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Juliette Lemaire

Is Aristotle the Father of the Square of Opposition?

Aristotle is the first Greek philosopher to have defined contradiction from a logical point of view. If we compare Aristotle to his master and predecessor – Plato – we could say that Aristotle has depersonalized[1] and formalized contradiction. In Aristotle, only discourses, sentences or statements are opposite to one another, rather than persons as it is the case in Plato's dialogues. To refer to 'contradiction', Aristotle uses the noun ἀντίφασις (*antiphasis*), whereas Plato uses the transitive verb ἀντιλέγειν (*antilegein*). In Plato's dialogues, somebody ἀντιλέγει ('contradicts') someone else, or ἐναντία λέγει ('says the contraries', i.e 'contradicts someone else' or 'contradicts himself'). So, Aristotle promotes a depersonalization and a formalization of contradiction, based on relations among opposite statements – which the tradition (and not Aristotle himself) calls 'the square of opposition'.[2] Nonetheless, there are different definitions of 'contradiction' in the different treatises of the *Organon*.

I will argue that Aristotle is the first to conceive of the square of opposition (hereafter 'the square'), but not the first to draw it. By considering Aristotle's two different definitions of 'contradiction', I will show how *De interpretatione* develops the main points of the square, and then, I will briefly introduce the first drawings and descriptions of the

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1 I apply to contradiction what L.-A. Dorion (1997, 604) says about dialectic.

2 Investigating the first appearance of the expression 'square of opposition' extends beyond the scope of the present paper. This expression, probably used for the first time in medieval texts, is not to be found in ancient texts.

square in antiquity, as designed by Apuleius, Ammonius and Boethius.

1. The Birth of the Square. Aristotle and Contradiction

1.1. Contradiction as one of the four Meanings of "Being Opposite": *Categories* and *Topics*

De interpretatione is the key treatise about the square. There, Aristotle conceives of the main relations of opposite propositions. But, before going into the details of the way Aristotle established these relations in *De interpretatione*, I will show how Aristotle thinks of contradiction in two other treatises from the *Organon*, namely the *Categories* and the *Topics*. First, we have to bear in mind that the *Organon*, as a systematic body of ordered treatises, is an invention of Aristotle's editors.[3] Aristotle had never systematized his treatises (*Categories, De interpretatione, Analytics, Topics* and *Sophistical Refutations*) in a progressive order. Thus, if the *Prior* and *Posterior Analytics* should be read together,[4] there is no need to read the *Categories* or the *De Interpretatione* as a preliminary to the *Analytics*. Of course, the *Topics* and the *Sophistical Refutations* must be read together.[5] Yet, there is no order from the simple to the complex, i.e. from terms in the *Categories* to propositions in *De Interpretatione* and then to arguments in the *Analytics* and the *Topics*. Organizing these works within the *Organon* comes from the tradition and not from Aristotle, and this will be made clear by the different ways in which Aristotle defines 'contradiction'. I will now show why.

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3 See Barnes (2009, 143); Brunschwig (1989, 482).

4 The very beginning of the *Prior Analytics* is an introduction to both treatises.

5 Some scholars think *Sophistical Refutations* is the ninth book of the *Topics*. See Dorion (1995), Smith (1997), Brunschwig (2007), Fait (2007).

In the *Categories*, Aristotle presents contradiction as one of the four senses of 'to be opposed to' (ἕτερον ἑτέρῳ ἀντικεῖσθαι). In chapter 10 of the *Categories* Aristotle says:

> Things are said to be opposed to one another in four ways: as relatives, or as the contraries, or as privation and possession, or as affirmation and negation. Examples of things thus opposed (to give a rough idea) are: as relatives, the double and the half; as contraries, the good and the bad; as privation and possession, blindness and sight; as affirmation and negation, '[He] is sitting' and '[He] is not sitting'. (*Categories* 10, 11b18-22, transl. by Ackrill, slightly modified)

There are four kinds of opposition: relatives, contraries, privation vs. possession, and contradiction ("affirmation vs. negation"). Aristotle gives some examples to clarify what he means. The examples "double" and "half" (for relatives), "good" and "bad" (for contraries), "blindness" and "sight" (for privation and possession) are single terms. Aristotle calls them "things said without combination".[6] We could think that the opposition between affirmation and negation is also an opposition between single terms: the example 'κάθηται—οὐ κάθηται' ('is sitting', 'is not sitting') seems to be an example of things said without combination.[7]

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6 Aristotle makes the distinction between "things said involving combination", λεγόμενα κατὰ συμπλοκήν, and "things said without combination", λεγόμενα ἄνευ συμπλοκῆς, in the beginning of the *Categories* (ch. 2, lines 1a16-19, transl. by Ackrill). From the examples used by Aristotle, it appears that combination means an association between a name (ὄνομα) and a verb (ῥῆμα): 'Man runs' is an example of "things said involving combination"; 'Man', 'runs' are examples of "things said without combination". See the first chapters (1-4) of the *Categories*.

7 See *Categories* 2, 1a18-19: Examples of those – e.g. things that are said – involving combination are: 'man runs', 'man wins'; and those without combination: 'man', 'ox', 'runs', 'wins'." Thus, a single verb, a verb alone is an example of a thing said without combination.

However if we read further,[8] Aristotle claims that the opposition of contradiction is an opposition of things said according to combination (λεγόμενα κατὰ συμπλοκήν) – i.e. sentences (λόγοι) – and not of terms (the example 'κάθηται-οὐ κάθηται', '[He] is sitting – [He] is not sitting' must be understood with an implicit subject). Thus, the opposition between affirmation and negation is an opposition of complex sentences (λόγοι), and this is why this type of opposition has a specific feature: it is the only one to be related to truth and falsity.[9] Aristotle says that necessarily one of the two opposite statements is true and the other false. But the other opposites are not related to truth and falsity. Since relatives, contraries, and privation vs. possession are opposite terms, namely things said without combination, they are neither true nor false. One can of course combine contrary terms in sentences. One can say 'Socrates is good', but in itself 'good' is neither true nor false.[10] You have to combine 'good' with another term in order to obtain a combined sentence that is either true or false. Aristotle writes:

> It might, indeed, very well seem that the same sort of things[11] does occur in the case of contraries said *with* combination, 'Socrates is well' being contrary to 'Socrates is sick'. Yet not even with these it is necessary always for one to be true and the other false. For if Socrates exists one will be true and one false, but if he does not both will be false; neither 'Socrates is sick' nor 'Socrates is well' will be

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8 See *Categories* 10, 13a37-13b12; 13b27-35.

9 See *De interpretatione* 1, 16a11-12: "For falsity and truth have to do with combination and separation".

10 Aristotle writes: "Nothing, in fact, that is said without combination is either true or false" (*Categories* 10, 13b10-11).

