quite unlike the Aristotelian classifications. For not only is there the difference in terms of need for instantiation, there is also the difference of Aristotle needing to carve out non-overlapping species and hierarchies of genera, whereas in Plato’s scheme the intermediate cuts can *crisscross* the generic Form of Art in a variety of ways.”<sup>27</sup>

Throughout the dialogues, Plato uses several different terms which have been translated variously as mixing, blending, combining, joining together, connecting, communing, sharing, interrelating and co-mingling.<sup>28</sup> One of the most expressive of these terms is “*symploke eidon*”, the intertwining or combining of ideas or concepts. (Note that the Latin *calque* of the Greek “sym-ploke” is “com-plex”.) Sayre (1969) – a classical scholar also schooled in

mathematics – confirms that “... *combination* among the Forms as depicted in the Sophist is a *symmetrical* relationship”<sup>29</sup>, not a subordinate one. Van Fraassen (1969) – not primarily a classical scholar but a philosopher of science, epistemologist and logician – has likewise noted that such concepts must represent logical conjunction, corresponding to “set intersection”.<sup>30</sup> And, as discussed in §3, any (extensional) conjunction of sets or (intensional) conjunction of concepts *automatically produce a typology*:

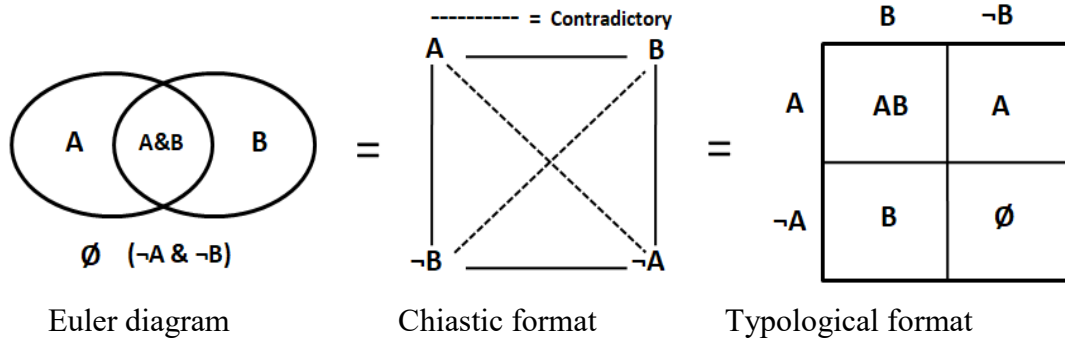


Figure 4.9: Three formats for binary concept conjunction

#### 4.4.1 The four-fold typology in Sophist

Some 12 Stephanus pages after the “dialectician passage”, near the end of the dialogue at *Soph.* 265-266, we find the Eleatic Visitor giving his interlocutor Theaetetus a lesson in cross-classification. The visitor starts out by making a distinction between two *bisociate contrary* forms concerning the “production of things”: On the one hand, between that which is produced by nature itself (*divine*) vs. that which is produced by *humans* (artefacts): and, on the other hand, between *originals*, i.e. the actual “things-in-themselves” (*noumenon*) vs. how these things appear to the senses (*phenomena*). This can be represented as parallel division (a quasi-tree – Figure 4.10).

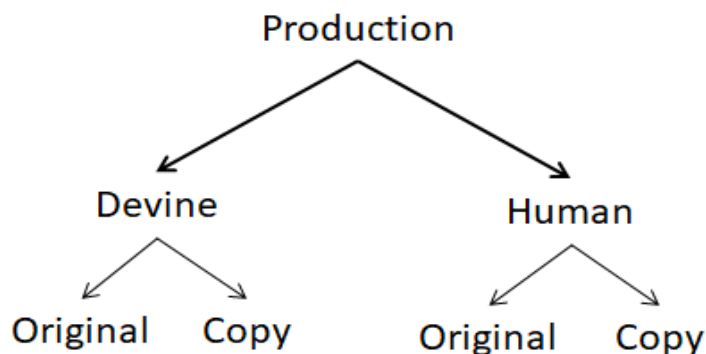


Fig. 4.10: Parallel division of Divine and Human production

Here is the text, starting at *Soph.* 265e3, where Plato turns this “quasi-tree” into a cross-classificatory matrix<sup>31</sup> :

“I will assume that *divine expertise* produces the things that come about by so-called nature, and that *human expertise* produces the things that humans compound those things into. According to this account there are two kinds of production, *human* and *divine*.”