11 E.g. for things opposed as affirmation and negation, 'it is necessary for one to be true and the other false'.

> true if Socrates himself does not exist at all. (*Categories* 13b12-19, transl. by Ackrill) [12]

In the *Categories* the opposition of contradiction is the only opposition obeying the following rule: it is necessary that one of the two opposites is true and the other false. It is an opposition between statements but here Aristotle says nothing about quantity, unlike in *De interpretatione* as we shall see below.

There is another treatise in which Aristotle talks about "contradiction" (ἀντίφασις) as one of the four meanings of 'to be opposed' – the *Topics.* In Book I of this treatise about

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[12] These lines compared to a passage in *De interpretatione* have raised the well-known debate about existential import. Aristotle claims that the contraries 'sick'/'fit' can be combined in a statement (λόγος). But it is not necessary that one of the two opposite sentences is true and the other one false. Why? In the example, 'Socrates is sick', 'Socrates is fit', if Socrates is alive, one of the two propositions is true. But if Socrates does not exist anymore, neither of them is true, since both are false. Some scholars, (e.g. Ackrill (1963, 110-111; 148-149) compare this passage with *De interpretatione* 11, 21a25-28 in which Aristotle says that the statement 'Homer is a poet' is true, even if Homer does not exist anymore. Ackrill (1963, 111) formulates the problem in the following way: "Does Aristotle maintain that the non-existence of the subject always make an affirmative statement false and a negative one true or does he have in mind only singular statements? How, in any case, is this view to be reconciled with the contention at *De interpretatione* 21a25-28 that 'Homer is a poet' does not entail 'Homer is'?" It is well known that a singular statement does not necessarily have existential import. But to explain the difference between the *Categories* and *De interpretatione*, we have to bear in mind Aristotelian philosophy. To ask whether Socrates is sick or is fit requires the following question: what is it for Socrates to be? It is to be alive. And being fit presupposes to be alive. Thus, if Socrates does not exist anymore, to say that he is fit or sick is nonsense. In contrast, for Homer, to be a poet does not presuppose to be alive. To understand this lack of existential import we should recall Aristotle's great philosophical discovery – i.e. that being is said in several senses (cf. *Metaphysics* Γ, 2, 1003a33). See Wolff (1988, 236-247).

dialectic, Aristotle uses ἀντίφασις, but does not define it. In this introductory book we find however the definition of a dialectical deduction or syllogism,[13] and hence the definition of dialectical premises. This type of premise differs from apodictic (i.e. scientific) premises which are 'true' and 'primitive'. Indeed, dialectical premises are ἔνδοξα which could be translated as 'reputable opinions'[14] – reputable opinions being opinions accepted by the majority of people or by the wise.[15]

The *Topics* are concerned with dialectical syllogisms, i.e. arguments used in dialectical debates. In a dialectical debate[16] there are two opponents, the questioner and the answerer. The answerer chooses freely a thesis he wants to support – for example 'The world is not finite' (hereafter T_1). The role of the questioner is to make the answerer accept the premises from which the negation of T_1 can be concluded. For, in dialectic, premises are asked in the form of yes-or-no questions, e.g. 'Is what is caused infinite?' Deduction is then

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13 *Top*. I, 1, 100a18-21.

14 Traditionally, *endoxa* has been translated by "probable opinions" (e.g. see "*opinions probables*" Tricot 1997) because of Boethius's translation who translated *endoxa* as "probabilis", meaning 'probable' or 'plausible'. But this translation is misleading as to what the endoxical premises are. An endoxical premise could be probable, but only by accident. The degree of truth is not the point for dialectical premises. See Barnes (1980, 498).

15 *Topics* I, 1,100b21-23: "Those opinions are reputable which are accepted by everyone or by the majority or by the wise — i.e. by all, or by the majority, or by the most notable and reputable of them". (transl. by Pickard-Cambridge).

16 See Moraux (1968).

the series of premises, leading to the destruction of the thesis supported by the answerer.[17]

Hence, dialectic is the art of finding the relevant reputable premises in order to destroy the statement supported by the opponent. It is precisely the role of the τόπος: finding the relevant premises for a given conclusion.[18] Thus, the *Topics* is a collection of τόποι and this is why this treatise could be considered as a method to become a (good) dialectician.

After having explained by means of ἔνδοξα what the dialectical premises are, Aristotle adds further features in chapter 10 where he makes use of ἀντίφασις:

> Dialectical propositions also include views which are like those which are reputable; also propositions which contradict the contraries of opinions that are taken to be reputable (*Topics* I, 10, 104a13-14, transl. by Pickard-Cambridge).

Literally, Aristotle says that premises that are similar to reputable opinions, and also contrary to reputable opinions put forward by contradiction (κατ' ἀντίφασιν

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17 For example, the answerer supports the thesis 'The world is infinite'. The questioner has to find the pertinent premises leading to the conclusion he wants to establish 'The world is finite'. In my example, the questioner uses the topos of contraries: 'If a contrary holds of the subject, the corresponding contrary cannot hold of the same subject at the same time'. The deduction would be as follows: "Is the world caused? – Yes. – Is what is caused finite? – Yes. – Thus, the world is finite". Hence, the answerer is defeated: he has accepted the premises leading to a conclusion which is the contradictory of the thesis he had chosen.

18 See the very clear explanation in J. Brunschwig (2002, XXXIX): "Le lieu [e.g. topos] est une machine à faire des prémisses à partir d'une conclusion donnée". The questioner knows the conclusion he has to obtain. By *modus ponendo ponens* or by *modus tollendo tollens*, he will be able to find the form of the relevant premises. The topos is a formal matrix which gives the rule of an argument. This claim leads some interpreters to take dialectical deduction as an hypothetical syllogism (Slomkowski 1997, 3).

προτεινόμενα[19]) are dialectical premises. Aristotle gives some examples:

> 1) A reputable opinion: 'One ought to do good to one's friends' (Δεῖ τοὺς φίλους εὖ ποιεῖν).
> 2) Its contrary: 'One ought to do harm to one's friends' (Δεῖ κακῶς ποιεῖν τοὺς φίλους).
> 3) The contrary put forward by contradiction: 'One ought not to do harm to one's friends' (Οὐ δεῖ κακῶς ποιεῖν [τοὺς φίλους]).[20]

In (3), the denial particle οὐ seems to modify the verb δεῖ. In the English translation, the denial particle 'not' applies to 'ought', but the question is whether the denial denies a term (only 'ought') or to the entire sentence ('One ought to do harm to one's friend').

Other passages from the *Topics* show that the denial is applied to terms. For instance in book II (ch.8, 113b17-24)[21] about the τόπος of opposition, Aristotle refers to the fourfold classification of "to be opposed" that we find

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19 J. Brunschwig (2002, *ad. loc.*) translates as follows: "Sont aussi des prémisses dialectiques ceux [*scil.* les énoncés] qui sont semblables aux idées admises, ceux qui sont contraires à des idées admises, *formulés selon la négative*", as if ἀντίφασις meant here 'to apply the denial particle'.

20 See *Topics* I, 4, 104a20-33.

21 Book II is devoted to the 'predicable' of accident. The *Topics* can indeed be divided in four main sections that correspond to a classification of the τόποι according to the way the predicate is related to the subject. From Porphyry's *Eisagoge* onwards, the tradition speaks of the 'predicables'. There are four predicables: the predicate belongs to the subject in a non-essential way and in a non-coextensive way – the accident (Books II and III); the predicate belongs in an essential way, but non-coextensively – the genus (Book IV); the predicate belongs in a coextensive way, but non-essentially – the property (Book V); the predicate belongs in an essentially and coextensive way – the definition (Books VI and VII). Book I is introductive, Book VIII conclusive in a way.

in *Categories* 10. In this passage, we see that the τόπος of contradiction (ἀντίφασις) is useful for contraposition:

> If the honorable is pleasant, what is not pleasant is not honourable. (Εἰ τὸ καλὸν ἡδύ, καὶ τὸ μὴ ἡδὺ οὐ καλόν) (*Top*. II, 8, 113b22-23, trans. by Pickard-Cambridge)
> If what is not pleasant is not honorable, then what is honorable is pleasant (Εἰ τὸ μὴ ἡδὺ οὐ καλόν, τὸ καλὸν ἡδύ) (*Top*. II, 8, 113b23-24, trans. by Pickard-Cambridge)
>
> i.: If S is P, then not-P is not-S.
> ii.: If not-S is not-P, then P is S.

The τόπος of contradiction is here a sort of operation that consists in applying the denial particle μή or οὐ to the terms 'pleasant' and 'honorable', and converting the places of the terms. It is clear in this passage that the denial denies terms and not sentences. Ἀντίφασις is thus useful for finding premises (as a tool in *Topics* Book I; as a τόπος in Book II, ch. 8).

Regarding contradiction, another interesting point in this treatise is that Aristotle mentions quantities with respect to dialectical problems. In the very beginning of the book devoted to the *predicable*[22] of the accident, Aristotle claims

22 See previous footnote.

that there are universal and particular problems.[23] Examples of universal problems are: 'Every pleasure is good' and 'No pleasure is good'. Examples of particular problems are: 'Some pleasure is good' and 'Some pleasure is not good'. He goes on to explain that if we show that the predicate holds of all things, we have at the same time shown that the predicate holds of some things, and the same for the negation. Here Aristotle explicitly expounds the rule of subalternation.

Thus we have seen that in the *Categories* and in the *Topics*, 'contradiction' is one of the four senses of 'to be opposed to one another'. I call this the semantic account of contradiction because Aristotle analyses the different meanings of the phrase 'to be opposed'. In Aristotelian terms, we could say that 'to be opposed to' is said in several ways. But in *De interpretatione*, the definition of contradiction is a logical one. Aristotle is interested in the structure of the λόγος and how the λόγος ἀποφαντικὸς is related to truth and falsity, but not in the meaning of the verb 'to be opposed to'. The definition of contradiction is logical because it comes from the definition of λόγος and the Aristotelian investigation about the way propositions are opposed. And in this treatise, it is exactly there that we can observe the birth of the square, or at least, the first written account of the square.

1.2. The Logical Definition of Contradiction: *De interpretatione*

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23 See *Topics* II, 1, 108b34-109a6: "Of problems some are universal, others particular. Universal problems are such as 'Every pleasure is good' and 'No pleasure is good'; particular problems are such as 'Some pleasure is good' and 'Some pleasure is not good'. The methods of establishing and overthrowing a view universally are common to both kinds of problems; for when we have proved that a predicate belongs in every case, we shall also have proved that it belongs in some cases. Likewise, also, if we prove that it does not belong in any case, we shall also have proved that it does not belong in every case.' (transl. by Pickard-Cambridge).

What is the context of the birth of the square of opposition? Aristotle has to face "sophistic difficulties".[24] What are these sophistic difficulties? Against those who claim that it is impossible to speak falsely and impossible to contradict, and more generally against those who use fallacies, Aristotle shows that contradiction is possible if we think of it as an opposition between an affirmation and a negation of a certain form. In *De interpretatione* 5, Aristotle defines the statement (ἀπόφανσις) as the combination between a noun and a verb (an ὄνομα and a ῥῆμα).[25] Aristotle distinguishes between simple statements and compound statements. But at the end of chapter 5 and in chapter 6,[26] he suggests another definition of the statement: he does not define it any longer as a combination between noun and verb, but rather as a sentence (λόγος) that says something about something (λέγει τὶ κατά τινος) or that says something cut off from something (λέγει τὶ ἀπό τινος).[27] Thus, Aristotle goes from a syntactic[28] to a semantic definition of the statement, and gives the definition of 'contradiction', ἀντίφασις, as an opposition between an affirmation and a negation. I quote the entire passage:

> The simple statement is a significant spoken sound about whether something does or does not hold[29] (in one of the divisions of time). An

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24 See *De interpretatione* 6, 17a33-37.

25 *De interpretatione* 5, 17a8-22.

26 *De interpretatione* 5, 17a23 ff.

27 See Ackrill's translation: "An affirmation is a statement affirming something of something, a negation is a statement denying something of something" (*De interpretatione* 6, 17a25-26).

28 Probably Platonic – see Plato, *The Sophist* 261e-262b.

29 'To hold of' translates the verb ὑπάρχειν: 'X holds of Y' is equivalent to 'affirm X of Y', and 'X does not hold of Y' is equivalent to 'deny X of Y'.

> affirmation is a statement affirming something of something, a negation is a statement denying something of something. Now it is possible to state of what does hold that it does not hold, of what not does hold that it does hold, of what does hold that it does hold, and of what does not hold that it does not hold. Similarly for times outside the present. So it must be possible to deny whatever anyone has affirmed, and to affirm whatever anyone has denied. Thus it is clear that for every affirmation there is an opposite negation, and for every negation an opposite affirmation. Let us call[30] an affirmation and a negation which are opposite a contradiction. I speak of[31] statements as opposite when they affirm and deny the same thing of the same thing – not homonymously, together with all such conditions that we add to counter the troublesome objections of the sophists.[32] (transl. Ackrill)

Here, Aristotle establishes the correspondence between every affirmation and denial. More precisely, he writes: every affirmation has its own denial and every denial has its own

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30 "Καὶ ἔστω ἀντίφασις τοῦτο..." 17a33.