“Now ... first divided the two kinds of production width-wise [horizontally], so to speak [Figure 4.11a]; now divide it [again] lengthwise [vertically]. In this way we now get four parts in all; two belong to us and are *human*, and two belong to the gods and are *divine*.” [Figure 4.11b].

“And again, when the division is made the other [vertical] way, one part of each half has to do with the making of real things [*originals*], and the two remaining parts may very well be called the making of *images* [copies]; and so productive art is again divided into two [other] parts.” [Figure 4.11c.]

When the penny finally drops for Theaetetus, he states:

“I understand better now; and I agree that there are *two kinds* of production, each of them *twofold* – the *divine* and the *human* by one method of bisection, and by the other *real things* and the product that consists of a sort of *likenesses*.”



Fig. 4.11a  
Lateral divide  
(Vertical cut)

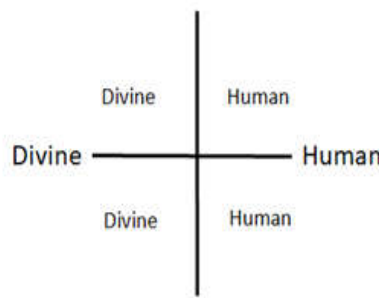


Fig. 4.11b  
Vertical divide  
(Horizontal cut)

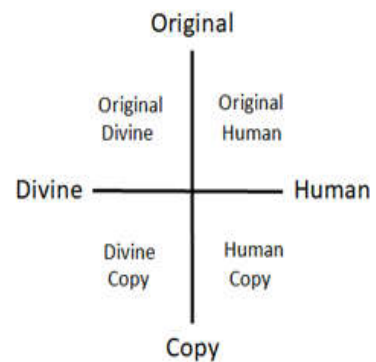


Fig. 4.11c  
Four-fold classification  
(Chiastic cross-cut)

Plato’s dialogues are full of such “verbal matrices” (cf. Brumbaugh, 1954), but this – as far as I know – is the first explicit, didactic presentation of a “four-fold classicisation”, the simplest form of a *typological model*. It is not known whether Plato actually included diagrams in his original works, but verbal *diagrammatic imagery* is certainly evident here.<sup>32</sup>

#### 4.4.2 The 2 x 3 typology in *Statesman*<sup>33</sup>

In the *Statesman*, Plato has the “Visitor” defining possible political constitutions on the basis of two co-ordinate variables. The first variable concerns *how many* are involved in ruling:

(291d1) “Visitor: We recognize *monarchy*, don’t we, as one of the varieties of rule in cities? ... After monarchy one would, I think, list the holding of power by *the few*. ... And isn’t a third type of constitution rule by the mass of the people, called by the name of *democracy*?”

The second variable concerns whether rule is carried out on an equitable, just and lawful basis – in short, whether it is governed *legally* or *illegally*:

(291e1) “I think that as things are people refer to the aspects of force and consent, poverty and wealth, and law and lawlessness ... and use these to divide each of the first two types into two. So they call *monarchy* by two names, on the grounds that it exhibits two forms, the one ‘*tyrannical*’, the other ‘*kingly*’ monarchy. ... And any city which has come to be controlled by a few people they call by the names of ‘*aristocracy*’ and ‘*oligarchy*’.

Then, at 302c-e, the Visitor puts it all together:

“...there are three sorts of constitution, monarchy [rule by one].. rule by a few and rule by many ... Let us, then, by dividing each of these into two parts, make six. ... We said that monarchy comprised *royalty* and *tyranny*, and the rule of the few comprised *aristocracy* ... and *oligarchy*; but to the rule of the many we gave then only a single name, *democracy*; now, however, that also must be divided ... [by] ruling according to laws and contrary to laws.

Rulers --> Legality	One	Few	Many
Legal	kingdom	aristocracy	democracy
Illegal	tyranny	oligarchy	democracy

Figure 4.12 : 2x3 typological matrix of political constitutions

Finally, there is also a 2x4 (or 2x2x2), i.e. 8-fold classification in the *Parmenides* that was researched by Sayre (1978, 1983) and further developed by Liu (2024), which I highly recommend for these interested in this topic.