31 "…λέγω…" 17a34. It is worth noticing that here Aristotle says "let us call" and "I speak of", whereas in the *Categories* Aristotle says "things *are said to be opposed to one another* in four ways" (*Categories* 11b17). On the basis of this difference we may conjecture that the definition of 'contradiction' in the *De interpretatione* has been invented by Aristotle, whereas in the *Categories* it has not – we could go further and conjecture that the fourfold classification of 'to be opposed' was used by the Platonic Academy. Thus, Aristotle says nothing about the origin of this classification, as if it were well known, and scholars agree to say that the *Categories* and the *Topics* were probably written in Aristotle's youth, i.e. when he was Plato's student (see Brunschwig 1967; Bodéüs 2002).

32 *De interpretatione* 5, 17a22-37.

affirmation – but an affirmation of what? A denial of what? Aristotle says that there is an opposition between the statements "of the same [thing] about the same [thing]", ἀντικεῖσθαι τὴν τοῦ αὐτοῦ κατὰ τοῦ αὐτοῦ,[33] i.e. the opposite statements are of the same predicate about the same subject.[34] This formulation carries with it a precaution against the tricks of the sophists: it is necessary to claim the univocal meanings of terms.[35]

Sophists and eristics use sophistical or eristical arguments, namely apparent refutations (φαινόμενοι ἔλεγχοι) that are not so. They infer an apparent contradiction[36] because their aim is to win, whatever the cost (φαινόμενα ἔνδοξα, φαινόμενος ἔλεγχος). In the *Sophistical Refutations* Aristotle wants to analyse and classify these apparent arguments that he also named 'fallacies' (παραλογισμοί). The basis of the Aristotelian classification of these apparent refutations is the distinction between refutations that "depend on the language used" and those "independent of language".[37] All these fallacies are due to the "ignorance of what refutation is".[38] The ignorance of refutation implies that an element of the definition of refutation is missing in the fallacy. Aristotle defines refutation as follows:

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33 *De interpretatione* 6, 17a34-35.

34 Ackrill's translation clarifies Aristotle's elliptical Greek. 'I speak of statements as opposite when they affirm and deny the same of the same'.

35 In *Metaphysics* Γ, 3, Aristotle is similarly cautious when he gives the first formulation of the principle of contradiction (1005b19-22).

36 See Dorion 1995, 71.

37 *Sophistical Refutations* 4, 165b23-24, trans. by Pickard-Cambridge.

38 *Sophistical Refutations* 6.

> For to refute is to contradict one and the same attribute— not the name, but the object and one that is not synonymous but the same—and to confute it from the proposition granted, necessarily, without including in the reckoning the original point to be proved, in the same respect and relation and manner and time in which it was asserted. (*Sophistical Refutations* 5, 167a23-27, transl. by Pickard-Cambridge)

What is an apparent refutation? An argument that exploits the ambiguity of language. For example Aristotle reports the "speaking-of-the-silent" argument that takes advantage of its corresponding to a number of meanings.[39] Here, there is homonymy between 1) the expression σιγῶντα λέγειν which signifies 'to talk about silent things' and 2) 'the silent is talking'. In *Sophistical Refutations*, Aristotle wants to analyse all forms of fallacies in order to avoid the traps of the sophists.

Aristotle, therefore, has to claim against the sophists that contradiction is of the same thing about the same thing. In *De interpretatione* 6, 17a38 ff., a further element is given. By distinguishing the quantity from the quality in the constituents of a statement, Aristotle formally contrasts contradiction with contrariety.

Aristotle defines quantity in two ways:

> Now of actual things some are universal, others singular (I call universal that which is by its nature predicated of a number of things, and singular that which is not; man, for instance, is a universal, Callias a singular). So it must sometimes be of a universal that one states that

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39 Is speaking of the silent possible? (Ἆρ' ἔστι σιγῶντα λέγειν;) for "speaking of the silent" also has double meaning: it may mean that the speaker is silent or that the things of which he speaks are so' (*Sophistical Refutations* 4, 166a12-15, transl. by Pickard-Cambridge slightly modified). See also170b19-26.

> something holds or does not, sometimes of a singular. (*De interpretatione* 17a38-17b3, transl. by Ackrill, slightly modified)

The first definition concerns the relation between the term and the item signified – the matter of the elements of the proposition in Peripatetic language.[40] For example, 'man' is said of several items (it is a universal, καθόλου), whereas 'Callias' refers to one single man (it is a singular, ἕκαστον). The second definition concerns the statement itself - this is the formal quantification: when you assert something universally, you introduce the quantifier 'every' (πᾶς) or the denial 'no' (οὐδείς).

Aristotle goes on to expound the relations of contrariety, and says something about indefinite propositions, and contradiction.

> Now if one states universally of a universal that something holds or does not, there will be contrary statements (examples of what I mean by 'stating universally of a universal' are: every man is white – no man is white). But when one states something of a universal not universally, the statements are not contrary (though what is being revealed may be contrary). Examples of what I mean by 'stating of a universal not universally' are: a man is white – a man is not white; man is a universal but it is not used universally in the statement (for 'every' does

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40 See Alexander of Aphrodisias, *In Analyticorum Priorum* 6.16-21; 27.27; 28.13-16. About these peripatetic terms, see Barnes 1990. About Ammonius's commentary on the *Prior Analytics* (*in An. Pr.* 1.3-9), Barnes (1990, 45) writes: "He [Ammonius] prefers πρᾶγμα to ὕλη and he indicates that the πράγματα underlying a sentence are the correlates of its σημαντικαὶ φωναί. Hence - or so one might optimistically surmise – there is a clear definition of ὕλη, and hence of εἶδος to hand: the matter of a sentence consists of, or is determined by, all and only its σημαντικαὶ φωναί; the remainder of the sentence constitutes its form".

> not signify the universal but that it is taken universally). […]
>
> I call an affirmation and a denial contradictory opposites (ἀντικεῖσθαι μὲν οὖν κατάφασιν ἀποφάσει λέγω ἀντιφατικῶς) when what one signifies universally the other signifies not universally, e.g. every man is white – not every man is white, no man is white – some man is white. But I call the universal affirmation and the universal denial contrary opposites, e.g. every man is just – no man is just. So these cannot be true together, but their opposites may both be true with respect to the same thing, e.g. not every man is white – some man is white. (*De interpretatione* 17b3-25, transl. by Ackrill, slightly modified)

In this text, Aristotle analyses the main relations of the so-called square of opposition. If one opposes universal affirmation to universal denial, there is contrariety: 'Every man is white', 'No man is white' (Πᾶς ἄνθρωπος λευκός / Οὐδεὶς ἄνθρωπος λευκός).[41] The opposition between universal affirmative 'Every man is white' (Πᾶς ἄνθρωπος λευκός) and particular denial 'Not every man is white' (Οὐ πᾶς ἄνθρωπος λευκός) is a contradiction; and the opposition between the universal denial 'No man is white' (Οὐδεὶς ἄνθρωπος λευκός) and the particular affirmative 'Some man is white' (Ἔστι τις ἄνθρωπος λευκός) is also a contradiction.

We may note that Aristotle does not define the 'particular statement',[42] and uses a periphrasis. He just speaks of a statement that "signifies not universally", whereas in the

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41 Other example: 'Every man is just, no man is just'.

42 About the ambiguity of the particular in Aristotle's texts, see Brunschwig 1969. Following the way in which the particular is understood, as being either maximal or minimal, different squares of opposition are possible (see 7-8).

Analytics he talks explicitly about "particular" (ἐν μέρει)[43] statements. Then, in *De interpretatione* 7, Aristotle explains there are also statements for which quantity is not specified: 'A man is not white', 'A man is white' (Οὐκ ἔστιν ἄνθρωπος λευκός. Ἔστιν ἄνθρωπος λευκός) – what Aristotle calls indefinite (ἀδιόριστον) in the *Analytics*.[44]

Thus, we have three relations of opposite statements in this text: contradiction, contrariety, and subcontrariety. But Aristotle says nothing in this treatise about subalternation. We do not find in *De interpretatione* all the relations of the so-called square of opposition.[45] But in the *Topics*, he relates, as we have seen, contradiction to the rule of subalternation.[46]

1.3. Did Aristotle Draw the Square of Opposition?

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43 See for example the very beginning of *Analytics*: "A proposition (πρότασις), then, is a statement affirming or denying something of something; and this is either universal or particular or indefinite. By universal I mean statement that something belongs to all or none of something ; by particular (ἐν μέρει) that it belongs to some or not to some or not to all ; by indefinite (ἀδιόριστον) that it does or does not belong, without any mark of being universal or particular" (*Prior Analytics*, 24a16-20, transl. A. J. Jenkinson).

44 See previous footnote.

45 As Fabien Schang told me during the 3rd Congress on the Square of Oppositon (Beirut, June 2012), from this passage of the *De interpretatione*, we could draw a butterfly rather than a square: on the basis of the Aristotelian text, the diagonals and the horizontal lines could be drawn, but not the vertical ones.

46 The rule of subalternation is of course known by Aristotle: he used it in the *Analytics* (see *Prior Analytics* for example A, 1, 25a5-25 on conversion; A, 4, 6, 28a18 ff.; 29a23-25 on reduction of imperfect syllogisms to perfect syllogisms in the different figures), that is to say when he is doing logic. But it is worth noticing that in *De interpretatione*, the treatise in which Aristotle defined logical contradiction and logical oppositions, Aristotle says nothing about subalternation – perhaps because subalternation is not strictly speaking an opposition between sentences? See Béziau (2003) and Shang (2012).

Now, did Aristotle draw the square? I think, it is clear that he did not, at least not in chapter 7 of the *De interpretatione*, where he explains the different opposite relations between statements. There is no term in *De interpretatione* 7 referring to a drawing. Nevertheless, further on in *De interpretatione*, there are two terms that may make us think that he draws it. In chapter 10[47] (*De interpretatione* 19b26-27), Aristotle says ὑπογεγραμμένων[48] and in 19b35 he says διάμετρον.[49] Ὑπογεγραμμένων means 'What is drawn' or 'What is written below', and διάμετρον refers to the diagonal. The chapter is about the denial of the indefinite noun and of the verb 'to be' (to discuss further this complex passage extends beyond the scope of the present paper). Then, in chapter 13, Aristotle expounds the modalities and says: let us see ἐκ τῆς ὑπογραφῆς,[50] i.e. '*in the following table* what we are saying' (transl. by Ackrill). Here, Aristotle presents the table of modalities. As Dale Jacquette (2012) said, we can claim that there is in *De interpretatione* 7 what will later become the square of opposition about quantified propositions – the AEIO square – but Aristotle did not draw it. Aristotle introduces the modalities in a table in *De interpretatione* 13, but this is not exactly a square. Then, there will be a fusion between the AEIO square and the modalities.[51]

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47 *De interpretatione* 19b26-27. See what Jean-Baptiste Gourinat (2009, esp. 172) says in "Le *De interpretatione* et la logique contemporaine".

48 *De interpretatione* 10, 19b26-27: "What is meant should be clear from the following *diagram*".

49 *De interpretatione* 10, 19b35: "Here, however, it is not in the same way possible for *diagonal* statements to be true together…"

50 See *De interpretatione* 13, 22a23.

51 In *Prior Analytics*, there is a sort of square: lines 51b36-39 are a sort of systematisation of the relations of opposition. But see Striker (2009, 244): the propositions are not arranged in the same way.

The treatise *De interpretatione* offers a logical definition of contradiction. Contradiction is defined as a specific opposition of sentences, depending on quality and quantity of sentences. Yet, other Aristotelian treatises offer another definition, where contradiction is one of the four meanings of 'to be opposed'. In the *Categories* and the *Topics*, contradiction is an opposition between sentences. The *Topics*, the *Categories* and *De interpretatione* share in common the fact that the negation is internal to the proposition.[52] But according to the *Categories* and the *Topics*, the difference between contrariety and contradiction does not depend on the quantity of the statements.

Aristotle was able for the first time to conceive of the main features of the square of opposition by analysing contradictory statements in *De interpretatione*.[53] It is the logical definition of contradiction that leads Aristotle to theorize about the square. But we do not find the square itself in Aristotle's texts. It will take another five centuries before we find it.

2. The First Square in Antiquity – Apuleius

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52 Thus, contradiction is for Aristotle internal to the statement, and the negation is applying to term. The Stoics will conceive of the contradiction as a negation of the entire statement (see Sextus Empiricus, *Adversus Mathematicos* VIII, 89-90; Gourinat 2000, 211 ff.). This difference reflects the distinction between term logic (the Aristotelian kind) and propositional logic (Stoic logic).

53 Even if *De interpretatione* offers a logical definition of contradiction by considering the quantity of statements, contradiction still belongs to a term logic in this treatise (and of course, also in the *Analytics*).

Apuleius of Madaurus (probably 125 to 180 AD), wrote the first extant Latin work on formal logic[54] titled *De interpretatione*.[55] In this treatise dating from approximately 150 AD, we find for the first time a square of opposition.[56] After the definition of 'proposition' (*propositio*)[57] in chapter

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54 This treatise is short but does not explain everything about formal logic. It was probably an ὑπογραφή, a sketch of formal logic addressed to students who already had some training in logic (for the meaning of ὑπογραφή see Galen, *Introduction to Dialectic*, XI, 2, 7). Cf. Barnes and Bonelli's Report of the Séminaire Genevois on Apuleius' *De interpretatione*.