#### 4.4.3 The misconstrued four-fold classification in *Philebus*

Our final example of Platonic cross-classification is taken from *Philebus*, but here we find it to be the victim of a misunderstanding in the literature. We treat this case because it helps to illuminate not only the issue of cross-classification, but also that of cross-disciplinary understanding and communication.

The problem taken up in the *Philebus* concerns the relationship between two central “properties” of the human condition: *knowledge* (i.e. “real” knowledge or *episteme*, not mere opinion) and *pleasure*. The question is which of these two are most indicative of the “good life”. The interlocutors (Socrates and Protarchus) agree that if one is forced to choose between

the two, then it is (“real”) *knowledge* which is superior. However, they also agree that these two properties are not mutually exclusive and can be combined. In that case, there would seem to be *three alternatives*: 1) there is the possibility of pleasure without knowledge; 2) of knowledge without pleasure; and finally 3) pleasurable knowledge (or knowledge which engenders pleasure). Then the visitor goes on to bring up a *fourth* factor: the *cause of or reason for the blend between the two*. It is on the basis of this “fourth factor” that some classical texts call this a “four-fold classification”. However, this is misconstrued chiasmic logic.

The knowledge-pleasure blend is not a *four-fold* classification because of the “*fourth* factor”, i.e. the “cause of the blend”. This “factor” is totally extraneous to the four-fold structure itself. As has been noted earlier, when two concepts or properties are conjoined, a 2x2 typology (a.k.a. four-fold table) is automatically formed (Fig. 4.13).

Thus the “four-fold” structure is already accomplished in the conjunction of *knowledge* and *pleasure*. The so-called “fourth factor” i.e. *the reason for the blend*, is not part of this “fold”. The whole idea of “fold” concerns geometric progression by combinatorial cross-ordering.

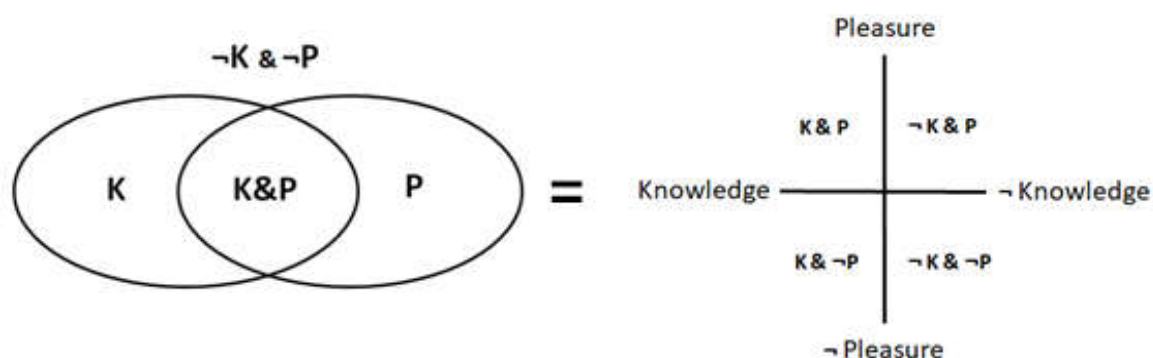


Fig. 4.13: Knowledge-Pleasure typology in Euler and typological format

I conjecture that Plato doesn’t mention the “implicit” (empty) fourth category ( $\neg K \ \& \ \neg P$ ) because he is, in this particular dialogue, more interested in the *substance* of the *knowledge vs. pleasure* issue itself, rather than in the *formal* aspects of cross-classification. (Note also that he ponders adding a “fifth factor”, although there is no such thing as a “five-fold table”. This further supports the view that, while he is promoting conceptual conjunction or “blending”, he is not specifically teaching cross-classification *per se* – as in the *Sophist*.)

Now, this is hardly an issue of great consequence and I report it simply “for the record”. However, it does emphasize the fact that, just as contemporary social scientists may often not be aware of earlier historical versions of certain modern methodological concepts, modern classical scholars may not be aware of the existence of contemporary classificatory concepts that generalise or formalise ancient prototypes of such concepts. Indeed, the identification of such historically comparable notions, and how these develop in the long-term (centuries; millennia) to express analogous or generalised methodological concepts, is one of the central features of Epistemological History.