55 The authorship of Apuleius of Madaurus has been disputed, but today scholars agree that it is highly probable that he is the author of this treatise. Whereas Aristotelian logic is conceived of as a tool, an ὄργανον, Apuleius considers logic as a part of philosophy, following the Stoic conception of logic. But the logic of Apuleius is a mix of Aristotelian and Stoic logic: "The matter of the work [e.g. Apuleius' *De interpretatione*] is mainly, though not entirely, Aristotelian, but (…) the presentation of the Aristotelian material is informed by, among other things, Apuleius' knowledge of Stoic logic (which seems to have been more influential than his acquaintance with the post-Aristotelian Peripatetics)" (Londey-Johanson 1987, 35). Apuleius' *De interpretatione* is an account of the theory of categorical syllogisms.

56 See Londey and Johanson (1987, 3).

57 Londey and Johanson (1987, 83) comment on the term '*propositio*' that it "is intended specifically as a Latinisation of Greek *protasis*" (used by Aristotle in the *Analytics*), thus equivalent to *apophansis*. See ch.1 of Apuleius' *De interpretatione*: "But although we argue by means of speech, of which there are various kinds (…), the one of these which is the most important for my topic is that which is called statemental [*pronuntiabilis*]. It expresses a complete meaning and is the only one of all of them that is subject to truth and falsity. Sergius calls it an *effatum*, Varro a *proloquium*, Cicero an *enuntiatum*, the Greeks a πρότασις and then an ἀξίωμα, while I, rendering literally, call it both a *protensio* and a *rogamentum*; but it will be more appropriately called a proposition [*propositio*]".

4, and the distinction between the 'universal abdicative' (*universalis abdicativa*,[58] i.e. universal affirmative), the 'universal dedicative' (*universalis dedicativa*, i.e. universal negative), the particular abdicative (*particulare abdicativa*, i.e particular affirmative), and the 'particular dedicative' ('*particulare dedicativa*', i.e particular negative), Apuleius begins his chapter 5 in the following way: "Now it is time to discuss how those four propositions are related to one another – and it is useful to consider them in a squared figure (*in quadrata formula spectare*)".

It is for the sake of usefulness that Apuleius draws a square, literally 'a squared figure', in order to picture the different relations among propositions, depending on their quantity and quality. Before drawing the diagram itself, Apuleius explains that the dedicative and abdicative universals are "inconsistent with one another" (*incongrua* = contrary); the particulars are "nearly equal to one another" (*subpar* = subcontrary); the diagonal of the square relates the "alternates" (*alterutra* = contradictory) to each other: "Those [two propositions] which are opposite to one another in both quantity and quality, may be called 'alternates', because it is indeed necessary that one or the other be true, which is said to be a complete and total conflict". Apuleius explains the relationship between contraries, subcontraries and contradictories. But he says nothing about the subalternates.

The square, according to Apuleius' text looks like this:[59]

Omnis voluptas bonum est Omnis voluptas bonum non est

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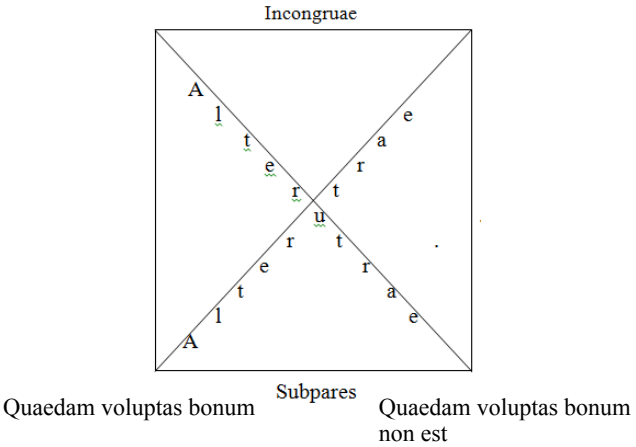
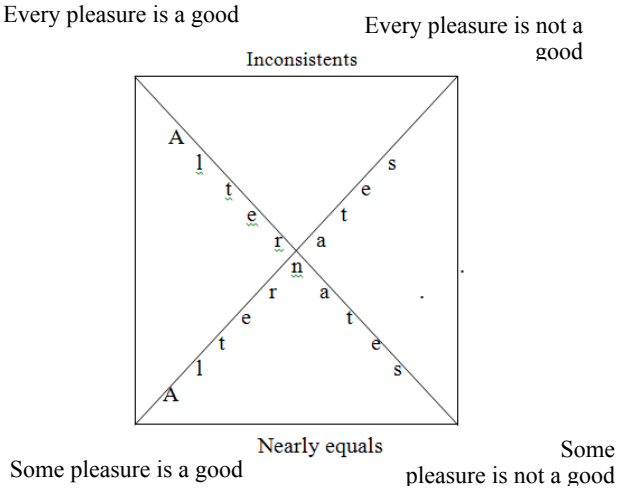
58 "*Abdicativus*" and "*dedicativus*" are based on the Greek – (*abdicativus* on καταφατική and *dedicativus* on ἀποφατική) (*Report of the Séminaire Genevois,* 27).

59 Here, I reproduce the square as it appears in the Londey and Johanson edition.





Apuleius makes some “geometrical” remarks: “Let there be dedicative and abdicative universals on the top line”, “Then let the oblique angular lines be drawn, one stretching from the universal dedicative to the particular abdicative, the other from the particular dedicative to the universal abdicative”.

But Apuleius does not talk about the vertical lines. With these remarks, we have some instructions to draw the square. Two interpretations are possible when reading Apuleius' text: either Apuleius is drawing up the diagram whilst writing the treatise, or he is writing the treatise whilst looking at a diagram already set out.[60] According to Londey and Johanson who have published the most recent study on Apuleius'
De interpretatione (1987), the former option is the correct one.[61] They think Apuleius is aware of the novelty of his diagram.

If we compare Apuleius with other versions of the square of opposition in antiquity,[62] we notice that the originality of Apuleius's diagram resides in the fact that even if the vertical lines, i.e. the subalternates, are drawn (since he is talking about a "*quadrata formula*"), Apuleius does not comment on the relationship between the universal and the corresponding particular. As for Aristotle, we may think the lack of explanation about the subalternates could be related to the fact that these propositions are not exactly opposed, but more precisely corresponding.[63]

3. The Second Setting out of the Diagram in Antiquity – Ammonius

Ammonius (440 AD in Alexandria – about 517 AD), held the chair of Neoplatonism in Alexandria where he taught the philosophies of Plato and Aristotle. We find the second diagram of opposition in his commentary on Aristotle's *De*

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60 Some scholars claimed Apuleius was copying a Greek treatise. See Flamand (1989, 304-307). But we do not have any other extant Greek text with this square.

61 Londey and Johanson (1987, 111-112).

62 The versions by Boethius and Ammonius.

63 See Béziau (2003, 225) and Shang (2012).

interpretatione 7.[64] Before giving "the explanation of what is said in the [Aristotelian] text", Ammonius says: "We must examine the points which are necessary for the understanding of the entire section" (see 86,28-30). First, he explains, the denial particle denies the predicate, and not the subject. The denial of 'Socrates walks' is 'Socrates does not walk', and not 'Not Socrates walks' (see 87,8-88,4). Then, Ammonius makes some remarks about the relations between the subject and the predicate: first he considers modalities,[65] then a universal subject and a singular subject (88,29-36). Ammonius further distinguishes four species of propositions: the undetermined proposition, the determined proposition that can be either a universal proposition or a particular proposition. Thus, the question Ammonius asks is: which determined propositions are contradictories? Universal propositions can be simultaneously false. Hence they cannot be contradictories, but contraries (ἐναντίαι). The particular propositions corresponding to them (i.e. to the contraries) can be true together – they are the subcontraries (ὑπεναντίαι). The relation between the universal proposition and the particular corresponding to it, is called subalternation ('subaltern' translates the Greek ὑπάλληλοι). Ammonius proceeds then to give the diagram of opposition, explaining which propositions are contradictories after setting out two figures:[66] First a figure of the opposition of the singular:

SINGULAR

Socrates walks	Socrates does not walk

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64 Ammonius' commentary on *De interpretatione* is the most ancient extant Greek commentary on the *De interpretatione* of Aristotle. See Brunschwig (2008, 36).

65 "Those who care about the technical treatment of these things call these relations the 'matters' (ὕλας) of the propositions, and they say that one of them is necessary (ἀναγκαίαν), another impossible (ἀδύνατον), and the third contingent (ἐνδεχομένην)" (88,18-20, transl. by D. Blank).

66 I reproduce here the figures and the diagram as they appear in Blank's edition.

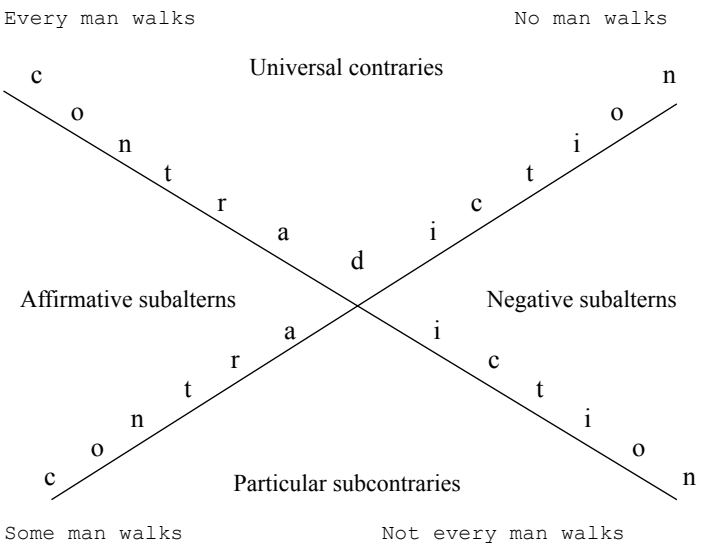
Then a figure of the undetermined:

UNDETERMINED

Man walks Man does not walk

And then, the diagram of opposition, or the figure of "the determined propositions":

DETERMINED



When Ammonius gives some comments on contradiction, he makes some reference to the diagram. He says that contradiction is the opposition of the propositions "placed diagonally".

> Thus, according to the diagram (διάγραμμα) given, those [affirmation and negation] which have their determinate propositions placed diagonally to one another contradict one another, for they always divide the true and the false (92,31-4)

We find here the main feature of contradiction: necessarily, one of the two opposites is true and the other false. It is worth noticing that Ammonius does not comment on contrariety, subcontrariety and subalternation in geometrical terms. Neither does he say anything about the origin of the diagram. He insists on contradiction as an opposition between diagonals. So we could say that in Ammonius, we do not have a square,[67] even if the subalterns are mentioned in the commentary on the Aristotelian text.

4. The Second Square in Antiquity –Boethius

Boethius (about 470 AD in Rome – 524 AD in Pavia) was the first to draw the square and to comment on subalternation. He did so in the commentary on *De interpretatione* 7 of Aristotle.[68] Before commenting on lines 17b3-6 (book II) given in the lemma in 146,27-147,1,

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67 In Blank's (1996, 99) translation a cross is drawn (i.e. the diagonals), not a square, much like in the Greek edition by Busse (1891) who had chosen Manuscript G. Manuscripts F and M also present more or less the same diagram; in Manuscript A, the diagram is omitted.

68 Boethius wrote two commentaries on the Aristotelian *De interpretatione*. The square appears in the second: *The second edition or larger commentary of Anicius Manlius Severinus Boethius on Aristotle's On Interpretation in Six Books*. We quote hereafter from the English translation: *Boethius, On Aristotle On Interpretation 1-3*, translated by Andrew Smith, London, Duckworth, 2010. The Latin text is from the Meiser edition (*Boetii Commentarii in librum Aristotelis Peri hermêneias, pars posteior*, rec. Carolus Meiser, Lipsiae, 1880).

Boethius says that the Aristotelian text is confused;[69] for this reason, he has to make "a few preliminary observations".[70] According to Boethius, Aristotle's main goal in *De interpretatione* 7 is the demonstration of contradiction. Boethius thinks he himself has to give a clear ordered account of the "four kinds of propositions" based on quality and quantity,[71] and through this account, he gives a "diagram" (*descriptio*[72]) – first a table, then a square.[73] What we would like to point out is the fact that Boethius explains the relations between the opposite propositions by the pattern itself. He writes:

> But when I say 'Some man is an animal' and 'Some man is not an animal' the particular affirmation is true, the particular negation false. And so *these are called subcontraries, either because they are placed under (*sub*) the contraries or because they themselves have, as already pointed out, characteristics opposite to those of their superiors under which they are set.*[74] And so in this *rectilinear opposition of*

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69 To make the Aristotelian text clear was also the aim of Ammonius. *De interpretatione* 7 is confused and badly organised. Each commentator's task is to make Aristotle clear.

70 After quoting *De interpretatione* 17b3-6, Boethius writes: "His [Aristotle's] intention is to demonstrate the opposition of contradiction. But because he has mixed up the direction and order of inquiry we are making a few preliminary observations before resuming our exposition of the text lest the reader be disturbed by the dark obscurity of confusion".

71 First universal and particular, because, he says, they "are determined" (147^{18-19}).

72 "Diagram" is Andrew Smith's translation for *descriptio*.