## 4.5 Porphyry, Simplicius and chiasmic “logic”

It is not certain who first started using the term chiasmus and “chiasmic order” to denote formal, combinatoric cross-classificatory structure. However, some five centuries after Plato’s formulation of such structure, the Neoplatonic scholar Porphyry (A.D. 234-305), in his *Isagoge* (an introductory text on classical logic) calls the simplest form of cross-division “chiasmic”. First (at 71.5), he states that some things “are said *in combination* by being joined by a *coordinating conjunction*”. Then (starting at 78,22) he shows how dichotomous or complementary concepts can be regarded in this way. The inquisitor (Q) in the dialogue takes up two complimentary concepts, the *universal* vs. the *particular*, and *substance* and *accident*, and asks his teacher how these should be ordered. “Chiasmic order” says the teacher...

“In *chiasmic order* ... to divide in the way, saying that among beings, some are either *universal substances* or *particular accidents*, and some either *universal accidents* or *particular substances*, is to use a *chiasmic ordering*: neither universals or particulars, or substances or accidents, are listed in an order of precedence.” [In this way it] “... sets out the *combined explanatory accounts* belonging to their names”. (79, 1-11, emphasis added.)

**Simplicius** (c. 480-c. 560) – in “On Aristotle’s “Categories” – approaches the matter in a way that better emphasizes chiasmus as a type of *bisociate square of opposition*. In explaining the same substance-accident vs. universal-particular coordination as Porphyry, he states: “When these are woven together, there comes about a total of six combinations (*sumplokai*). Among these, two are non-existent: *viz.* those which bring together contradictories [i.e. lines 1 and 2]”. [44: 21-24]:

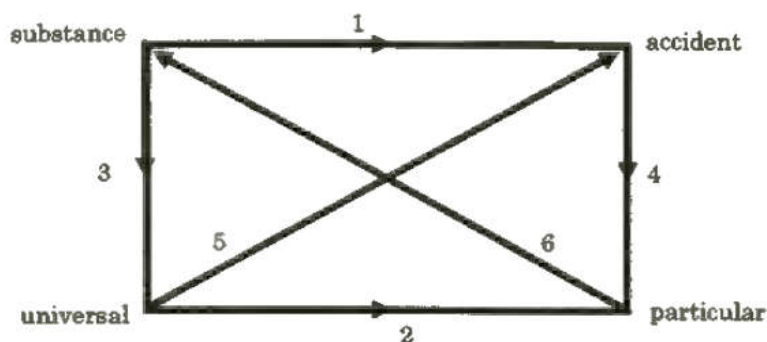


Fig. 4.14: Simplicius’ chiasmic square

The translator notes:

“These six combinations are arrived at by *chiasmic logic* ... which was popular at least since the time of Porphyry. We start with an enumeration of four terms, in this case substance, accident, universal, and particular. They are then arranged in a square, with each term placed at one of its angles. ... The lines with arrows indicate the possible relationships between these four terms (bearing in mind that in Greek, unlike in English, word order is relatively unimportant). We thus end up with a total of six possible combinations (*sumplokai*): (1) accidental substance [contradiction]; (2) universal particulars; [contradiction]; (3) universal substance; (4) particular accident; (5) universal accident; and (6) particular substance. Simplicius will now set out to investigate each of these six possibilities of existence.” (N. 453, p. 126f. Brackets added.) ....

“Thus ... combinations (3), (4), (5), and (6) - which Ammonius (*In De Interp*, 25,8-9) calls the 'subordinate' and 'diagonal' couplings respectively- are considered real logical possibilities. [N. 457]

\* \* \*

So much for ancient chiasmic modelling. In the “Western” world, it will take some seven centuries before the next major step in the evolution of cross-order combinatoric modelling takes place. And when it comes, it is with the help of Hindu and Islamic science and philosophy.

## [5. Ramon Llull and the Combinatorial Art]

(To be continued...)