73 At least in the English translation: table p. 95, square p. 97.

74 The emphasis is my own as in the rest of this quotation.

> *contraries and subcontraries* there can be falsity but never truth in both *superiors* whereas in both *inferiors* there can be truth but never falsity. But if you look at the *diagonal oppositions* and oppose a universal affirmation to a particular negation and a universal negation to a particular affirmation, one will always be found true the other false and it can never be the case that when the universal affirmation is true the particular negation is not false or when the latter is true that falsity does not immediately attach to the former. In turn if the universal negation is true the particular affirmation is false and if the particular affirmation is true the universal negation is false. *You can check this in the diagram below* and you will see the same thing also in any other terms you might care to examine (151, 8-30).

Here is the square:[75]

[75] I reproduce here the square as it is printed in Smith's translation (2010, 97).

Universal affirmation		**Universal negation**
Every man is just	Contraries	*No man is just*
Universal universally		Universal universally
S U B A L T E R N A T E S	C S O E N I T R R O A T D C I D C A T R O T R N I O E C S	S U B A L T E R N A T E S
Particular affirmation		**Particular negation**
Some man is just	Subcontraries	*Some man is not just*
Universal particularly		Universal particularly

Boethius continues:

> *The universal affirmation and particular negation which are diagonal and the universal negation and particular affirmation which are likewise diagonal are called contradictories.*[76] And this is the contradiction about which he is enquiring, that one is always true the other always false. We have *appended a comprehensive diagram to the discussion above. Something conceived in thought and in the mind is the more firmly implanted in the memory when it is presented visually* (154,2-10).

76 My italics as in the rest of this quotation.

Boethius gives the features of the different kinds of opposition in geometrical terms (diagonal oppositions, rectilinear opposition …). Hence, the contradiction and the other kinds of opposition are explained with reference to the pattern. Boethius says explicitly that the diagram is here to make clear what otherwise would remain obscure whilst also being a helpful reminder. Thus the square of opposition, *qua* square, is useful for the sake of clarity and for memory.
After the preliminaries and the diagram, Boethius concludes:

> There are then two forms of contradiction: (1) between universals diagonally opposed to particulars, (2) between individually opposed propositions taking account of all the determination discussed in *On Sophistical Refutations* (154,17-20).

He goes then back to the Aristotelian text:

> Then because we have shown how propositions relate to each other and how they form contradictory opposites, let us now return to Aristotle's words which will be very easy to understand when we have taken in these preliminaries. *So if one states universally of a universal that it is or is not, there will be contrary statements. I mean by a universal statement of a universal, e.g. 'Every man is white', 'No man is white'.* [77] He sets down fully the thought of the diagram above (*superioris descriptionis intellegentiam plenius notat*) (154,20-29).

Thus the square is a clear picture of what Aristotle had written obscurely. The square is a picture which expresses a thought: the relations of opposite propositions, set down for the first time by Aristotle.

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77 The emphasis is made by the translator A. Smith: Boethius is quoting Aristotle.

The other interesting fact I want to point out in this text, is the following: the vertical lines are drawn, and the subalternation rule is clearly expressed.[78] Secondly, whereas in Apuleius' square, there was no reference to Aristotle's text (*De interpretatione* 7), Boethius explicitly investigates Aristotle's *De interpretatione*, presents his square as an explanation of the Aristotelian text, thereby producing the square *before* quoting and commenting on the Aristotelian text, shedding light on what Aristole said confusingly. Ammonius is also commenting on Aristotle's *De interpretatione*, gives explanations and puts the confused text in order. However, he does not say explicitly that he is drawing the diagram in order to clarify the Aristotelian text.

What distinguishes Boethius from Apuleius takes him closer to Ammonius: both, Boethius and Ammonius, comment explicitly on Aristotle's text section by section; both set out a diagram; and there are other parallels between the two commentaries.[79] It has been claimed that Boethius was directly based on Ammonius.[80] But scholars today agree that Boethius does not follow Ammonius (the sections of the commentaries are different, the diagrams are also different, and so on and so forth).[81] It is worth noticing that Ammonius was a Neoplatonic commentator, whereas Boethius was first of all a translator, an Aristotelian commentator and logician. They did not belong to the same "family" of

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78 147,30-148,5: "The pair universal and particular affirmation are called subalternates. Universal and particular negation are also called subalternates because particularity is always included under universality. Here one has to understand that where there is a true universal affirmation the particular affirmation is also true and where there is a true universal negation the particular negation is also true".

79 See Courcelle (1948, 264-278).

80 See Courcelle (1948).

81 Boethius does not make reference to Plato. But Ammonius does. See Shiel (1990).

commentators.[82] Therefore, the more plausible conclusion is that Ammonius and Boethius used the same Greek text as well as, in all probability, some notes from the Porphyrian corpus.[83]

To conclude, we can say that Aristotle, by expounding a logical definition of contradiction, had theorized what was to become the square of opposition. Aristotle had conceived of the different relations between the different opposite propositions. This is why the pattern we can draw up from *De interpretatione* resembles more the shape of a butterfly than a square. Aristotle is enquiring about contradiction and opposition of propositions in this treatise. The fact that subalternation is not a real opposition could explain Aristotle's silence about subalternation in *De interpretatione*. We obtain a square if we merge *De interpretatione* with the *Topics*, in which Aristotle expounds the subalternation rule. In antiquity, the first square of opposition is found in Apuleius' *De interpretatione*. Apuleius himself talks about a "squared figure", *quadrata formula*. But he did not comment on the vertical lines. Vertical lines are missing in the diagram we find in Ammonius' *On De interpretatione* whereas Ammonius talks about the subalternate propositions. We

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82 About the ancient commentators on Aristotle, see Sorabji (1990).

83 Shiel notes there are "ninety instances of Greek parallels" between Ammonius and Boethius. "These parallels however, prove no more than that Boethius is everywhere using Greek" (Shiel 1995, 356-357). He also points out that there are more differences than similiarities between Ammonius and Boethius. Shiel (1995, 359) explains, Boethius "was not following an exact or complete copy of Porphyry's work. The latter was lengthy [...]. But Boethius' commentary is built from scanty Porphyrian material, which he first translates and then applies to Aristotle's text". Thus, the comparison between Ammonius and Boethius shows only that Boethius is translating from the Greek, not that he is following Ammonius. Shiel (1995, 361) concludes his article thus: "Boethius is translating marginal notes, the explanatory *sententiae* that he encountered in his Greek Aristotle". Did the square itself belong to these marginal notes?

must wait for Boethius in order to see how the vertical lines are drawn and commented on. If we compare the first diagrams of opposition in antiquity (i.e. Apuleius', Ammonius' and Boethius'), Boethius' diagram is the most interesting because with it Boethius explains the different relations of opposition in virtue of the square alone. Thus the square is drawn to clarify what Aristotle had written confusingly. The square helps us to understand the relations between opposite propositions. By representing these relations geometrically, Boethius wants to help our memory and thought. The posterity of the square shows he was right to draw it.

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