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## Notes

- <sup>1</sup> Körner, 1976, p. 6.
- <sup>2</sup> Beyond these three (ontology, epistemology and ethics) even psychology and aesthetics may be added. However, I agree with Havelock (1963) that the “theory” is primarily epistemological: “... it seeks to define the character of that knowledge which we would call universal...” (p. 30).
- <sup>3</sup> “It is easy for the modern reader to forget that Plato was heir to a pedagogical tradition in which the use of mathematical illustration seems to have been a standard device for clarifying discussion. It is equally easy to forget that behind this tradition lay the new discovery of mathematics as a promising instrument of science, and that successes with it in music and astronomy must have led one to expect equally effective applications to politics and medicine.” (Brumbaugh, 1954, p. 15.)
- <sup>4</sup> In this very general sense it may apply to many animals also. See e.g. Turner *et. al.* (2021).
- <sup>5</sup> “It is a gift of the gods to men, or so it seems to me, hurled down from heaven by some Prometheus [alluding to the Pythagoreans] along with a most dazzling fire.” (Philebus, 16c).
- <sup>6</sup> E.g. Hippocrates (460–370 BC) is credited with the famous bisociate chiasmic model involving the two dimensions *hot-cold* and *dry-wet*, which produce the four states of nature: Earth, Air, Water and Fire. Similar chiasmic techniques were certainly employed far earlier.
- <sup>7</sup> This does not mean that Plato conceived of “models” in exactly the same way that we do today. *Paradeigma*: from *παρα-* (*para-*, “beside, near”) + *δείκνυμι* (*deiknumi*, “to show”), and translated variously as “to compare” or “to set up an exemplar, type or model”. Thus in this context, what Plato means by a “model” in the *Sophist* and *Statesman* is an existing *comparative analogical structure or function* which can be employed as a “template” in order to aid in the investigation of another (more complex) structural/functional complex. (For a discussion concerning the *functional analogical aspect*, see e.g. Gill (2006); Frede (2020).)
- <sup>8</sup> Plato sees this method of concept classification as not only in the service of science, but that it is actually what makes it possible for us to think and reason at all. In the *Sophist* the “Visitor” talks about “... the *weaving together* of forms is what makes speech and reasoning possible for us.” (*Sophist* 260a.) And in the *Phaedrus* (266b), Socrates states: “I am myself a lover of these divisions and collections, so that I may *be able to think and to speak*.” It is hardly anachronistic to compare this to Fauconnier and Turner’s modern account: “Mental spaces are small conceptual packets constructed *as we think and talk...*”. (Fauconnier & Turner (1996), p. 113.).
- <sup>9</sup> SOCRATES: God knows whether this is the right name for those who can do this correctly or not, but so far I have always called them “dialecticians”. (*Phaedrus*, 266b-c.)
- <sup>10</sup> “‘Dialectic’ has acquired multiple, often conflicting, meanings in the history of western philosophy. It has been identified with rhetoric, sophistry, Socratic ‘cross-examination’, Platonic ascent from the sensible to the spiritual, late-Platonic definition by division into genera and species, Aristotelian

sifting of opinions pro and con, Kantian ‘transcendental’ illusions of the understanding, Marxian socioeconomic stages through capitalism to socialism, etc.” (Kainz (1996), p. 1. Cited in Rescher (2007), p. 119.) (Kainz might have added Hegel and Fichte to the soup.)

For a further critique of the 19<sup>th</sup> and 20<sup>th</sup> century misuse of “dialectic” see e.g. Hoffman (2005b). For a thorough discussion of the term for science and philosophy in general, see e.g. Rescher (2007).

- <sup>11</sup> Evans (1977), Preface.
- <sup>12</sup> Rescher (2007), p. 139.
- <sup>13</sup> He also used the term in a less systematic manner in other contexts, of which we are not concerned here.
- <sup>14</sup> Kaldis (2008), p. 68. “[T]he role of the Dialectic itself as a more basic ... method of argument or rigorous philosophical intuition that transcends and supports what we now call ... the separate methodologies of different scientific fields...”. Cf. Stekeler-Weithofer (1992).
- <sup>15</sup> For a detailed account of these two “modes”, see e.g. Ritchey (2021) §2.3.
- <sup>16</sup> “The Platonic dialectic anticipates nearly everything in the Aristotelian logic except the explicit exposition of the syllogism. ... Many virtually complete syllogisms can be picked out of dialectical arguments in Plato, especially in the Parmenides and ... Republic, and some of the later Platonists assumed his acquaintance with the syllogism, its moods and figures.” (Shorey (1924), p. 1.)
- <sup>17</sup> Add to these Cornford (1935), Shorey (1924), Cherniss (1945), Sayre (1969). All of these scholars rightly maintain that Platonic *diairesis* also involved symmetric (co-ordinate-conjunctive) relationships. For an extended discussion see e.g. Sayre (1969), Chapter III/7: The Mingling of the Forms, pp. 182-203. Jowett (1892) also refers to Platonic “cross-division” in the Introduction to his translation of Sophist)
 

In his book “Plato's Mathematical Imagination”, Robert Brumbaugh emphasizes Plato’s use of “spatial orientation to differentiate kinds of relation” (Brumbaugh, 1952, p. 20). He calls these *verbal matrices* which “... define a term by locating it in relation to a set of other systematically ordered terms” (p. 72). In “Logical and Mathematical Symbolism in the Platonic Scholia” (1961, p 45) he points out Plato’s particular use of “*cross-classification* in combination matrices”. Other terms have used by different scholars, including lenses, meshes, networks and lattices (see e.g. Pasqualoni, 2016). Cf. Serres *réseau* (Watkin 2020, p. 76.)
- <sup>18</sup> Among these are Gill (2012; 2019), Ionesco (2014), Pasqualoni (2016), Smith (2018, 2019, 2020), Liu (2021, 2024), Pavani (2023).
- <sup>19</sup> Although this taxonomy is organised on a different basic division than Pavani’s (2023), it was nonetheless inspired by her diagram which, in turn, was inspired by Mary-Louse Gill’s (2019) earlier diagrams. My thanks to both.
- <sup>20</sup> Benjamin Jowett – one of its modern translators and interpreters – states that the Sophist contains the seeds of just about everything that scientific methodology requires. It is regarded as the basis for Aristotle’s development of syllogistic logic and well as the precursor to “modern” compositional analysis and synthesis. Martin Heidegger gave a famous lecture series on it (1924-25) that influenced a whole generation of epistemologists and historians of science. (Heidegger, 1997)
- <sup>21</sup> As far as I can ascertain, the term “dialectician passage” was first used by Colin Smith (2020).
- <sup>22</sup> Lloyd (1952) p. 110, referring to Stenzel (1931).

- <sup>23</sup> “Being”, “motion”, “rest”, “sameness” and “difference”. The discussion of how these great kinds relate to one another is a fascinating – if not to say mindboggling – experience in itself, but is not necessary for the present discussion.
- <sup>24</sup> Plato is famously adverse – for the most part – to using fixed technical terms, and in the Sophist we see him using several terms – variously translated as kinds, forms, classes, genera, ideas, wholes – more or less synonymously. This, of course, has added to the enigmatic nature of this passage.
- <sup>25</sup> Translation by H. N. Fowler in Plato (1921).
- <sup>26</sup> Here I am encouraged by Colin Smith’s study of the “dialectician passage”, when he notes:  
“Here I interpret a central passage in Plato’s Sophist by focusing on understudied elements that provide insight into the fit of the dialogue’s parts and of the Sophist-Statesman diptych as a whole. I argue that the Eleatic Stranger’s account of what the dialectician “adequately views” at Sophist 253d1-e3 involves both division and the communion of ontological kinds – and not just one or the other as has usually been argued.” (Smith (2020), p.1 - Abstract).
- <sup>27</sup> Moravcsik 1992), p. 217.
- <sup>28</sup> E. g. Van Fraassen (1969); Sayre (1969); Harte (2002).
- <sup>29</sup> Sayre (1969), p. 193 (emphasis added) u/ “The Mingling of the Forms”.
- <sup>30</sup> Van Fraassen (1969), p. 493.  
“We allow each Form A to be represented by a region H(A) of the logical space H, and understand “x participates in A” to be true if and only if x’s location in H is within the region H(A). Then, that A and B combine is represented by an overlap of H(A) and H(B). By designating a set E of “occupied” points (locations of real things in the logical space) we can represent the blending of A and B by an overlap of E and H(A) and H(B).”
- <sup>31</sup> Translated text compounded from Fowler (Plato, 1921) and White (Plato, 1959).
- <sup>32</sup> “It is easy for the modern reader to forget that Plato was heir to a pedagogical tradition in which the use of mathematical illustration seems to have been a standard device for clarifying discussion. It is equally easy to forget that behind this tradition lay the new discovery of mathematics as a promising instrument of science, and that successes with it in music and astronomy must have led one to expect equally effective applications to politics and medicine.” (Brumbaugh, 1954, p. 15.)
- <sup>33</sup> For a more detailed discussion see Liu (2021)